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Bismillahirahmanirrahim.

First and foremost, let us all offer our gratitude to Allah Almighty for His blessings and grace, enabling us to gather here for allowing us to publish the Kinabalu Multidisciplinary Academic Research Journal (KIMARA), Vol. 3, December 2024. The main objective behind establishing the Kinabalu Multidisciplinary Academic Research Journal (KIMARA) is to disseminate academic research findings and innovative work conducted by educators across various disciplines, such as tourism, agriculture, manufacturing industry, engineering and social sciences.

I would like to extend my appreciation and sincerest congratulations to all the researchers who have submitted their research papers for publication in the current issue of the KIMARA journal. The publication of the journal will foster a research culture among the lecturers ensuring esteemed educationalist to be able to compete in coherent to the current transformation in this country. Your hard work and perseverance inspire us all, and I wish you all the best in your future academic endeavours. My sincere gratitude goes out to the Research, Innovation, and Commercialization Unit (UPIK) and the editorial boards of KIMARA for their remarkable efforts. I am sure it is a worthwhile endeavour for everyone participating.

Thank you.

MD NOR BIN ABDUL HALIM
Director
Politeknik Kota Kinabalu

Bismillahirahmanirrahim.

To begin with, it is an honour to extend sincere congratulations to the Research, Innovation, and Commercialization Unit (UPIK), Politeknik Kota Kinabalu, and the editorial board for the publication of Kinabalu Multidisciplinary Academic Research Journal (KIMARA), Vol. 3, 2024. The published journals consist of research papers presented during the International Multidisciplinary Academic Conference 2024 also known as IMAC'24.

The publication of Kinabalu Multidisciplinary Academic Research Journal (KIMARA) Vol. 3, 2024, will be a vital platform for researchers, educators, and industry leaders to share their insights and innovations and drive progress in tourism, agriculture, manufacturing, engineering, and social sciences sectors.

Congratulations to all the esteemed researchers who have submitted their research papers for publication. Your dedication to academic excellence is commendable, and your contributions to the field of research are invaluable.

Thank you.

ABDUL RAZAK BIN MOHD DAIM
Deputy Director of Academic
Politeknik Kota Kinabalu

Bismillahirrahmanirrahim

Assalammualaikum Warahmatullahi Wabarakatuh

Kinabalu Multidisciplinary Academic Research Journal (KIMARA) 3rd volume has been successfully published in 2024 under the Innovation and Commercial Research Unit Politeknik Kota Kinabalu. Kimara Journal is a platform for academicians to publish research papers at various levels. KIMARA Journal 3rd volume in 2024 has received research papers in multiple fields, including social science, humanity, business management, science and technology, economics and business, engineering and technology, and arts and wood- based technology.

In tandem with Kamus Key Performance Index (KPI) Jabatan Pengajian Politeknik dan Kolej Komuniti (JPPKK) Teras 6, KPI 13, which is to cultivate research, the research papers must be published in a certain number in the current year. Likewise, KPI Pelan Strategik Politeknik Kota Kinabalu (PSPKK) Objektif Strategik (OS) 9 for the year 2024, which is to preserve research and innovation, has set the Sasaran Kerja Utama (SKU) 28, which requires the publication of 26 research papers in 2024.

On this occasion, I would like to express my appreciation and congratulations to all the researchers and journal editors involved in contributing ideas and expertise to complete the KIMARA Journal 3rd volume in 2024. I am sure and believe that this journal will be able to drive the excellence of Kota Kinabalu Polytechnic in particular and also all Polytechnics and Community Colleges in general to face various challenges, especially in Industrial Revolution 5.0 (IR5.0) and also Technical Education Vocational and Training (TVET). It is hoped that cooperation from all parties to fully mobilize energy in producing this impactful journal can improve researcher performance by optimizing available resources and further boost the excellence of Polytechnics and Community Colleges on the international stage.

Best regards,

Dr. MOHD ISA BIN JAFFAR
Head of Research, Innovation and Commercialization Unit
Politeknik Kota Kinabalu

Assalammuaaikum warahmatullahhiwabarakatuh and Good Day.

Welcome to Kinabalu multidisciplinary Academic Research Journal (KIMARA), Volume 3.

It is a great pleasure and anticipation for the third volume of Kinabalu multidisciplinary Academic Research Journal (KIMARA). This milestone marks a significant step forward in our collective journey to foster academic excellence across diverse disciplines.

As we embark on this new chapter, we are deeply grateful for the unwavering support of our authors, reviewers, and the wider academic community. Your contributions are valuable to this publication, ensuring its continued relevance and impact.

In this volume, we present an extensive collection of academic work, encompassing a wide range of disciplines. From the depths of human knowledge to the frontiers of scientific discovery, each article reflects the dedication and intellectual rigor of our authors.

We are particularly proud of the rigorous peer-review process that underpins this journal. As we move forward, we remain committed to promoting access and fostering a vibrant academic community. Our journal provides a platform for researchers to share their findings with a global audience, promoting dialogue and collaboration across disciplines.

I encourage you to explore the diverse range of articles in this volume and engage in intellectual conversations they inspire. Let us continue to build upon the legacy of the Kinabalu multidisciplinary Academic Research Journal (KIMARA), making it a platform of academic excellence and catalyst for innovation.

Thank You.

Dr. SUZAN BINTI IMPAK
Publication Coordinator
Research, Innovation, and Commercialization Unit
Politeknik Kota Kinabalu

Assalammuaaikum Warahmatullahhiwabarakatuh and Good Day.

It is with immense pride and a sense of accomplishment that I welcome you to the third volume of the Kinabalu Multidisciplinary Academic Research Journal (KIMARA). This volume marks a significant milestone in our journey to foster academic excellence and disseminate cutting-edge research across a diverse range of disciplines.

Today, with the culmination of countless hours of dedicated research, rigorous analysis, and meticulous writing from 69 exceptional researchers. This volume showcases the intellectual prowes of scholars working across a spectrum of field, including agriculture, business, social sciences, education, applied science, engineering, and renewable energy.

This diverse range of disciplines reflects the interconnected nature of our world and the need for interdisciplinary approaches to address complex global challenges. Each paper in this volume represents a unique contribution to our understanding of these challenges and potential steppingstone towards innovative solutions.

We are particularly proud of the rigorous peer-review process that underpins this journal. This process, conducted by a distinguished panel of international experts, ensures the highest standards of quality and integrity, guaranteeing that each published article is a valuable addition to the global body of academic literature.

As we navigate an increasingly complex and interconnected world, the need for interdisciplinary research has never been more critical. This journal serves as a platform for researchers to bridge disciplinary boundaries and share their insights and foster collaboration.

From exploring sustainable agricultural practices to analyzing business models for renewable energy, from understanding the intricacies of social dynamic to advancing technological innovation, the 69 papers in this volume offer a rich tapestry of knowledge. Each article represents a unique contribution to our understanding of the world and our place within it.

We are committed to continuing our mission to promote open access and foster a vibrant global academic community. We strive to provide a platform for researchers to share their findings with a wider audience, sparking new ideas and fostering intellectual exchange.

I encourage you to explore the diverse range of articles in this volume and engage in intellectual conversations that inspire.

Dr. SUZAN BINTI IMPAK
Chief Editor
Kinabalu MultiDisciplinary Academic Research Journal (KIMARA), Vol.3, 2024
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The Impact of International Trade on Sustainable Development inMalaysia

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Abstract

The 17 integrated goals under the Sustainable Development Goals (SDG) emphasized that any action in one areawill affect the outcomes of other areas. Thus, the development or action planned must be balanced in form of social, economic, and environmental sustainability. It is widely known that efficient trade creates more employment opportunities, lowers down prices of products and eventually stimulates the growth necessary to endpoverty. International trade plays an important role in supporting economic growth. However, international tradealso posed a significant threat over the environment. Without proper trade policies, this situation will also affect the society and eventually hamper the progress toward sustainable development. Thus, this paper is set out to investigate the impact of international trade on both pillars of sustainable development, namely economic growth, and environmental quality. Autoregressive Distributed Lag (ARDL) co-integration test is applied to show the co-integrating relationship between the selected variables for Malaysia for the period from 1980 to 2022. The researchobjectives for this study are twofold. Firstly, it attempts to examine whether international trade enhances economicgrowth in Malaysia. Next, this study also seeks to determine whether international trade leads to higher CO_2 emissions in Malaysia.

Keywords: International trade; economic growth; environmental quality; ARDL Cointegration

1. Introduction

The Sustainable Development Goals (SDG) was designed by the United National Development Programme (UNDP) back in 2015 with its main target of ending poverty, protecting the earth by ensuring prosperity for the world population. The 17 integrated goals under SDG emphasized that any action in one area will affect the outcomes of other areas. Thus, the development or action planned must be balanced in form of social, economic and environmental sustainability. Most international organizations, for instance, the United Nation (UN) and World Trade Organization (WTO) believe that international trade supports sustainable development. WTO (2016) stated that trade growth enhances a country's income generating capacity, which is one of the essential prerequisites for achieving sustainable development. It is obvious that trade can provide big support to the economic pillars of sustainable development. In 2015, developing countries made up 48 per cent of world trade, rising from 33 per cent in 2000. At the same time, the number of people living under the poverty line was reduced in half between 1990 and 2015 (WTO, 2016). It is widely known that efficient trade creates more employment opportunities, lowers down prices of products and eventually stimulates the growth necessary to end poverty (Shen, 2018).

Generally, countries that trade more have been seen to have a high growth path, some of which has been attributed to trade (Gwaindepi, Musara and Dhoro, 2014). Moreover, international trade plays a vital role in enhancing economic growth through specialization in producing products in which it has a comparative advantage and by transferring the resources among the different countries (Belloumi and Alshehry, 2020). However, international trade also posed a significant threat over the environment. Without pro per trade policies, this situation will also affect the society and eventually hamper the progress toward sustainable development. Jafar et al (2008) stated that any development that incorporates the environment, including natural resources, is a medium for attaining sustainable development, which will guarantee prosperity and quality of life of the present as well as the future generations.

It is obvious that trade, environment and sustainable development have a very complex relationship. Thus, this paper is set out to investigate the impact of international trade on both pillars of sustainable development, namely economic growth and environmental quality. The research objectives for this study are twofold. Firstly, it attempts to examine whether trade openness enhances economic growth in Malaysia. Next, this study also seeks to determine whether trade openness leads to higher CO2 emissions in Malaysia.

2. Literature Review

There are many different interpretations when it comes to the nexus between international trade and sustainable development. Many studies previously suggested a positive relationship while others are claiming a negative one. It is without a doubt that international trade plays a vital role in enhancing economic growth. However, when environmental issues are brought into the debate, a development cannot be measured solely based on economic growth. Both pillars are vital in achieving sustainable development.

The developments in endogenous growth theory have stimulated the debate as to whether international trade contributes to economic growth. Mah (2005) found out that there are no long-run relationships between net exports and the real GDP of China. The paper also suggested that no short-run and long-run causality exists between export expansion and China's economic growth. Tang (2006) extended the previous study by adding imports into the model and discovered that there is no long run relationship between exp orts, imports and GDP of China. The study further suggested that China's economic growth does granger-caused imports in the short-run. Similarly, few other prior studies also claimed a negative impact of international trade over economic growth (Abbas and Raza 2013, Bakari and Tiba 2019).

On the contrary, Heshmati and Sun (2010) demonstrate that the increasing participation of China in the global trade helps the country to reap the static and dynamic benefits, which eventually stimulates rapid economic growth across its provinces. Similarly, Zang and Bimbridge (2012) investigated the relationship between foreign trade in South Korea and Japan and discovered that there is bi-directional causality between import and economic growth in both nations. Moreover, it is also reported that Japan seem s to experience export-led growth while South Korea has a negative effect on export growth. Trade openness also significantly contributed to the growth process of few selected Asian countries through expansion of domestic investment (Muhammad Tahir and Imran Khan, 2014). In addition, Hasnain Ahamad (2018) also discovered that international trade, specifically focusing on import and export, has affected Bangladesh's economic growth positively. Strong positive correlation between the variables were also suggested in the study.

In the same manner, Farahane and Hesmati (2020) empirically tested the hypothesis that international trade may act as a growth-engine by using panel data for Southern African Development Community (SADC). The findings illustrate that export expansion stimulated growth while higher levels of openness to trade may reduce growth due to lack of full establishment of the primary instruments for achieving SADC's central objective. Next, Abendin and Duan (2021) examines the role the digital economy plays in international trade impacts on Africa's economic growth. The findings indicated that trade has positive effects on economic growth when interacted with the digital economy. Similarly, few other studies also suggested the existence of long run relationship between foreign trade and economic growth (Awokase 2008, Busse and Koniger 2012, Bakari 2017, Blavasciunaite, Garsviene and Matuzeviciute 2020, Farag et al., 2021). In another recent study, Kong et al., (2021) discovers a long-term stable co-integration relationship between trade openness and the quality of economic growth. The author also pointed out that trade openness significantly promotes the quality of China's economic growth in both short and long term. Undoubtedly, there is an inconclusive finding over th e impact of international trade on economic growth.

The literature review shows that the international trade-economic growth relationship clearly is debatable. This is due to a few factors, namely different proxies used for international trade, various techniques used for model estimation, different periods for studies, etc. Although economic growth is an important dimension of sustainable development, it is not the only dimension that matters. Environmental quality is also another vital segment in achieving sustainable development. Obviously, the study of international trade-environmental – link is not uncommon. In fact, there have been numerous studies to investigate this subject. For instance, several studies on the impact of trade openness on the carbon dioxide (CO_2) emissions suggested the presence of a long-run relationship. Trade openness is proven to improve the environmental quality by lowering CO_2, sulphur dioxide (SO_2) and nitrogen dioxide (NO_2) emissions as well as decreases in air and water pollutions in some countries (Dean and Lovely 2010; Chong et al., 2015; Frankel and Rose 2015; Sadat and Alom 2016; Bernard and Mandal 2016; Le et al.,2020; Karedla et al., 2021)

For the case of country-specific, Ling et al., (2015) examined the impact of trade openness towards the CO_2 emissions in Malaysia. The result ascertains that trade openness positively affects environmental quality by reducing the CO_2 emissions. Likewise, several other studies also suggested similar findings. Unidirectional causality is present, running from trade openness to CO_2 emissions as well as significant and positive relationship between international trade and environmental quality of Malaysia (Ismail and Mawar, 2012; Agarwal, 2012; Bekhet and Yasmin, 2013).

Conversely, a series of studies has indicated an inconclusive result over the impact on environmental quality caused by an expansion in international trade activities. In a study that focuses on developing and less-

developed countries, Cole (2004) claims that less-developed countries do not adopt rigorous regulations in order to attract more foreign investment in less pollution-intensive industries compared to the developing countries. Similarly, Managi et al., (2009) found out that trade is beneficial to the environment of OECD countries while posing detrimental effects on SO2 and CO2 emissions in non-OECD countries. These findings are also supported by Le et al., (2016) in which trade openness leads to environmental degradation for the global sample but results differ according to the income level of countries. The authors also express that trade openness has a benign effect on the environment in high income countries, but harmful effects in middle- and low-income nations. Moreover, Nguyen et al., (2021) utilizes ARDL and cointegration bound tests to examine the relationship between Vietnam's economic growth, financial development, transportation capacity and environmental degradation. Their findings show that significant long-term cointegration exists among variables. The authors also suggested that an increase in per capita GDP and financial development worsens environmental quality while transportation capacity and foreign investment can improve environmental quality.

Despite the indecisive relationship between international trade and environmental quality suggested in the previous empirical findings, several recent studies have emphasized the negative impact brought by trade openness. According to Mahmood et al., (2019), the pollution haven hypothesis is found to be true in the case of Tunisia. Expansion of trade openness is proven to increase CO2 emissions which eventually causes environmental degradation. Similar results are also suggested by Ansari et al., (2020). By focusing on the top CO2 emitter countries, namely USA, Japan, Canada, Iran, Saudi Arabia, UK, Australia, Italy, France and Spain, the author found out that an increase in trade does Granger cause CO2 emissions in the long run. Furthermore, Belloumi and Alshehry (2020) employed the autoregressive distributed lag (ARDL) cointegration approach and discovered that trade openness has a long-term relationship with economic growth and environmental quality. However, in the short-term, trade openness does not affect both indicators. Besides, in the long-term, trade openness has a significant negative impact on Saudi Arabia's economic growth as well as its environmental quality. Lastly, Sheikh et al., (2020) utilized ARDL model on India's empirical data to test the relationship between sustainable development and trade openness. The study confirms the presence of a negative relationship between India's trade openness and environmental quality. The authors also concur that trade openness tends to be both distorting and detrimental to the future generations.

3. Methodology

This study utilizes annual data for Malaysia, obtained from the World Development Indicator (WDI, 2018) published by the World Bank for a period of 40 years starting from 1980 to 2022. For hypothesis testing, the Autoregressive Distributed Lag (ARDL) cointegration is employed. This approach is initiated in three steps. Firstly, checking for stationarity of all variables is done by employing a few conventional unit root tests, such as the augmented Dickey-Fuller (ADF) test and the Philip-Perron (PP) test. Next, once all variables are integrated of order zero or one, the relationship between variables are examined using the bound test of Pesaran et.al (2001). Further analysis is determined using error correction models to estimate the short -term and long-term coefficients. The data employed in this study focuses on two pillars of sustainable development, which is economic growth and environmental quality. The value of per capita GDP at constant prices data is used as an indicator for economic growth, while CO2 emissions is used as the environmental quality indicator. Trade openness variable is indicated by the ratio of total export and import to GDP. Foreign Direct Investment (FDI) inflows are measured by the share of FDI in GDP while the ratio of credit accorded to private sectors is used as a proxy for finance development. In addition, domestic investment is indicated by the share of gross fixed capital formation in GDP.

To check the impact of trade openness on economic growth in Malaysia, we perform the econometric model as shown in the equation (1) below:

$$LGDPPCt = \text{a} + \beta 1 LGFCFt + \beta 2 LECPCt + \beta 3 LTOt + \beta 4 FDIt + \beta 5 LFINDt + \varepsilon t \quad (1)$$

L is the natural logarithm, t is a time trend that takes the years from 1980 to 2022, GDPPC is the GDP per capita at constant price, GFCF is gross fixed capital formation (percentage of GDP that represents domestic investment), ECPC is energy consumption per capita (kg oil equivalent), TO is trade openness (percentage of total export and import over GDP at constant price), FDI is net inwards of foreign direct investment as percentage of GDP, FIND is financial development and εt is an error term. The purpose we transform into natural logarithm is to make highly skewed distributions to less skewed. But variable FDI we cannot transform into natural logarithm is due to negative values in certain years. The various variables are chosen based on previous research such as by Fetahi- Vehapi et al. (2015), Fayyaz et al. (2018) and Kong et al. (2020).

For environment quality econometric model mainly adopted by Ridzuan et al. (2017) and Chandia et al. (2018) as stated in equation (2) below:

$$LCO2t = a + \beta 1 LGFCFt + \beta 2 LECPCt + \beta 3 LTOt + \beta 4 FDIt + \beta 5 LFINDt + \varepsilon t \qquad (2)$$

Variable CO2 is CO2 emission per capita in metric tons can be explained by gross fixed capital formation, energy consumption per capita, trade openness, FDI and financial development.

4. Findings and Discussion

Step one in the findings we are starting with the unit root test. Table 1 below shows the results of the unit root testfor the various variables in this study. The unit root test is tested for both level and first difference using Augmented Dickey Fuller (ADF) test and Philips-Perron (PP) test. From the results, we find that none of the variables is integrated at the second difference. They are stationary at their levels or at their first differences. Therefore, this study can proceed with ARDL bounds test to cointegration technique test.

Table 1: Results of Unit Root Tests

Variables	ADF Test		Phillips-Perron Test	
	Level	First Difference	Level	First Difference
LGDPpc	-2.311	-5.557*	-2.501	-5.506*
LCO^2	-1.192	-7.212*	-1.235	-7.177*
LGFCF	-2.741	-4.707*	-2.240	-4.665*
LECpc	-1.815	-6.313*	-1.791	-6.817*
LTO	-1.013	-5.206*	-1.052	-5.111*
FDI	-5.455*	-7.091*	-5.454*	-19.608*
LFinD	-2.537	-5.254*	-2.558	-5.900*

Note: *, **, *** shows the level of significance at 1%, 5%, and 10% respectively.

For the second step of the analysis, we conduct the ARDL bounds F-test for cointegration of Pesaran to check equation (1) and (2) if there is a cointegration relationship between the variables. Both economic growth and environmental quality models are estimated with unrestricted constant and no trend. Table 2 below shows the results of the ARDL bound F-test. We find that all values of F-statistics are greater than the upper bound critical values I(1) at even 1% significance level for environmental quality models. For the economic growth model, values F-statistics are greater than the upper bound critical values I(1) at 10% and 5% significance level. Hence, we can conclude the presence of cointegration relationship among the various variables for both models.

Table 2: Results of autoregressive distributed lag (ARDL) Bounds Test

Model	Max. Lag	ARDL Lag Order	F-Statistic	k
Economic Growth	3	ARDL (3,4,4,4,3,3)	11.4933	5
Environmental Quality	3	ARDL (4,4,4,4,4,4)	35.3553	5
	Case 3: Unrestricted constant and no trend			
Level of Significance	I (0)		I (1)	
10%	1.81		2.93	
5%	2.14		3.34	
1%	2.82		4.21	

Note: 1) k is the number of dynamic regressors. 2) The null hypothesis is the absence of a relationship.

Third step we estimate the error correction models to determine the short- and long-term coefficients as shown intable 3 and table 4. In table 3, the coefficient of the lagged error correction term ECT is -1-725 for economic growth model and -1.594 for the environmental quality model. It shows both models were significant and stable. Hence, we can confirm the presence of a cointegration relationship among all the variables.

Table 3: Short-term elasticities and error correction term estimates

Variables	Economic Growth Model (D(LGDPpc))	Environmental Quality Model (D(LCO^2))
	Coefficient (p-Value)	Coefficient (p-Value)
D(LGFCF)	0.326* (0.00)	-0.222** (0.01)
D(LECPC)	-0.323* (0.00)	0.730* (0.00)
D(LTO)	-0.294*** (0.06)	0.881* (0.00)
D(FDI)	0.000* (0.00)	-0.00* (0.00)
D(LFinD)	-0.104*** (0.10)	0.139** (0.01)

ECT (-1)	-1.725* (0.00)	-1.594* (.0.00)
R-Squared Adjusted	0.98	0.99
R-Squared	0.99	0.99

Note: 1) *, **, *** shows the levels of significance at 1%, 5% and 10% respectively. 2) The values between parentheses are p-values.

Table 4: Long-term elasticities estimate

Variables	Economic Growth Model	Environmental Quality Model
	Coefficient (p-Value)	Coefficient (p-Value)
LGFCF	0.080 (0.20)	-0.080 (0.30)
LECPC	1.122* (0.00)	0.209* (0.00)
LTO	-0.202* (0.00)	0.909* (0.00)
FDI	0.000* (0.00)	0.000** (0.01)
LFinD	-0.097 (0.11)	-0.021 (0.69)

Note: 1) *, **, *** shows the levels of significance at 1%, 5% and 10% respectively. 2) The values between parentheses are p-values.

The results of this study underscore the global challenge of balancing economic growth with environmental sustainability. While international trade and investment are critical for fostering economic development, they often contribute to environmental degradation, particularly in developing countries like Malaysia. The short run relationship is also presented in table 3 and table 4 for long run relationship, estimated coefficientsare statistically significant at 1%, 5% and 10% significance level The short- term positive effects of foreign direct investment D(FDI) and domestic capital formation D(LGFCF) on economic growth are encouraging. It indicates that a higher level of domestic investment and foreign direct investment has a significant positive and short run effect on economic growth. However, gross fixed capital formation (LGFCF) is also positive in the long run but not significant. When domestic investment increases by 1%, economic growth will increase by 0.08%.

Findings for variable trade openness has a negative impact toward economic growth in the short run by 10% significant level as well as in the long run by 1% significant level. the negative impact of trade openness suggests that Malaysia's industries may struggle to compete globally or may rely too heavily on resource-intensive, low-value exports It is consistent with Waheed et al. (2021), which indicates that developing countries face difficulties in fully leveraging the benefits of trade liberalization. In another previous study, trade openness positively affects economic growth in developed countries, but it can have negative impacts for developing countries like Malaysia, Kim and Lim (2009). Finally for variable finance development find its negative coefficient and significant at 10% level of significance for short-term. But it is not significant in the long-term. Thus, we can conclude finance development negatively affects economic growth in Malaysia for the short-term. The negative impact of trade openness on growth highlights the need for Malaysia to diversify its export portfolio, shifting away from low-value, resource-intensive products. By investing in technology-driven and value-added sectors, Malaysia can better integrate into the global economy while reducing environmental degradation. Although international trade can support Sustainable Development Goals (SDGs) by fostering economic growth and reducing poverty, it can undermine environmental sustainability if not carefully managed. Therefore, Malaysia must take proactive steps to align its trade policies with broader objectives, such as lowering CO2 emissions, improving energy efficiency, and promoting sustainable development.

In the environmental quality model, positive impact can be found in D(LTO) and D(LFinD) in the short run and significant, showing financial development and trade openness positively significant on environmental quality. These results can be supported with findings of Zhu et al. (2019) argued economic performance has a positive impact on CO2 emission. Our empirical results find energy consumption (LECPC) in the long run having a positive and significant association with CO2 emission by 1% significant level. Any increase in energy consumption by 1% will lead to an increase in CO2 emission by 0.209%. These findings indicate that energy is the main force of pollution in Malaysia. Saboori et al. (2012), Saboori and Sulaiman (2013) and Chong et al. (2015) who reported similar results for energy consumption in Malaysia in the previous research. The short-termelasticities of trade openness have positive coefficients and are significant at 1% level of significance, as well as significant in the long-term. So can conclude trade openness leads to an increase CO_2 emission in Malaysia for short-term and long-term. Moreover, the study confirms that trade openness and energy consumption significantly contribute to increased CO2 emissions in Malaysia. This finding is consistent with other research showing that developing nations oftenface heightened environmental pressures due to less stringent

environmental regulations (Cole, 2004; Managi et al., 2009). Like many other developing countries, Malaysia risks becoming a "pollution haven," attracting industries that prioritize profits over environmental sustainability. To stimulate economic growth while minimizing environmental harm, Malaysia should prioritize investments in clean energy and green technologies. Such investments would help reduce the country's dependence on energy-intensive industries and mitigate the environmental consequences of trade. Additionally, Malaysia should consider implementing stricter environmental regulations to avoid becoming a pollution haven. Encouraging industries to adopt cleaner technologies and sustainable practices would be a crucial step toward reducing CO2 emissions and other pollutants

5. Conclusion

This study aims to examine the effects of gross fixed capital formation, energy consumption, trade openness, foreign direct investment, and financial development on economic growth and environmental quality in Malaysia from 1980 to 2022. Advanced econometric techniques, such as the Augmented Dickey- Fuller (ADF) and Phillips- Perron (PP) tests, were employed to check the stationarity of the data, along with the cointegration bounds test. The empirical results indicate that while all variables significantly i nfluence economic growth, only gross fixed capital formation and foreign direct investment show a positive impact in the short run. In the long run, gross fixed capital formation continues to have a positive, but statistically insignificant, effect on economic growth. Conversely, trade openness demonstrates a negative impact on economic growth in both the short and long term in Malaysia. In terms of environmental quality, the findings reveal that trade openness is positively and significantly correlated with CO2 emissions. Similarly with financial development, positively impact CO2 in the short run.

This study also highlights the broader global challenge of balancing economic growth with environmental sustainability. In Malaysia, foreign direct investment (FDI) and domestic capital formation contribute positively to short-term economic growth. However, the negative effect of trade openness suggests that Malaysia's industries may face global competitiveness challenges or rely heavily on resource-intensive, low- value exports, which, in turn, contribute to higher CO2 emissions. This is exacerbated by less stringent environmental policies, positioning Malaysia and similar developing nations as potential "pollution havens."

To mitigate these issues, Malaysia should focus on increasing investments in clean energy and implementing stricter environmental regulations to reduce its reliance on energy-intensive industries. Diversifying exports toward higher-value, technology-driven sectors would help Malaysia achieve better integration into the global economy while minimizing environmental harm. Ensuring that trade policies align with sustainability goals is critical for fostering both economic growth and environmental protection.

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Factors Affecting Business Finance Course Achievement of Business Studies Diploma Students

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Abstract

Business Finance is a compulsory course taken by 5th semester students of the Diploma in Business Studies (DPM) at Polytechnic. This course involves calculations in addition to the theory that requires the mastery of technical skills to score and get excellent results in the final exam. However, based on the past final exam results, the student didn't reach the target 100% level of students' achievement in grade C and above, even though the course lecturer has taken various initiatives to help students understand the topics being taught, whether on the theory or calculations' part. Thus, a study needs to be conducted to explore the factors that influence the achievement of the Business Finance course among Polytechnic students. This qualitative study gathered data through interview and content analysis involving twelve (12) DPM Muadzam Shah Polytechnic students with low grades in the past Business Finance final exam as respondents using inductive and deductive analytic methods. The student achievements considered for this study involve session 1 of 2023/2024 and session 2 of 2023/2024. Several variables have been identified to be considered as factors that influence student achievement in the subject of business finance in this study, including interest, attitude, learning style, and teaching methods. Based on the study conducted, it can be concluded that the interest factor is the main contributing factor that influences the achievement of the Business Finance course among Muadzam Shah Polytechnic students. It is hoped that certain parties can use the results of this study to improve student academic achievement in Business Finance courses of DPM. Ultimately, future researchers may also study business finance achievement at other polytechnics and institutions that offer the same course.

Keywords: - Business Finance, Muadzam Shah Polytechnic, achievement

1. Introduction

Students are the most valuable resource for every nation because the quality of higher education directly affects the nation's social and economic development. Academic success among students is crucial to producing graduates of high quality who will excel as leaders and provide labor for industries. Furthermore, academic achievement will increase one's income and better position in the workforce. The student's academic achievement plays an important role in producing good quality graduates who will become great leaders and manpower for industries (Ali, Jusoff, Ali, Mokhtar & Andin Salamat, 2009).

Business Finance is one of the core courses that is compulsory taken by students in Diploma Business Studies in Polytechnics. This course is important because it exposes students to the concepts of finance, organization, financial analysis, financial planning, involved in calculations, and building technical skills among students. This course is also important because achievements in this subject will have impacts on students' Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) results, which will subsequently contribute to the attainment of the Course Learning Outcomes (CLO) and Program Learning Outcomes (PLO) established by the polytechnic.

Table 1: Analysis Of Final Assessment Achievement Session I: 2023/2024

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	E	E-	F
1.5	16.2	27.9	17.6	13.2	10.3	7.4	1.5	1.5	1.5	1.5	0	0	1.5

Table 2: Analysis Of Final Assessment Achievement Session II: 2023/2024

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	E	E-	F
1.6	9.5	19	12.7	15.9	22.2	9.5	6.3	1.6	1.6	1.6	0	0	0

Tables 1 and 2 show the student's results for the course of business finance for session 1: 2023/2024 and session II: 2023/2024. For session 1 2023/2024, there were 68 students in semester 5 who have taken this course,

and it was found that 7.5%, equivalent to 5 students, received a grade of C or below. For session II: 2023/2024, there were 6 students, or 11% out of 63 students who took this course, who received a grade of c or below.

Therefore, a study needs to be conducted on students, especially those who received grades of C and below, to identify the factors influencing their achievement in the final examination for this business finance course. Thus, all 12 students who achieved grades of C and below in both sessions have been selected as respondents for the study conducted.

2. Literature Review

This study aims to explore the factors that influence student achievement in a Business Finance course and four variables have been chosen as factors identified, including interest, attitude, learning style, and teaching methods.

2.1 Achievement

Academic achievement is a clear indication of how well students are acquiring knowledge and may be used to assess both the general growth of students and the efficacy of teaching and learning in higher education. Academic achievement is a more long-lasting behavioral outcome that can potentially accumulate over time because of the subjective and objective assessment of students through learning in class or independent study. A study conducted by Wang (2019), stated that academic performance and achievement are interchangeable. This is agreed by (Masud et al., 2019), who found academic achievement is thought to be closely related to academic performance. It turns into one of the many crucial factors affecting a student's academic achievement. According to Li et al., (2019), university students' academic achievement can be analyzed by using four criteria: communication, self-management, cognitive learning, and interpersonal facilitation. A student's ability to succeed in assessments and the final test determines their academic achievement. Every student strives for and is referred by his or her grade to good academic success (Alani et al., 2020).

2.2 Interest

Interest will turn into a driving force for learning, a strength to inspire someone to learn. Students who enjoy learning will appear more supportive of continuing education than those who only find it difficult to learn more and more because of their lack of encouragement. Eventually, students who consistently perform poorly in mathematics may lose interest, which will change their learning habits (Yeh et al 2019). According to the previous study, motivation and interest have a strong connection because interest acts as an inspiration in people, guiding their attention in specific paths, and mentions that a person who is interested in something will pay close attention to it, remain interested in it throughout time, and appear to be enjoying it and will enjoy it results in satisfaction (Sarumaha, M. S., & Laiya, R. E, 2023). When someone finds something interesting and begins to focus on accomplishing it, they are drawn to it. Students' curiosity will motivate them to learn, which will impact their academic achievement (Lastri et. al., 2020). In addition, due to lack of interest, students could learn more slowly (Harefa, 2022).

2.3 Attitude

Attitude plays a critical role in students' success. Positive attitudes of motivation and involvement in mathematics are linked to positive views toward the topic, which enhances performance and accomplishment (Chen et al.,2018). In addition, positive attitudes could assist students in acquiring a growth mindset (Limeri et al.,2020). Students may face obstacles, and they may be able to face and remain open to learning and growth with a good attitude. On the other hand, students who have a fixed mindset frequently believe that their skills are unalterable and are less likely to venture outside of their comfort zones or seize new opportunities. A study by Julaihi et al., (2022) states that students who have strong self-efficacy beliefs are also more likely to set challenging tasks for themselves and work hard to achieve those goals. Additionally, students who have larger aspirations for their education typically perform better than those who have lower aspirations. (Askın & Oz, 2020).

2.4 Learning Style

Learning styles and academic achievement are closely related. This is because how students acquire information and approach challenges is greatly influenced by their learning styles. A study by Siddiquei & Khalid (2018) indicates that 17% of the change in learning performance can be related to the combined influence of personality and learning style. According to Srivastava & Shah (2021), learning styles express the way a student prefers to study along with how they assimilate information through educational methods that are in line with the content, context, and cognitive abilities of the lesson. Some researchers found that sequential and visual learning styles significantly impacted academic achievement. (Ang *et al.*, 2017). Further, Shah et al (2017), state that understanding learning styles can assist a teacher in recognizing and resolving issues with students' learning. This

will enable the teacher to better align the curriculum with the student's needs, which will motivate the pupils to learn more quickly.

2.5 Teaching Methods

Every teaching method intends to raise students' academic standing and develop effective learning skills. According to Freeman et al. (2014), students who participated in active learning sessions reported better levels of engagement and satisfaction in their courses, and they scored 6% higher on exams than students who attended standard lectures. Besides, numerous studies have already examined how instructional strategies affect students' motivation. Teachers might think about using alternative teaching techniques when engaging with the students more entertainingly. (Mamolo, 2019). Cudney & Ezzell (2017) found that implementing different teaching techniques has a favorable effect on students' learning and inspires a shift in their desire. Yuliansyah & Ayu (2021) also reported that giving students tasks related to projects and interactive activities during the educational process can help them become more proficient presenters by allowing them to work together and exchange ideas.

3. Methodology

This study uses qualitative methods, and interview instruments have been conducted by researchers to obtain data, and the data was then analyzed using content analysis methods. Data was collected through interviews and content analysis of their lesson tasks, such as exercises, tests, practical exercises, and lesson observation. During the interview process, the researcher recorded the session via MS Teams using a semi-structured interview guide and recorded important data in writing. Researchers use both methods to ensure that the data received is more accurate and clearer. In this study, the researcher interviewed 12 students from Muadzam Shah Polytechnic who obtained grades C and below in the Business Finance course to achieve all the research objectives that focus on the factors that influence low results in the Business Finance course. The factors affecting Business Finance Course Achievement of Business Studies Diploma Students were identified and analyzed. Creswell (2014) described a qualitative study as one that takes place in a natural setting and the researcher goes to the site to conduct the research, enabling them to get detailed information about the problem. All the interviews were audio recorded, and notes were taken to complete the recordings. The spreadsheet was used to code and analyze the interview transcripts. Coding helps effectively label and retrieve data (Miles and Huberman, 1994). The coding was done based on the themes that emerged and those that were predetermined. The inductive and deductive analytical methods were used to create the themes. Then, the codes were connected to form categories for each case. The acronym S1 in the findings refers to Low-Performance Students (LPS) 1 involved in this study and so on.

4. Findings and Analysis

The results of the interviews conducted found that there are four factors that contribute to low achievement in the Business Finance course, namely interest, attitude, learning style, and teaching method. Each of the following factors is summarized and discussed as follows.

4.1 Participants Demographic

Table 3 lists the background of the 12 respondents involved in the interview process. They are students of DPM at Muadzam Shah Polytechnic who obtained a grade of C or below in the Business Finance course. They also got an average grade of C for mathematics in SPM.

Table 3: Participant Demographics

Participant	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**
Gender	M	F	M	M	F	F	F	F	M	F	F	F
Grade Math (SPM)	C	D	C	B	D	C	D	E	B	C+	E	D
Grade Add Math (SPM)	-	-	-	F	-	-	-	-	-	-	-	-
Grade Business Finance	C-	D	C	C	C-	D+	C	F	C	D+	C	D

M=Male, F=Female, SPM=Sijil Pelajaran Malaysia

4.2 Interest

This study revealed that low interest among students in subjects involving calculations, such as Business Finance Course, is a major factor contributing to low academic achievement. Several key themes were identified through interviews with students who received grades C and below explicitly, involving difficulty perception, self-efficacy, and motivation. This discussion aims to gain a deeper understanding of those themes and their implications for the low achievement of this course. Table 4 sheds light on the participants' scrutiny of the interest factor.

Table 4: Findings of interest factor

	Theme	Quotation
1	Difficulty perception	S1: *While studying, it's ok... during the final exam, I can't answer. When you have to take it, it's okay because it feels like a learning cost. The final time was difficult because it included all the chapters.* S2: *Interest in Business finance. Excited.....I think it's like basic cost or accounting because I have liked accounting since semester 1. But when I've learned it's hard…it's gone astray from what I expected. I have to study hard because it's hard* S3*: I don't like it. Look a little dizzy. Not a friend.* S4: *I like to calculate like I do accounting, I like to memorize formulas and solve problems. I was interested in learning Business Finance early when learning. Topic 1 and Topic 2. After that, it's hard not to be interested.* S5: *I don't like to count because I think math has been difficult since school. I'm not interested in Business Finance because it has mathematics and accounts.* S6: *Just a little...don't like to count...because it's hard. A little interest in Business Finance, some are easy...some are difficult. Business Finance a lot of sentences and counting…and the theory is also difficult.* S7: *I don't like math...I'm slow to understand...it's a bit difficult dizzy. I am a little interested in Business Finance which is easy and can be understood... in the first chapters. Business Finance…. counting and hard.* S8: *Not interested in counting from school anymore complicated. I have little interest in BF because it's difficult. BF is difficult because I don't understand counting.* S9: *Intermediate....easy topics I like...difficult ones. I don't like them* S10: *Not interested…. difficult* S11: *I don't like math since school...it's so hard…. there are certain I can't answer...I don't like math…I get confused sometimes* S12: *Lack of interest because...some parts can be...some can't. It's ok... sometimes it's ok....sometimes it's hard*
2	Self-efficacy	S1: *The topic is getting harder and harder...stress to catch up. After the final target B or C., I am only interested in the subject of Organizational Behavior because it is a theoretical subject.* S2: *Topics 1-2 can be done, Topic 3 and above are difficult, and many formulas have to be memorized. Target B or C only.* S3: *I don't want Business Finance...but now I have to do an internship related to Business Finance.* S4: *Interest in Business Finance work such as accounts and formulas are easy to do as you already have basic knowledge.* S5: *I'm interested in finance-related work because I have to do an internship...whether you want it or not, you have to like it...for example, calculate the selling price….do it in Excel* S6: *Don't want Business Finance...take the field of operations* S7: *It's okay in the field of Finance because I've studied it before.* S8: *It is possible to enter the field of finance even if it is difficult... but you have to study a lot more.* S9: *Target C and above. I don't want to pressure myself. I don't want to go into the finance field... It's hard to study... I'm afraid of my career so I can't work.* S10: *Target C... difficult. I don't want to be in the finance field... I'm afraid I won't be able to work.* S11: *No Target A....know the ability level.... There is a topic that I don't quite understand ... do the exercises but when the final exam is confused. Interested but need a lot more training to do the job.* S12: *Target B or just pass...finance has to do a lot of training...too lazy to do exercises. It's just normal. even interns are hard.*
3	Motivation	S1: *About 50-50 interest. If the question is complicated, I'm not interested. If it's easy I'm interested.* S2: *Interest in counting when it's easy. 50-50.* S3: *The feeling of having to take a BF……sad and not happy .....think there is no point or no use in studying this. About the formula... basic math is ok... but memorizing the accounting formula… I don't think it's possible.* S4: *The feeling of taking a BF is just like accounting, but in the end I lost interest, I can't score.* S5: *Feelings...why do I have to take BF…because I think of it like math. If the theory is ok. I think that there is no calculation subject in the final semester. Stress is also because there is a calculation subject in final semester 5.* S6: *The feeling…..rubbish…it's hard. A little stressful because the theory is hard to understand. The question is long... it's hard to understand .. theories like in Topic bond I don't like.* S7: *The feeling...you have to take it....so, head on...as long as you pass. Stress because of the final exam, I had to catch up on a lot of things that I didn't understand* S8: *Fear of failure because it is difficult. I'm stressing about the back-to-back chapters because I don't understand.* S9: *I don't like BF....more difficult topics than easy ones. Personal Financing course is easy…BF is difficult* S10: *Dislike BF…. due to calculations. BF…hard. BF…the lowest course score in the list of courses I need to take for DPM.* S11: *It's hard to understand at first. it takes a long time to understand.* S12: *Some parts are difficult, and some are easy. BF…. calculation. BF….I'm afraid because it's sound hard.... when you've always practiced….it's ok too*

4.2.1 Difficulty perception.

Most respondents share the same perception regarding the Course of Business Finance, which is that when a subject involves calculations, they consider it difficult and are not interested in continuing the process of learning that subject. For them, this subject is taken out of obligation to fulfill the requirements of the program they are enrolled in. This makes it difficult for them to concentrate during the learning sessions. Besides that, students find Business Finance difficult because they don't understand the technique, its methods, and the conceptual foundation. Students who have a negative perception of this course find it difficult to give themselves the opportunity to understand this subject, and it creates a sense of not enjoying attending class. Since school, students are less interested in mathematics, and calculations make them less effort to understand the subject. Furthermore, students become less interested in learning and engaging in training when they perceive subjects such as business finance as challenging and complex. This finding is in line with the finding that students who think this subject is difficult ignore the activities given and prioritize passing the above well.

4.2.2 Self-efficacy.

Most students enrolled in this course have different backgrounds in fields other than computing. Low performance is often experienced by students who lack confidence in their abilities, especially relating to calculations matters. Students have low self-efficacy since most students have less confidence in solving calculation problems and fear that their answers are incorrect and fear scorn from their peers. Students who struggle with calculation and mathematics anxiety, experiencing stress, worry, or unease, and do not believe in their existing abilities.

4.2.3 Motivation.

The compulsory requirement of this course for a DPM program makes students feel pressured to take it exhibit a passive learning style. Their motivation and effort to achieve good performance are reduced by this thinking. Students perceive themselves as inefficient in calculations and believe that all assignments involving calculations are hard to complete. As a result, they are less motivated to attempt to solve the problem. Students may find it difficult to stay motivated because they don't have a strong sense of purpose or know how their academics relate to their long-term objectives.

4.3 Attitude

The performance of DPM students revealed the following results regarding the attitudinal element. The related themes that emerged from the findings are calculation phobia, presence and commitment, and imitative tendencies. Table 5 clarifies the participant's views that support the themes.

Table 5: Findings of attitude factor

	Theme	Quotation
1	Calculation phobia	S1: *I didn't do the exercises that were given. At the beginning of the semester, I don't care about the answers...when I get close to the final exam, I'm busy looking for answers* S2: *If I understand, answer directly...if you don't understand, ask someone for help/copy. Wait for the lecturer's answer so you can check.* S3: *Follow the mood to do exercise... usually last minute... because you are not very good at it... wait for everyone to study and do the same. Make sure the lecturer gives the answer. ...as last-minute revision can use the answer. Make sure everyone who learns understands by asking friends. If it's a topic that you're not interested in/don't know, just leave it unanswered... I don't want to get distracted.... do the easy stuff first, then focus on the hard stuff.* S4: *Last minute..wait for the friends in the same room to do it together. Make sure the lecturer gives the correct answer.....check the correct answer. Make sure all the questions can be understood so that all topics for the final can be answered.* S5*: Keep doing all the exercises given for fear of forgetting how to do them. I want an answer from the lecturer, I want the correct answer for review.* *If there's a topic that I can't handle, I'll let it go first. If I think too much about that topic. can't cover other topics. If the topic is difficult...I copy the practice answers first. .. catch up later during the finals.* S6: *If it's easy, do it straight away... the hard one... don't do it... wait for the other person's answer.... copy it first. Wait for the lecturer's answer. I don't understand, ask a friend.* S7: *I didn't do the training straight away... because it was difficult.... when I wanted to do it ....it was blurry... it was difficult.....copy the member's answer. Wait for the lecturer's answer to know the answer. Catch-up outside of class.* S8: *Just made it last minute..not interested in looking for an answer. Wait for the lecturer's answer to know the answer. You have to understand because you have to answer the exam.* S9: *Wait for the lecturer's answer to know the answer.... if it's wrong... learn from the answer. I'm targeting questions that I can answer only during the finals. I understand completely* S10: *Wait for the lecturer's answer, I want to know the answer.....I want to know if I can do it or not*

		S11: *If it's easy, do it right away* S12: *Do it gradually...a little*
2	Presence and commitment	S1: *It's ok to come to class. Didn't come to class because I fell asleep.* S3: *Happy to go to BF class. The lecturer is fun… interesting.* S2: *I'm afraid to come to class because the lecturer gave me so many exercises that I didn't have time to finish/answer...just copy it guys...stress. I didn't miss it. Sometimes I start to feel lazy, but my roommate forces me to go. If I'm not ready for work/training, I feel lazy to go to class. It's ok to go to class...if you don't go to class, you won't understand.* S4: *At first, it's ok.... when I've missed a lot or don't understand...lost. I'm too lazy to study in class. So, I'm too lazy to go. Always attend class.. I'm a class leader. Attending class because I'm the class leader, not because I like BF. Not excited to go to BF class because it's hard to learn BF.... so, lazy to go to class.* S5: *Class BF...like to go to class.... When the topic is easy, exercises are easy to do.....like to come to class.... After a while the topic becomes difficult...don't like it .... stress because it is difficult. When there is a new topic... a difficult topic... I feel too weak to come to class. I rarely skip class. If you don't come, there is a reason. Do not skip for fear of missing the exercise that the lecturer gives. Not excited to go to BF class because BF class is difficult.. why finance?* S6: *Ouch....BF...it's hard to study... forced to go to class. Sometimes I'm excited to go to BF class because I want to finish a topic.* S7: *It's a bit heavy...I always skip.... lazy.. I skip when the lecturer teaches a difficult topic. Not excited to go to BF class because it's hard to understand.* S8: *It's ok... I've never been absent....if I don't come, I don't know what the lecturer is teaching. Not excited to go to BF class because I don't like it.* S9: *Feeling...happy..normal...environmental..teach relaxed. Sometimes I miss it... it's hard to wake up in the morning. It's normal... don't wait for BF* S10: *The feeling...it's normal.....because I came to study. Sometimes I skip because I always wake up late. Not excited about the BF class... It's ok if there is a class or not.* S11: *It's ok... I want to add knowledge too. Sometimes I get sick.... because I'm sick.. sometimes I'm lazy. Follow the mood...excited to go to BF class because I want to learn a new topic. if the topic is difficult and the exercises are not ready, I am not excited to come to class.* S12: *It's ok... like it or not you have to learn too BF... new things. Missing class once..... fever.*

4.3.1 Calculation phobia.

Based on the finding, there are circumstances where students are not working hard enough on doing their calculation exercise on their own but rather copying from their friend. This creates a vicious circle where students who copy don't learn, which in turn reinforces their negative attitude towards the subject because they never really understand the concepts required. Academic dishonesty, such as cheating, is often caused by a negative attitude towards learning. Students who imitate not only fail to learn but also reinforce a negative attitude towards learning. This shows that the lazy and complacent attitude found in this study not only prevents students from achieving academic success but also damages their academic integrity.

4.3.2 Presence and commitment.

Students who attend classes often do so only to meet attendance requirements without any active involvement. Class attendance, especially attendance that involves active participation, is one of the most important factors in ensuring academic success. Students who are actively involved in class significantly improve their academic performance. In the context of this study, "being physically present but not mentally" is not enough to ensure that students master the concepts taught in Business Finance. Students should make a frequent review of the topic, do assignments to the best of their ability, and be ready for assessment, all which points to a persistent effort in studying. It's important to aim for ongoing progress as opposed to only fulfilling the minimum requirements.

4.4 Learning style

The findings show that the learning style of students plays an important role in their achievement in the Business Finance course. Students who prefer to study in groups tend to rely on peers to complete exercises, especially when they have difficulty with more challenging tasks. They also distance themselves from the lecturer and are more comfortable asking questions and learning with friends. This leads to some significant effects on their academic performance. Table 6 shows the responses of the participants that strengthen the issues.

Table 6: Findings of learning style factor

	Theme	Quotation
1	A Double-Edged Sword	S1: *Study in groups and do exercises. Lost doing exercise...ask a clever friend because he is intelligent. Just imitate if you can't answer the question.* S2: *Study in groups. Do exercises with a group. If it's lost or can't do it, ask a clever friend. Ask in the group... he will give the answer. Imitate.* S3: *Group...not sleepy.... can share many ideas.. know if you do it wrong. I understand the question…. try asking smart friends. Imitate but understand the answer. .. depending on the situation... if you know how…just to do it….if lost, imitate and try to understand the answer* S5: *Group….. friends will support you. Ask a friend if you don't understand. Imitate but understand the answer. Learning how to support a lot. Group is not bored. Ask a friend if you don't understand. Look at the situation... don't copy it... do it until you understand... try it first. .. give the same answer as your friend.* S6: *Group.. too many topics to understand, have to refer to smart friends. Understand for yourself...if you don't… have a friend teach. Ask and understand correctly…. just copy... last choice just imitate* S9: *Group...two... when you understand, you can group. If someone understands. Do exercise in a group...can race who is ready first. Look at the topic. those who don't understand are just copying it*
2	Engagement with lecturer	S1: *Didn't meet the lecturer...shy to meet and ask...likes to ask friends only.* S2: *It is more comfortable to study with friends.* S3: *Prefer a friend to teach, easier and understanding.* S4: *I didn't meet the lecturer because I was too lazy to go to the lecturer's office, I wanted to go straight back to the hostel after class.* S11: *Not communicating with the lecturer, afraid of getting angry.* S6: *Never meet the lecturer...shy to meet and ask, feel comfort with asking clever friends.* S8: *Just ask friends, easier understand…. never met a lecturer…fear of doing wrong* S7: *Ask a friend, getting lazy to meet the lecturer at the office.* S9: *Just ask a friend and get the answer.* S10: *I couldn't meet and ask the lecturer, I was afraid the lecturer would be disappointed because I wasn't focused in class.* S12*: Never ask a lecturer in a week...prefer to ask a friend first*

4.4.1 A Double-Edged Sword.

Group learning can be an effective method of deepening understanding, as long as each group member is actively and critically involved. However, as this study points out, when students rely too much on peers for answers, they lose the opportunity to develop necessary problem-solving skills. While collaborative learning can improve understanding, it also risks becoming "taught learning" when students simply copy answers without understanding the concepts. Reliance on peers to complete exercises, especially when students choose not to ask the lecturer, indicates a passive learning style. This may make it easier for students to pass the test minimally but prevents them from mastering the skills needed to understand deeper concepts, which are important in courses like Business Finance. While learning in a group can reduce fear and increase confidence, it can also hinder individual learning if students rely too much on their peers. Although group-based learning can increase motivation and help students to share knowledge, it can also cause students to become dependent on solutions provided by others. In the study, students who tend to copy a friend's work without trying it themselves run the risk of losing a deep understanding of the concepts being taught. This results in subpar performance, particularly on exams when mastery of concepts is essential.

4.4.2 Engagement with Lecturer.

According to this study, students never, if ever, ask questions of their lecturers during the semester, with excuses including shyness, idleness, or a fear of receiving a reprimand. An essential component of successful learning is communication between instructors and students. Students miss out on important advice that can help them overcome uncertainty and difficulty in the subject when they refuse to ask the lecturer for help. One possible reason why students are unwilling to engage with professors could be a lack of confidence or belief that they should be able to solve problems on their own or in groups. But in the long run, this thinking may work against them, especially in classes like Business Finance where students need to have a thorough understanding of the material and be able to apply it to solve complex problems. Students with a passive learning style often acquire surface understanding and memorize facts without understanding the underlying concepts. This can make it difficult for students to complete assignments or assessments that require extensive use of materials, which will contribute to low academic achievement in the course.

4.5 Teaching methods / Mode of instruction

In the context of low student achievement in the Business Finance course, the teaching method plays a very important role. Based on the findings, there are two main issues related to teaching methods that harm student performance specifically, amount of training and quality of feedback and speed of teaching and difficulty of understanding. Table 7 is an excerpt from participants related to the issues.

Table 7: Findings of teaching methods factor

	Theme	Quotation
1	Amount of Training and Quality of Feedback.	S12: *Lots of practice...I like it. Some discuss the answer, and some don't.* S11: *There's a lot of practice too...it's ok* S10: *There are a lot of exercises...I like it...if you don't understand, the lecturer asks which part you don't understand* S9: *Many exercises.... but don't know the correct answers* S8: *The lectures did not ask to submit the answers…so, I don't. If I know. I answer. ...if don't just leave them* S6: *Many exercises.... make sure the answers are ready whether correct or not* S5: *The lecturer gives many exercises. Good. He told us to send it. He always asks to do the exercises. He discussed the answer on the whiteboard but not all..the last topic had no time to discuss.* S3: *A lot of exercises. I like it. He discussed the answers in the class but not all the questions…didn't have time.* S2: *I didn't submit the task. The lecturer makes sure the students make and send it. Lecturers rarely discuss the answers in class.* S1: *I didn't submit it as I didn't have time and didn't know how to solve the questions. Lecturers sometimes discuss the answers..I even forgot which question has not been discussed yet*
2	Speed of Teaching and Difficulty of Understanding .	S1: *Have to teach something interesting for each topic. The last topic is quite difficult. Do not teach very fast so that you can quickly understand.* S2: *Lecturer teaches ok...but fast...I'm late pick-up...difficult for a slow learner. Example questions with practice are not the same.... have to give examples and other exercises (which don't have answers) and do them together in class* S12: *Don't teach too fast…I cannot catch up very fast.* S3: *Not so fast. but there's not enough time in the class. The questions given are ok, there are a lot of questions and assignments but need time to understand.* S5: *The teaching method is ok..theory, calculation, example, questions. The questions given are ok because there are so many questions and tasks. The middle and final topics are quite difficult. Don't teach too fast to be able to understand.* S10: *Teach one by one...do the calculations, don't be too fast. step by step* S11: *I like it..if you don't understand, the lecturer asks which part you don't understand… but there is not enough time...I just want to understand that the class is over* S9: *The early chapters are easy to understand but Topic 3 and above are difficult… the lecturer has to teach not to go too fast*

4.5.1 Amount of Training and Quality of Feedback.

The lecturer gives many exercises after each topic, but weak students often do not submit the exercises. Accurate and constructive feedback is one of the main factors in improving student performance. However, if the lecturer is unable to monitor and provide feedback to all the exercises due to the excessive number of exercises, the students lose the opportunity to improve and understand their mistakes. Critically, this shows that although lecturers try to provide a lot of training, their effectiveness depends on the quality of the feedback provided. Without useful feedback, training cannot maximize student learning potential. Additionally, students who do not submit exercises may feel disengaged or unrecognized for their efforts, which in turn reduces their motivation to complete subsequent exercises.

4.5.2 Speed of Teaching and Difficulty of Understanding.

The main problem identified is that the speed of teaching is too fast for weak students. Too fast a teaching speed can hinder student understanding, especially in complex courses such as Business Finance. Weaker students may need additional time to understand newly introduced concepts and calculation techniques. In these situations, lecturers may need to consider a more flexible teaching approach, such as breaking the topic into smaller parts or providing additional review sessions. This is to ensure that all students, especially those who are weak, can follow and understand the material taught without undue stress.

5. Conclusion

Based on the study conducted, the researcher can conclude that the four factors that have been used as variables in this study, including interest, attitude, learning style, and teaching technique have indeed been proven to have a significant influence on students' achievements in the final examination for the course of Business Finance. Among those factors, interest is the most influential factor in student achievement. Difficulty perception, self-efficacy, and motivation all have significant effects on students' interest in Business Finance courses. The level of student engagement with the learning process and academic success is greatly influenced by their enthusiasm in courses such as Business Finance. Student achievements in this course can be improved with treatments aimed at increasing interest among the students by reducing the sense of difficulty, increasing self-efficacy, and using a more engaging teaching style with motivation.

Besides that, a negative attitude towards calculations and subjects considered difficult in Business Finance courses is also one of the main factors contributing to low academic performance. This finding emphasizes the importance of a positive attitude, active attendance, and academic honesty in achieving academic success. Therefore, teaching interventions aimed at changing attitudes and increasing students' intrinsic motivation and active engagement in learning are essential to overcome this problem and ensure that students can reach their full potential and overcome these challenges.

Other than that, students' learning styles, particularly the tendency to study in groups and rely on friends to complete exercises, also have a significant impact on their achievement in the Business Finance course. This passive attitude, combined with the reluctance to interact with the lecturer, prevents students from gaining a deep and comprehensive understanding of the subject. Therefore, institutions need to consider teaching strategies that can encourage learners to actively teach and more frequent interaction between students and lecturers.

Lastly, teaching methods are also important in determining student achievement in a course. A lot of training is good to strengthen students' skills, especially courses that are technical, such as calculations. It needs to be discussed and taught practically. Fast teaching also affects weak students. Lecturers need to be more careful with students who have a low level of acceptance and support them with motivation.

The researchers hope that the findings of this study can serve as a guide for the parties involved to take the initiative to examine the outlined factors that have a significant influence on students, specifically those taking the subject of business finance, and take further action to resolve the problem. It is hoped that it can contribute to better student achievement in the calculation courses taken in the future. Besides that, future researchers can consider exploring other factors that contribute to the low achievement among students, especially those who take a calculation course.

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Halal Tourism in Sabah: Perception Among Sabah Community College Students

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Abstract

The concept of halal tourism has begun to gain popularity among tourists in Malaysia. Malaysia has been recognized as "Top Muslim-Friendly Destination of the Year (OIC)" in Halal Travel Awards 2024. Sabah, a state in Malaysia is one of popular destination among tourist either inbound or outbound. The primary focus of the initiatives to establish halal tourism in Sabah is to cater the requirements of Muslim tourists, including prayer facilities, food and beverages, and services that compliance with Sharia regulations. However, the concept of halal tourism is still new in Sabah due to various factors such as demographics. Therefore, this study is conducted to understand the perception of halal tourism in Sabah among students at Sabah Community College. The sample of this study are students who currently study in any Community College in Sabah in tourism and hospitality related program. Data was obtained by using a questionnaire that was distributed using Google Forms. The sampling technique used is random sampling technique. The analysis used is a descriptive analysis using SPSS v.22. In summary, the analysis results show that most respondents are positive about halal tourism in Sabah. The respondents are positive that halal tourism helps to introduced restaurant that served halal food and beverages. The result also show that halal tourism allowed tourist to be treated warmly. Apart from that, the result show that halal tourism allowed tourism provider to provide separate accommodation between men and women. Therefore, this study is essential to determine which aspects need to be improved in introducing the tourism industry in Sabah.

Keywords: Halal tourism industry; Sharia compliant; Sabah halal tourism; Halal tourism perception

1. Introduction

Islamic tourism is a novel tourism product that has been implemented in Malaysia and the majority of Islamic countries. The demand and supply for halal tourism are increasing. This indicates that the trend is currently overgrowing. According to Abdul Rahman and Roslan (2019), Malaysia is a well-known halal tourism destination that caters to the requirements of Muslim tourists in terms of destination suitability and family vacation facilities and services. This includes Sabah, one of the most popular destinations in Malaysia. Sabah has exceptional potential in the halal tourism sector Mohmed Razip Hasan (2021). According to the Sabah Tourism Board, tourism is the third greatest income-generating industry in the state of Sabah. Thus, it is imperative to establish halal tourism to attract inbound and outbound tourists to choose Sabah as a halal tourism destination. However, to establish a halal tourism destination, perception from locals, particularly the youngsters, are important since they are the future generation that leads towards the successful plan. Plus, positive perception from youngsters leads to greater support to make a successful halal tourism destination Jayadi et al. (2021). Most of the previous researchers conduct research on understanding the perception of young travellers towards a halal tourism destination from traveller points of view. Meanwh ile, research on understanding the perception of locals' youngsters towards halal tourism remained scarce. It must be noted that some of Muslim-friendly destinations face difficulties in meeting the necessary requirements to cater to the interests of non-Muslim tourists while adhering to the principles of halal tourism services Rahman et al. (2019). As the halal tourism industry is still in its infancy in the state of Sabah, it is imperative to execute a study to ascertain the community's perception, particularly the youngster towards the concept. This research will assist the tourism industry in comprehending the requirements of visitors who desire Sharia -compliant tourism.

2. Literature Review

A study conducted by Abdul Rahman & Roslan (2019) shows that Malaysia does have the potential to develop halal tourism. However, the strategy and cooperation among all stakeholders of halal tourism products should be given attention if Malaysia wants to excel as the top country in offering and attracting tourists to enjoy halal tourism-based products to this country. Sabah is a popular travel destination because of its diverse culture, breathtaking scenery, and rare fauna Le et al. (2021). The ability of the nation for halal tourism resides in its

capability to provide services that cater to the requirements of Muslim travellers while highlighting its inherent natural and cultural allurements. The initiatives to cultivate halal tourism in Sabah encompass augmenting the quantity of halal-certified enterprises, enhancing Muslim-friendly amenities, and endorsing Sabah as a halal-friendly destination through marketing campaigns Tourism Malaysia (2019).

In heterogeneous communities, there might be differing perspectives among young people regarding halal tourism. Some may perceive it as an inclusive and courteous practice, while others may view it as niche or elitist Mohsin et al. (2020). The local youth's awareness and comprehension of halal tourism significantly influence their perceptions. Individuals who possess a comprehensive understanding of the concepts and advantages of halal tourism are more inclined to endorse and actively participate in this industry Juliana et al. (2022). Among the things that need to be paid attention to in the campaign to introduce halal or sharia-compliant tourism are destination selection, food, accommodation suitability, sharia-compliant activities, guest treatment, and issues related to Islamic tourism Abdul Rahman & Roslan (2019). In addition, the existence of Islamic heritage, such as mosques or places of worship in Malacca, and traditional museums in Negeri Sembilan, whether in terms of artistic sophistication or uniqueness, can be highlighted as an attraction to introduce Islamic tourism to the public Yahya et al. (2021); Hamid (2019).

One of the issues that frequently arise among Muslim tourists when travelling is the need for accommodation services that are friendly to Muslim users and free from immorality Arasteh & Eilami (2011); Nurohman & Qurniawati (2021). In Islamic tourism, accommodation must be friendly to Muslim users regarding facilities and services Sabri et al. (2021). This comprises lodgings with gender-segregated recreational areas, halal cuisine, and no alcohol service Bastaman (2019). Additionally, some hotels provide prayer mats and Qibla direction indicators in their rooms Basendwah et al. (2024). It provides added value in attracting Muslim tourist. Activities such as visiting mosques, historical places related to Islam, Islamic monuments, or halal conferences are among the activities that can be included in halal tourism. As for the food, the food served must be halal and does not contain any illegal or questionable elements Sabri et al. (2022). Halal cuisine must abide with Islamic dietary regulations, which forbid some ingredients and demand particular cooking techniques. The availability and quality of halal food has been found to have a substantial impact on Muslim tourists' pleasure and likelihood of returning to a destination Sodawan & Hsu (2022). As addition, certified halal food help Muslim tourists trust the food more Junaidi (2020).

This study underscores the importance of understanding the perceptions of Sabah Community College students regarding halal tourism, particularly as their involvement in local tourism activities makes them a relevant group for this research. The findings highlight the need to promote halal tourism through increased collaboration among stakeholders, enhanced Muslim-friendly amenities, and effective marketing strategies, as emphasized by Wibawa et al. (2021). Sabah, with its diverse culture and natural attractions, has the potential to become a leading halal tourism destination. However, addressing the specific needs of Muslim travellers, such as halal-certified businesses and appropriate accommodations, is crucial. By examining the perceptions of young individuals, this study offers valuable insights that can contribute to the growth and sustainability of halal tourism in the region. Conducting this study is therefore essential for guiding future efforts in positioning Sabah as a halal-friendly destination.

3. Methodology

This study is a quantitative study conducted in the form of a survey. The study sample consisted of 102 students from College Community in Sabah. A simple random sampling technique was used to obtain research data through questionnaires using 1 to 5 point lickert scale. The main variable items in the questionnaire are adapted from the study of Wibawa et al. (2021), as shown in Table 3. This analysis uses descriptive analysis using SPSS v.22 and level determination is based on the mean score value, as shown in Table 1. The item with the highest score is an element or factor in halal tourism that Muslim tourists prioritize.

Table 1: Level Determination Based on Min Score

Mean Score	Level
1.00 – 1.99	Weak
2.00 – 2.99	Low
3.00 – 3.99	Moderate
4.00 – 5.00	High

Source: Dicky et al. (2019)

4. Findings and Analysis

4.1 Respondent background

The background of the respondents is shown in Table 2. The data collected from both male and female students. Based on the data obtained, there are students who have used Islamic tourism packages. However, most of the students have not yet travelled to any place either inbound or outbound.

Table 2: Respondent Background

Item		Frequency (N=102)	Percentage (%)
Gender	Male	33	32.4
	Female	69	67.6
Religious	Non-Muslim	20	19.6
	Muslim	82	80.4
Have you ever travelled using an Islamic tour package?	No	89	87.3
	Yes	13	12.7
How often do you travel domestically?	Rarely	70	68.6
	Frequent	6	5.9
	Always	6	5.9
	Never	20	19.6
If you want to travel, will you choose Sharia-based tourism (Halal Tourism)?	No	9	8.8
	Yes	93	91.2

4.2 Data analysis

This study was conducted to understand the perception of halal tourism in Sabah among students at Sabah Community College. The overall results of the analysis are shown in Table 3. The results of the analysis of 15 items show the perception of students in Sabah Community College towards halal tourism in Sabah. The students belief that halal tourism industry will introduce restaurants that provide halal food and drinks (mean=4.26); will treat tourists well (mean=4.24); will provide separate accommodation for men and women (mean=4.20); and will bring Muslim tourists to pray when the time has come (mean=4.20). 14 elements were also accepted by obtaining a mean score above 4.00.

Table 3: Perception of halal tourism in Sabah among students at Sabah Community College

Item	Standard deviation	Mean	Level
The halal tourism industry will introduce restaurants that provide halal food and drinks	1.04	4.26	High[1]
The halal tourism industry will treat tourists well (such as welcoming guests warmly with the spirit of loyalty of friends and gentlemen)	1.04	4.24	High[2]
The halal tourism industry will provide separate accommodation for men and women	1.01	4.20	High[3]
The halal tourism industry will bring Muslim tourists to pray when the time has come	1.05	4.20	High[3]
The halal tourism industry will provide an intellectual Islamic tourism experience with an informative and instructive experience	1.02	4.18	High
The halal tourism industry does not introduce immoral places	1.12	4.18	High
The halal tourism industry introduces the existence of Islamic heritage such as mosques or places of worship either in terms of artistic sophistication or uniqueness to the public	1.03	4.17	High
The halal tourism industry will lead to historical places that are related to Islam	1.09	4.15	High
The halal tourism industry will provide an understanding of the concept of traveling in Islam	0.98	4.15	High
The halal tourism industry will introduce activities that are free from immoral elements	1.05	4.12	High
The halal tourism industry introduces accommodation facilities/hotels/homestays that are free from immorality	1.05	4.08	High
The halal tourism industry will introduce an atmosphere of attraction for tourists according to Islamic law	0.96	4.07	High
The halal tourism industry will introduce tourist attractions that are more popular than immoral places	1.11	4.02	High
The halal tourism industry will introduce places of worship or mosques accessible to non-Muslims	1.00	4.02	High
The halal tourism industry introduces local heritage that does not conflict with Islamic law	1.08	3.95	Moderate

[1,2,3]Indicators of highest to lowest position

The findings from the survey highlight a generally positive perception of halal tourism among students at Sabah Community College, with most items receiving high mean scores, indicating strong agreement with the statements provided. The highest mean score (4.26, SD = 1.04) was associated with the perception that the halal tourism industry will introduce restaurants providing halal food and drinks. This suggests that students place

significant importance on the availability of halal food as a fundamental aspect of halal tourism, which aligns with the expectations of Muslim tourists and reflects a strong awareness of dietary requirements within Islamic practices Battour & Ismail (2016). Similarly, there was a high level of agreement (mean = 4.24, SD = 1.04) that the halal tourism industry would treat tourists well, emphasizing hospitality characterized by warmth and respect, values that are deeply rooted in Islamic culture Henderson (2016). This reflects the students' understanding that the principles of halal tourism extend beyond just food and accommodation to include the overall treatment and experience of tourists.

The provision of separate accommodations for men and women and ensuring that Muslim tourists can pray when the time comes both received a mean score of 4.20 (SD = 1.01 and 1.05, respectively). This indicates a strong perception among students that halal tourism must cater to religious practices and gender segregation in accommodation, which are key components of maintaining religious observance during travel. The perception that halal tourism will offer an intellectual Islamic tourism experience (mean = 4.18, SD = 1.02) and introduce Islamic heritage such as mosques or places of worship (mean = 4.17, SD = 1.03) shows that students expect halal tourism to be both educational and culturally enriching. This aligns with the broader goals of halal tourism, which seeks to not only provide religiously compliant services but also to enhance understanding and appreciation of Islamic culture and history.

The item with the lowest mean score (3.95, SD = 1.08) was related to the introduction of local heritage that does not conflict with Islamic law. While still falling within the 'high' category, this slightly lower score could indicate a more cautious approach among students regarding the integration of local heritage with halal tourism. This might reflect concerns about ensuring that all aspects of local culture are compatible with Islamic principles Timothy & Iverson (2006). Overall, the consistency of high mean scores across all items reflects a generally strong and positive perception of halal tourism among the students. These findings underscore the importance of developing halal tourism in a way that meets the expectations of Muslim travellers, particularly in providing halal food, ensuring respectful treatment, and catering to religious practices. The positive perception among students suggests that there is a supportive environment for halal tourism in Sabah, which could be leveraged by tourism developers and policymakers to further promote and expand this niche market.

5. Conclusion

Sabah is one of the amazing tourist destinations in Malaysia. However, due to several variables, including demographics, the halal tourist sector concept is still relatively new in the state of Sabah. This study was conducted to understand the perception of halal tourism in Sabah among students at Sabah Community College. The data suggests that halal tourism is expected to strongly adhere to Islamic principles, focusing on halal food and drinks as a key element, alongside warm, welcoming hospitality. Respondent also prioritize gender segregated accommodations and the facilitation of prayer, ensuring religious observance is maintained throughout their journey. Additionally, the industry is expected to offer intellectual and spiritual experiences by promoting Islamic heritage along with history while strictly avoiding immoral sites and activities. Shariah compliant attractions are emphasized over popular secular ones, with a focus on educating tourists about the principles of travel in Islam. Inclusivity is reflected in ensuring access to mosques for non-Muslims, while the preservation of local heritage is valued if it aligns with Islamic law. These results indicate that students have positive perception towards halal tourism in Sabah. Most of the students choose to travel to halal tourism destination. The students believe that halal tourism will brings more positivity towards Sabah as tourism destination as it will provide more halal food and beverage, more friendly locality and better accommodation option for tourist. Since most of the respondents agreed that halal tourism will brings more benefits and positivity towards them, related stakeholders could play roles in enhancing halal tourism in Sabah.

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The Impact of Environmental Awareness and Willingness to Pay on Students' Decisions to Purchase Eco-Friendly Products

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Abstract

The public's growing knowledge of the depletion of natural resources has led to a considerable growth in environmental conservation consciousness in recent years. This increased awareness has resulted in significant changes in consumer attitudes, particularly an increased interest in eco-friendly product. As consumers become more conscious of the environmental impact of their purchases, they prioritize products and services that minimize harm throughout their lifecycle, including aspects such as recyclability and energy efficiency. Despite the growing preference for eco-friendly products, the factors influencing consumers' purchasing decisions are complex and multifaceted. Based on this background, this study aims to determine the relationship between environmental awareness, willingness to pay, and consumer purchasing behavior. The main objective of this study is to evaluate how environmental awareness and willingness to pay affect students' purchasing decisions. By using a simple random sampling method, questionnaires were distributed to Kota Kinabalu Polytechnic students. The size of this study is a total of 107 respondents, determined through the G*Power Standalone Program. A total of 150 respondents participated in this study. Research data were analyzed using SPSS Version 27 and SmartPLS 4.0 software. The research data shows that there is a significant and positive effect between willingness to pay and environmental awareness on students' decisions to purchase eco-friendly food packaging. In conclusion, this study emphasizes the important role of environmental awareness and willingness to pay in understanding the decision of students to purchase eco-friendly food packaging. These findings suggest several interventions that can be directed, such as educational campaigns, incentives for sustainable choices, collaboration with service providers, curriculum integration, and research funding. By implementing these recommendations, institutions can foster a culture of environmental responsibility among students, contributing to the greater need to reduce packaging waste and advance sustainability.

Keywords: Willingness to Pay, Environmental Awareness, Purchase Decision, Eco-Friendly Products

1. Introduction

Academic dishonesty is a common issue in educational institutions worldwide, and this collective act undermines the Consumer behaviour has shifted notably in recent years, with a growing preference for eco - friendly purchasing choices driven by increasing environmental awareness. Customers are recognizing the importance of selecting products and services that minimize environmental harm throughout their entire life cycle, from production to disposal (Kotler et al., 2018). This shift reflects a broader commitment to sustainability, where individuals seek to fulfil their personal needs while also supporting businesses that promote environmentally conscious practices (Albayrak et al., 2013). Eco-friendly products, defined as those made from materials and processes that promote environmental and social responsibility, include items with recyclable packaging, energy-efficient components, and biodegradable ingredients, all contributing to resource conservation and environmental protection (Cai et al., 2017; Khoo et al., 2019; Guerrini et al., 2018). A key characteristic of these products is their recyclability at the end of their life cycle (Dotson, 2015).

Understanding customer behaviour towards green products relies heavily on the concept of willingness to pay. According to Moser (2015), customers' willingness to pay plays a crucial role in their choices to buy environmentally friendly items. Khoiriyah and Toro (2014) assert that willingness to pay plays a crucial role in elucidating customers' ability to allocate additional funds towards environmentally friendly products. Xu et al. (2020) emphasize the importance of willingness to pay, demonstrating that it has the greatest influence on client buying choices. This implies that when consumers recognize the value of environmentally friendly items, particularly those that align with their environmental concerns, they are more inclined to prioritize these products, even if they are more expensive. Martinho et al. (2015) demonstrate that consumers are typically inclined to pay a higher price for environmentally friendly items, as long as the cost stays fair.

Nevertheless, the influence of price on purchase decisions might differ, as certain studies propose that it might have less significance when compared to other product characteristics like quality or brand reputation (Hao et al., 2019; Ketelsen et al., 2020). In addition, studies conducted in Malaysia, India, and Indonesia consistently demonstrate that having knowledge about the environment and being concerned about it greatly increases the probability of buying eco-friendly products. This emphasizes the global importance of willingness to pay in the context of green consumerism, as shown by research conducted by Ramayah et al. (2010), Pradeep (2012), and Rini et al. (2017). This highlights the interdependence between environmental consciousness, willingness to pay, and the increasing inclination towards sustainable consumer habits.

Students, especially those in the younger age group, have a substantial impact on the growing trend of adopting environmentally mindful shopping choices. Research indicates that those who are more environmentally conscious, particularly younger generations, are more likely to choose products that are consistent with their beliefs, even if they are more expensive (Debora Indriani et al., 2019; Ahmed & Zhang, 2020). Students exhibit a higher tendency to engage in this behavior since their purchasing decisions are mostly driven by their environmental awareness (Zhuang et al., 2021). Research conducted in Malaysia, India, and Indonesia consistently shows that being aware of and caring about the environment increases the chances of buying eco-friendly products. This highlights the global importance of this trend among students (Ramayah et al., 2010; Rini et al., 2017).

The relationship between environmental awareness and green purchasing behavior is evident; however, the elements that impact customers' decision to purchase eco-friendly products are intricate and diverse. Consumers can be motivated to contribute to environmental well-being, while others may be impacted by societal norms, psychological considerations, and situational situations (Grimmer et al., 2016). Furthermore, the ongoing research focuses on investigating the uniformity of these behaviors in various purchasing situations and among different customer demographics. Therefore, this study seeks to examine the relationship between the environmental awareness and willingness to pay on the students' decisions to purchase eco- friendly products.

2. Literature Review

2.1 Purchase Decision

Purchase decisions are complex processes influenced by a variety of factors. Kotler et al. (2018) describe green purchasing decisions as the deliberate selection of goods and services that minimize negative environmental impacts throughout their life cycle. Widayanto et al. (2023) view purchase decisions as a process of integrating information about different products to make a choice among available options, while Syahruddin and Karim (2019) emphasize that these decisions are thoughtful and informed, considering both consumer desires and the range of available products. As environmental awareness grows, the importance of making eco-friendly purchasing choices has increased. These choices include buying eco-friendly products, supporting green businesses, and adopting sustainable consumption habits. Albayrak et al. (2013) note that consumers are motivated not only by the desire to acquire goods but also by a commitment to supporting businesses that prioritize environmental sustainability. Gadenne et. al. (2011) add that such decisions often reflect a broader concern for the environment and a commitment to sustainable purchasing behaviors.

Research has identified several factors that influence individuals' intentions to make environmentally friendly purchases. Debora Indriani et al. (2019) highlight the importance of environmental awareness and knowledge of eco-friendly products as key determinants. Ahmed and Zhang (2020) expand this by identifying five categories that influence green purchase intentions: psychological factors, environmental factors, knowledge of eco-friendly products, environmental awareness, and environmental knowledge. Environmental awareness plays a crucial role in shaping consumer behavior towards green purchases. Hamzaoui et al. (2010) assert that green consumerism, driven by environmental awareness, forms the foundation of green purchase decisions, particularly among younger consumers. Zhuang et al. (2021) define green purchase intention as the consumer's desire to buy environmentally friendly products, which is directly influenced by their awareness of environmental issues.

Numerous studies have shown that a strong understanding and concern for the environment positively impact individuals' intentions to buy green products. Diamantopoulos et al. (2003) found that environmentally concerned consumers are more likely to choose green products, believing that these choices will improve their quality of life and contribute to environmental well-being. Consistent findings have been reported in developing countries, including Malaysia (Ramayah et al., 2010) and Indonesia (Rini et al., 2017).

2.2 Environmental Awareness

Environmental awareness has become a crucial element in influencing sustainable consumption habits, especially among students. Recent research has emphasized the substantial impact it has on shaping

perspectives to make environmentally-friendly purchases. Hira et al. (2024) discovered that students' intentions to buy eco-friendly products are greatly affected by environmental awareness as well as technological variables such as perceived usefulness, convenience of use, social norms, and trust in green products. As a reflection of the younger generation's larger eco-friendly consumption patterns, Kerin et al. (2024) found that environmental awareness had a substantial impact on UNJ Cosmetology students' interest in green cosmetic items. Tazizur et al. (2024) provide further support for this trend, demonstrating that students' views and purchasing intentions towards eco-friendly products are positively influenced by environmental awareness, green product knowledge, and health concerns.

In addition to specific product categories, ecological awareness also encompasses the concept of the circular economy. According to Chang et al. (2024), students' opinions toward items in the circular economy are heavily influenced by their environmental awareness, which in turn affects trust, commitment, and purchase decisions. This finding emphasizes the importance of raising environmental awareness in order to encourage environmentally friendly purchasing habits among college students. Jaya Uniyal (2024) states that environmental knowledge is crucial in motivating sustainable consumption patterns among students, emphasizing that its significance should not be undervalued. In order to successfully encourage environmentally conscious purchase decisions among students, Kerin et al. (2024) and other scholars propose that it is crucial to nurture environmental awareness through education while simultaneously addressing economic considerations. With the increasing awareness of the environment, there is a considerable opportunity for a more sustainable future driven by well-informed and conscientious consumer decisions. Based on the reviewed literature, the following hypothesis is proposed:

H1: Environmental awareness has a positive and significant influence on the purchase decision for green products.

2.3 Willingness to Pay

The increasing interest in environmentally friendly products among students is significantly influenced by environmental awareness, product knowledge, and willingness to pay. Students' growing interest in eco - friendly items is mostly shaped by their environmental consciousness, understanding of product attributes, and willingness to spend money. The importance of these elements in influencing students' green buying habits is highlighted by recent studies. Research conducted by Huzaifa et al. (2024) and Ratn a et al. (2023) shows that students who have a thorough understanding of eco-friendly products and show higher levels of environmental awareness are more inclined to purchase environmentally friendly products.

In this situation, the importance of willingness to pay has become a critical factor. Ferry (2023) emphasizes the significant impact of willingness to pay on students' purchasing decisions for eco-friendly products, underscoring its influence on consumer behavior. Ratna et al. (2023) have found evidence of a favorable association between the willingness to pay and interest in green items. Moeun et al. (2021) found that buyers in Generation Z are strongly committed to sustainability, with willingness to pay being the most important element affecting their decisions.

The influence of consumers' readiness to spend money extends to many demographic groups and situations. According to Zheng et al. (2020), the willingness to pay has a major impact on undergraduate students' purchase decisions. This finding supports the idea that the adoption of eco-friendly products requires a financial commitment. Furthermore, Mohd et al. (2021) and Mahmoud et al. (2022) have demonstrated that students' willingness to pay a higher price reflects their dedication to sustainable alternatives . Research by Sanjoy et al. (2023) further demonstrates that there is a clear relationship between consumer preferences and willingness to pay for eco-friendly products in certain contexts, such as the coffee market (Patrik et al., 2013). These studies highlight the significant influence of willingness to pay on the buying behavior of environmentally friendly products, especially among environmentally conscious students. Based on the reviewed literature, the following hypothesis is proposed:

H2: Willingness to pay has a positive and significant influence on the purchase decision for green products.

Figure 1 depicts the research framework used in this study.

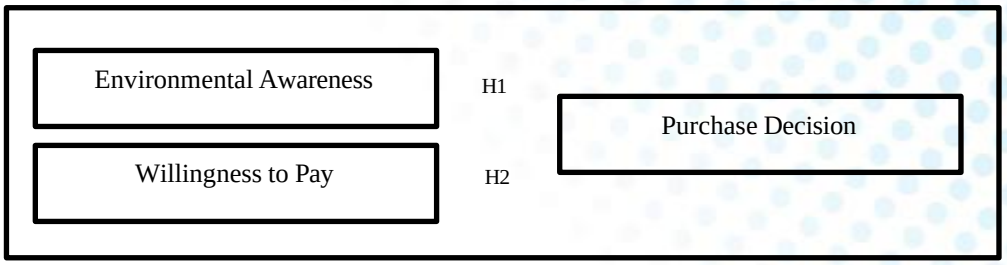

Figure 1: Research Framework

3. Methodology

This study aims to investigate the link between students' environmental awareness and their willingness to pay, particularly in relation to their purchasing decisions for eco-friendly products. Quantitative research methodology was employed to investigate the relationship between environmental awareness, willingness to spend money, and purchase decisions among students at Politeknik Kota Kinabalu. The quantitative technique was selected due to its accuracy and close adherence to statistical standards. Three major constructs were examined by the questionnaire: willingness to pay, environmental awareness, and purchasing decisions. The constructs used in this study were adapted from previous research to ensure their reliability and validity. Environmental awareness and purchase decision were measured using items from Prakash et al. (2017) and Orzan et al. (2018), while willingness to pay was assessed using items from Prakash et al. (2017) and Mishra et al. (2017). The questionnaire was pilot tested before to ascertain its reliability. To determine the reliability of the questionnaire, a pilot test was conducted beforehand. The Cronbach's alpha values for all constructs were over 0.70, indicating high reliability (Pallant, 2020). Specifically, the willingness-to-pay construct had a value of .79; the environmental awareness construct had a value of .92; and the purchasing decisions construct had a value of.89. The population comprises all students enrolled at Politeknik Kota Kinabalu in 2024, and the sample size consists of a minimum of 107 respondents, as determined using the G*Power Standalone Program. This calculation, based on a medium effect size (F = 0.15), an alpha level of 0.05, and a power of 0.95 with two predictors, ensures robust results. To reduce selection bias and ensure that every student had an equal opportunity to participate, the simple random sampling technique was used. Data were gathered using a structured questionnaire disseminated using Google Forms to adhere to the study's eco - friendly strategy by minimizing the use of paper. A total of 150 students participated in the study. SmartPLS 4.0 was used for data analysis because it was more accurate than more conventional tools like SPSS and could handle non-normally distributed data.

4. Results

Prior to conducting the simple random sampling, a full list of all students enrolled at Politeknik Kota Kinabalu in 2024 was acquired. Students were subsequently chosen randomly from each department to ensure equal participation opportunities, hence reducing selection bias and improving sample representativeness.

The data of the respondents shows that 60.7% of the respondents are female, and 39.3% are male. The largest proportion of respondents, falls within the age group of 20 (40.7%), while the second largest group consists of individuals aged 21 (20%). The remaining age categories exhibit lower proportions, with the youngest participants aged 18 (2%) and the oldest group aged 25 and beyond, accounting for 6% of the sample. JPH students make up the largest group of responses (26%), followed by JP (22.7%), JKA (20%), JKM (16%), and JKE (15.3%). In terms of semester distribution, the largest proportion of respondents (44%) are in Semester 4, while the remaining respondents are fairly similarly spread over the other semesters, with the smallest group (8%) being in Semester 6.

Table 1 presents the findings on the convergent validity of the constructs. Each construct loading ranges from 0.733 to 0.895, surpassing the acceptable threshold of 0.70, indicating a high level of item reliability. All constructs have composite dependability (CR) values greater than 0.70, ranging from 0.844 to 0.917, indicating strong internal consistency. With environmental awareness at 0.680, willingness to buy at 0.763, and purchase decision at 0.699, the average variance extracted (AVE) values for all constructs also surpass the minimal requirement of 0.50, demonstrating convergent validity. Every construct satisfies the AVE requirements, as shown in the "Convergent Validity" column. The VIF values are below the commonly accepted threshold of 5, which ranges from 1.772 to 3.199, showing the absence of any major multicollinearity among the items. All of these values, i.e., items, loading, CR, AVE, and VIF, are all in compliance with the values suggested by Hair et. al.

(2017).

Table 2 presents the analysis of discriminant validity using the Fornell-Larcker criterion. According to Fornell & Larcker (1981), the average variance extracted (AVE) value for each construct should exceed the correlation with the construct in the model. According to the table, all construct values meet the criteria. This suggests that each construct possesses discriminant validity. The high correlation between purchase decision and willingness to purchase (0.836) indicates a particularly strong relationship between these two variables, suggesting that students' willingness to pay significantly influences their purchasing decisions.

Table 1: Convergent Validity

Construct	Item	Loading	CR	AVE	Convergent Validity (AVE>0.5)	VIF
Environmental Awareness	EA1	0.852	0.908	0.680	yes	2.813
	EA2	0.875				3.199
	EA3	0.840				2.643
	EA4	0.799				2.101
	EA5	0.733				1.831
	EA6	0.843				2.945
Willingness to Purchase	WP1	0.876	0.844	0.763	yes	2.386
	WP2	0.895				2.441
	WP3	0.848				2.554
Purchase Decision	PD1	0.829	0.917	0.699	yes	3.052
	PD2	0.831				2.023
	PD3	0.844				2.533
	PD4	0.879				2.165
	PD5	0.784				2.419
	PD6	0.847				1.772

Table 2: Discriminant Validity

	Environmental Awareness	Purchase Decision	Willingness to Purchase
Environmental Awareness	**0.825**		
Purchase Decision	0.811	**0.836**	
Willingness To Purchase	0.760	0.836	**0.873**

Table 3 presents the findings for two hypotheses that investigate the impact of environmental knowledge and willingness to purchase on purchase decisions. Both hypotheses are supported since both environmental knowledge and willingness to purchase have a considerable impact on purchase decisions. The standard ized beta value for Hypothesis 1 is 0.416, suggesting that environmental awareness has a relatively positive impact on purchasing decisions. The F value of 0.32 indicates a moderate effect size, while a VIF of 2.37 indicates a low level of multicollinearity. The t-value of 6.10 indicates a statistically significant relationship, supporting the conclusion that H1 is acceptable. The standardized beta coefficient of 0.520 for Hypothesis 2 indicates a considerable positive influence of willingness to purchase on the decision to purchase. The t-value of 6.98 provides strong evidence of the relationship's statistical significance. The F value of 0.50 suggests a large effect size, while the VIF (2.37) shows a low level of multicollinearity. The R-value of 0.77 indicates that 77% of the variation in buying decisions can be accounted for by environmental awareness and willingness to purchase. A Q2 value of 0.76 shows a high level of predictive relevance. The values of R2, standard beta, T-values, and Q2 are all in line with the threshold recommended by Hair et. al. (2017), F2 values recommended by Cohen (1988), and VIF values by Rogerson (2001).

Table 3: Hypotheses Testing

Hypothesis	Relationship	Std Beta	Std. Error	T-Value	R^2	F^2	VIF	Q2	Decision
H1	Environmental Awareness -> Purchase Decision	0.416	0.068	6.10**	0.77	0.32	2.37	0.76	Supported
H2	Willingness to Purchase -> Purchase Decision	0.520	0.074	6.98**		0.50	2.37		Supported

5. Discussion, Implication and Conclusion

The results indicate that willingness to pay is a significant predictor of students' purchasing decisions for eco-friendly products, as evidenced by a high standardized beta coefficient (β = 0.520). This suggests that students who are more willing to invest in green products are more likely to follow through with eco-friendly purchases. This relationship is further supported by a statistically significant t -value (6.98) and a large effect size (F = 0.50). The findings align with previous studies, such as those by Kerin et al. (2024) and Tazizur et al. (2024), which also found a strong positive relationship between willingness to pay and green purchasing behaviour. These results underscore the importance of financial commitment as a motivator for sustainable consumer behavior among students. The high predictive relevance ($Q^2 = 0.76$) and substantial explained variance ($R^2 = 0.77$) suggest that a significant portion of students' purchase decisions can be attributed to their willingness to pay for green products. This implies that interventions aimed at increasing students' financial commitment to sustainable products—such as educational campaigns highlighting the long-term benefits and value of eco-friendly products—could be particularly effective in promoting green purchasing behaviours.

Environmental awareness was also found to have a positive and statistically significant impact on students' purchase decisions (β = 0.416). The t-value (6.10) and moderate effect size (F = 0.32) confirm the robustness of this relationship. This finding suggests that students who possess higher levels of environmental awareness are more likely to make eco-conscious purchasing decisions. The low level of multicollinearity (VIF = 2.37) indicates that the environmental awareness construct is independently influencing purchase decisions without significant overlap with other variables. These results are consistent with the findings of Prakash et al. (2017) and Orzan et al. (2018), who reported that environmental awareness plays a crucial role in shaping consumers ' attitudes and behaviours toward green products. However, the relatively lower beta coefficient compared to willingness to pay suggests that while environmental awareness is important, it may not be sufficient on its own to drive purchasing decisions. Students may be aware of environmental issues but still refrain from purchasing green products if they are not willing to pay the price premium often associated with these items.

The study's findings have substantial implications for targeting students as consumers. Because students are more likely to support eco-friendly items and frequently have heightened environmental knowledge, marketing campaigns should highlight the benefits to the environment. In order to increase students' willingness to pay extra for environmentally friendly items, educational institutions and student organizations can play a significant role in raising awareness of sustainability. Companies that cater to students should be transparent about the environmental impact of their products and the advantages of making sustainable decisions. Furthermore, providing incentives or price reductions on environmentally conscious products for students could also stimulate their buying choices.

This study highlights the significant influence of environmental awareness and willingness to pay money on shaping students' purchasing decisions. Marketing initiatives targeting students should concentrate on emphasizing the benefits of sustainable products and promoting environmental consciousness. Businesses can effectively engage students who are eager to support and spend more on sustainable solutions by matching product offerings with students' ideals and providing targeted promotions or discounts on eco-friendly things. This strategy not only accommodates the preferences of students but also takes advantage of their willingness to pay a higher price for environmentally friendly products. Future studies should look at how different levels of environmental awareness affect students' willingness to pay, as well as how context influences their choice of eco-friendly products.

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Adapting to the Era of Independent Tourism: Challenges and Opportunities for Travel Agencies

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Abstract

Independent tourism has grown rapidly due to advancements in technology, especially among younger generations of travellers. This shift has brought both challenges and opportunities for the travel industry. The rise of digital platforms and easy access to information has expanded travel options in terms of destinations, transportation, and activities. Tourists can now customize their trips to suit their preferences, leading to a more personalized travel experience. This conceptual paper uses a systematic review methodology to explore the challenges and opportunities travel agencies face in the era of independent tourism. Hence, the purpose of this paper is to deepen understanding of this evolving field and identify gaps in existing literature. Based on the finding, most of the scholars support that travel agents must contend with growing competition, shifting consumer expectations, and altered value offerings. To remain competitive, travel agencies need to leverage technology to improve their services, offering specialized expertise, personalized packages, and unique experiences that go beyond what independent tourists can access. Travel agencies may find innovative ways to provide worthwhile experiences and exclusive access to places by collaborating with local partners, destination management organizations, and tour operators. Travel agencies can survive and thrive in a competitive travel market by embracing the era of independent tourism and changing their business model.

Keywords: travel agency, independent tourism, challenges, opportunities

1. Introduction

The tourism sector encompasses diverse option of travel, particularly Free Independent Travel (FIT) presenting distinctive experiences and opportunities for travelers. FIT facilitates customized exploration of destinations, tailored to individual preferences and interests, thereby offering a personalized travel experience. This mode significantly influence the tourism landscape, reflecting varied consumer demands and contributing to the industry's dynamic nature. In the mid-20th century. In the mid-20th century the tourism industry has long been dominated by traditional package tours, (Crous-Costa et al., 2023)). These tours provide a convenient and cost-effective way for people to travel, offering an itinerary that includes transportation, accommodation and activities. Travel agencies play an important role in organizing these tours, ensuring a smooth and stress-free travel experience for tourists. However, with the advent of the internet and the rise of digital platforms, the tourism landscape has undergone significant changes. FIT has become an increasingly popular travel trend, and its market has grown globally (CBI & Affairs, 2021). These changes require a drastic shift for travel agency operators to meet changing market demands (Al-Azab & Al-Romeedy, 2023). The travel agencies has necessitates to comprehend the evolving dynamics of tourist preferences and behaviors, focusing on personalized experiences and flexibility in travel arrangements (Li et al., 2021). Due to this, travel agencies must overcome a number of challenges and opportunity of this new market development in order to maintain their operations.

This paper distinguishes itself from previous research by providing a comprehensive analysis of the challenges and opportunities faced by travel agencies in line with the growing Independent Traveler (FIT) trend. It offers novel insights and practical recommendations that contribute to the ongoing discourse on the evolution of the tourism industry. Specifically, this paper aims to explore the challenges and opportunities faced by travel agencies as they adapt to the shift towards independent tourism.

2. Literature Review

The tourism industry has significantly transforme post-COVID-19, particularly with the rise of independent tourism, where travelers increasingly plan and book their trips online, by passing traditional travel agencies. This shift, driven by technological advancements and changing consumer preferences, offers

greater control and flexibility to travelers (Lu, 2023) but poses substantial challenges for travel agencies. These agencies, historically essential for organizing travel plans and securing cost-effective solutions, now face reduced customer bases and must reevaluate their business models to stay relevant (Abrate et al., 2019). The research problem centers on understanding the impact of independent tourism on traditional travel agencies, highlighting the challenges of digital transformation, adapting to new consumer demands for flexibility and customization, and maintaining competitive pricing. Despite these challenges, there are significant opportunities for agencies to innovate by leveraging technology, offering value-added services, and providing personalized travel experiences (Elgarhy & Abou-Shouk, 2022).

2.1 An Overview of the shift toward Independent Tourism

The tourism industry has shown rapid development after the world was shocked by the covid-19 pandemic. According to the Statista Research Department, 2023. A 41% increase in tourist spending in 2022 compared to the previous year and is expected to reach 2.29 trillium U.S. dollars in 2023. Travel agencies serve as pivotal players within the tourism industry. They act as intermediaries' parties, bridging the gap between travelers and the various tourism elements to their trips. By offering services such as fl ight and accommodation booking, transportation arrangements, tour guides, and travel agencies simplify planning processes for individuals and groups (Foster & Bentley, 2022). Beyond convenience, they provide expertise, helping clients navigate the complexities of travel. In addition, agencies engage in negotiations with suppliers to get cost-effective solutions that may be difficult for independent tourists to find. Amidst a time characterized by an excessive amount of knowledge, travel firms provide customized suggestions and individualized encounters, rendering them essential for several world travelers.

Tourists can be categorized using different criteria, such as their personality traits, demographic characteristics, level of experience, and the purpose of their travel. In recent years, tourist has become more independent due to online information, technology, and changes in the tourism landscape (Pencarelli, 2019). The rise of independent tourism, which is characterized by individuals planning their own trips online without relying on travel agencies or package tours (Sutyrina et al., 2021). It is illustrated that independent vacation planning is booming today's travel market, which is becoming more personalized, digitalized and independent from giant tour operators (Polukhina et al., 2020). This form of tourism allows travellers to have greater control and flexibility over their itineraries, as they can choose their destinations, activities, and accommodations according to their preferences and interests. The pattern and characteristics of independent tourism include tend to have individualistic tendencies and prioritize their own satisfaction and personal interests when selecting destinations. Their behavior during the trip is also focused on individual experiences and enjoyment (He et al., 2021). They engage in extensive information search to gather knowledge about potential destinations, accommodations, transportation, and activities. They rely heavily on online resources, reviews, recommendations from friends and family, and social media platforms to make informed decisions (Sutyrina et al., 2021). Research and previous studies have highlighted that sociodemographic factors such as age and gender, as well as travel characteristics like length of stay and previous travel experience, can affect tourists' preference for independent travel arrangements or packaged travel arrangements (Boto-García et al., 2022).

The concept of independent travel involves individuals arranging, customizing, and planning their own trips without relying on tour operators. It can also be defined as the people who travel on their own and explore destinations without relying on organized tours or travel agencies. It allows tourists to have more control over their itinerary and experience and emphasizes autonomy, independence, and freedom (Boonkaew et al., 2023). According to the United Nations World Tourism Organization (UNWTO), over 57% of visitors from other countries travelled independently in 2019 (UWTO, 2019). They usually travel alone or in small groups and plan their own trips. There are several factors attributed to the rise of independent tourism, including technological advancements, changing consumer preferences, and a desire for unique travel experiences.

Independent tourism has also grown due to economic factors, as tourists can choose accommodations, dining, and activities based on their budgets (Chung et al., 2020). However, contribution to the travel agent business is minimal since independent tourists do not rely on their services. To attract the market of independent tourists, travel agencies must modify their business strategies and offerings (C. H. Liu et al., 2020). They are taking this action to satisfy the demands of these savvy and capable tourists. Travel agencies must recognize and solve the unique difficulties they face to adjust to this new era. It presents challenges for traditional travel agencies, but also offers new opportunities for innovation and adaptation for the travel industry. To stay relevant, travel agencies need to adapt to changing traveler preferences, embrace technology, and add value to the independent travel experience (Pencarelli et al., 2021). According to Mihajlović, (2020), travel agencies that traditionally market tourist packages and specialize in the sale of packages are expected to face challenges due to this shift in tourist behavior.

2.2 The Challenges for Travel Agencies in the Age of Independent Tourist

The development of technology has changed the landscape and human thinking for travel. They can get information quickly and easily so they can make plans according to their taste and budget (Pai et al., 2020; Agarwal et al., 2020). Based on previous studies there are several challenges faced by travel agencies. Basically, the role of a travel agency has been to help tourists plan and organize their trips and ensure a smooth and enjoyable travel experience such as booking flight tickets and arranging tours. The evolution of online travel booking platforms has reshaped the travel landscape, diminishing reliance on traditional agencies (Jin & Hu, 2022; Rafdinal, 2021). Travelers now enjoy autonomy to research, compare, and directly book flights, accommodations, and activities through online platforms (Pai et al., 2020; Agarwal et al., 2020). These resources offer convenience, extensive information, and competitive pricing, altering consumer behavior. This trend has led to a diminished flow of potential customers towards travel agencies, reducing opportunities for agencies to showcase their expertise, build relationships, and provide tailored solutions (Xiao et al., 2021; Youssef & Zeqiri, 2022).

In the era of independent tourism, travel agencies face the additional challenge of adapting to evolving consumer preferences and expectations regarding the flexibility and customisation of their travel experiences. They seek personalized itineraries, unique and authentic experiences, and the freedom to make their own choices during their trips (Pai et al., 2021). Other than that, they also expect quick and efficient communication, seamless online booking processes, and immediate access to information and assistance. In additional, independent tourists often prioritize cost savings and are more willing to spend time researching and planning their own trips to find the best deals and experiences (Kan, 2022). Furthermore, they expect quick and efficient communication, seamless online booking processes, and immediate access to information and assistance (Monterey & Borbon, 2021; Hsu et al., 2020). Technological advancements and the need for digital transformation as challenge to travel agency. In the era of independent tourism, the travel agency should investigate methods to leverage technology to improve their services and maintain their competitiveness (Balaşescu & Balaşescu, 2022). This includes the implementation of online booking systems, the enhancement of their website and online presence, and the promotion and consumer engagement via social media platforms (Chen et al., 2021). Additionally, they can focus on offering specialized knowledge and expertise in niche markets, providing personalized recommendations and itineraries based on customer preferences, and offering exceptional customer service and support throughout the travel process (Ryan et al., 2023). Travel agencies may also contemplate forming strategic alliances with online booking platforms and websites to increase their visibility and appeal to a greater number of independent tourists (Ryan et al., 2023).

2.3 Opportunities for Travel Agencies in Independent Tourist

While independent tourists may be less dependent on traditional travel agencies for information and reservations, there are still some opportunities for the agency to success in this market (IvyPanda, 2023). The travel agency can provide value-added service to meet the needs and special preferences of an independent tourist including offering customized routes, suggestions for activities, and unique experiences that cannot be obtained if they are booked online (Aboushouk & Tamamm, 2023). Other than that, i t includes arranging transportation, accommodation, and activities, as well as offering 24/7 support and assistance in case of any problem or emergency. In addition, travel agencies can leverage their expertise and relationships with suppliers to negotiate better deals and discounts for independent tourists (Services & Kalra, 2019).

The desire for flexibility and freedom is one of the key characteristics of an independent tourist. They often prefer to have the flexibility to plan their own itinerary and make spontaneous decisions during their trip. This presents an opportunity for travel agencies to offer flexible and customizable packages that cater to the individual preferences and interests of independent tourists (Pencarelli, 2019). Furthermore, travel agencies can also utilize technology to their advantage in catering to independent tourists. They can develop user-friendly online platforms and mobile apps that allow independent tourists to easily research, book, and manage their trips. Other than that they can leveraging technology to improve online presence, automate tasks, provide personalized services, and enhance communication and collaboration with service providers (Guo et al., 2023). Overall, travel agencies can adapt their services and strategies to meet the changing demands of independent tourists and position themselves as valuable partners in the planning and execution of independent travel experiences. This aligns with the findings of various studies that emphasize the impact of technology on tourism and the importance of catering to the preferences of independent travele rs (Guo et al., 2023; ;Rafiq et al., 2022).

3. Methodology

This is a conceptual paper based on a literature study in tourism and hospitality using a systematic review. According to [Oman Medical Journal, 2022] a systematic review is a specific and reproducible method to search, identify, select, appraise, and summarize all studies relevant to a particular fields (T. Liu et al., 2022). Therefore, this systematic review was based on online open-access journal articles and open-access theses

and dissertations from the website (Arabadzhyan et al., 2020), to investigate and analyze extant literature concerning the challenge and opportunity and various strategies employed by travel agencies to cater to the trend of independent tourism.

The researcher reviewed the literature for 5 years, from 2019 to 2023 to ensure the inclusion of the most recent and relevant studies. The findings from this paper are based on secondary sources of data. To identify relevant studies, the database searches using the keywords “independent tourism”, “travel agency”, Digital era on tourism and hospitality industry, "challenge and opportunity on travel agency "impact of independent tourism to travel agency business,” and “travel agency business strategies for adapting to independent tourism.". Studies were excluded if the literature are did not focus on the specified themes and were not published within the specified timeframe.

From the review’s findings, a comprehensive view was made to understand the challenges and opportunities faced by travel agencies in catering to the trend of independent tourism. The systematic review also delved into the various strategies employed by travel agencies to adapt to the digital era and the impact of independent tourism on their business. This comprehensive analysis provides valuable insights into the evolving trend of the independent tourism, shedding light on the implications for travel agenc ies and their operational strategies.

4. Findings and Discussion

The growing trend in independent tourism represents both challenges and opportunities for travel agencies. Thus, travel agents are required to modify their business strategies and offerings to meet the demands of this type of tourist (Pencarelli, 2019). This section discusses the findings in depth, focusing on five key strategies that travel agencies can adopt to cater to the needs of independent tourists.

4.1 Embracing Digital Platforms and Online Presence

Embracing digital platforms and online presence is crucial for travel agencies aiming to attract independent tourists (Buhalis & Sinarta, 2019). Online travel agencies and booking systems enable travel agencies to provide the high level of involvement and real-time experience creation that independent tourists seek (Adam et al., 2023). Incorporating personalization of services and expert recommendations into online tourism systems can replicate the personalized experience and expertise offered by traditiona l travel agencies (Wang, 2020). Moreover, prioritizing the incorporation of the latest technological advancements is essential to meet the expectations of tech-savvy independent tourists (Chamboko-Mpotaringa & Tichaawa, 2023). This involves allocating more budget to upgrade technology and ensuring staff are trained in the latest advancements to provide efficient service (Arnold et al., 2022). The impact of digitalization and infrastructure development on domestic tourism has been recognized, indicating the significance of technology in shaping the tourism landscape (Arteeva et al., 2022). Additionally, the role of information and communication technologies in sustainable independent tourism has been highlighted, emphasizing the influence of technology on the development and promotion of independent travel experiences (Zhang et al., 2021). There are six benefits of embracing digital platforms and online presence such as increased reach and visibility, customer engagement, cost-effective marketing, e-commerce growth, real-time analytics and data-driven decisions, and building brand authority and trust. Overall, the integration of technology in the tourism sector aligns with the preferences of independent tourists for autonomy and flexibility, enhancing the overa ll customer experience and contributing to the resilience and adaptability of the tourism industry.

4.2 Developing Tailored Packages for Independent Tourist

Next strategy is developing tailored packages for independent tourists. The development of tailored packages for independent travelers involves creating customizable itineraries, offering unique experiences, and catering to specific interests and preferences (Tarantino et al., 2019). This could involve offering modular itineraries, where travelers can pick and choose elements such as accommodations, activities, and transportation. To achieve this, the integration of technology and the use of metaheuristic a lgorithms can be employed to improve itinerary recommendations for tourists, allowing for personalized orienteering and enhancing the overall customer experience (Tenemaza et al., 2020; Pilato et al., 2023). Additionally, the utilization of personalized travel itineraries with multi-access edge computing touristic services can further contribute to meeting the preferences of independent travelers by considering factors such as the popularity of points of interest, visitor's preferences, and time limits to complete the tour (Fonseca et al., 2019). Furthermore, user preferential tour recommendation based on Point Of Interest (POI)-embedding methods can provide a finer representation of POI types and optimize time and locational constraints based on past trajectories from similar tourists, aligning with the desire for autonomy while still offering expertise (Ho & Lim, 2021).

4.3 Enhancing Customer Engagement and Communication

Enhancing customer engagement and communication is essential in addressing the current challenges in the tourism industry. Travel agencies can leverage various digital platforms such as email newsletters, social media interactions, and webinars to engage with potential and past customers (Nagaraj et al., 2020). The integration of artificial intelligence and robotics in the tourism sector can significantly improve customer engagement and traveler experience (Carvalho et al., 2022); Ivanov & Webster, 2019). Prompt responses to inquiries and offering genuine advice can position agencies as valuable sources of information, thereby enhancing customer engagement (J. Liu & Chen, 2023; Dudek et al., 2019). Furthermore, the use of customer engagement technologies can impact service innovation in a network of travel agencies, influencing sales channels, customer relationships, and retail marketing policies (Hollebeek & Rather, 2019). By valuing independent travelers and employing effective communication strategies, travel agencies can foster customer loyalty and satisfaction, encouraging these travelers to seek further assistance from the agencies (Zhang & Li, 2022; Kan, 2022).

4.4 Investing in Data Analytics and Personalized Marketing

To add up, it is undeniable that research on related matters should also be taken into action. Travel agencies should be investing more on data analytics and personalized marketing in order to spectate and study the thorough aspects of an independent traveler (Humagain, 2019). With that being said, collecting and analyzing data on customer preferences, behaviors, and past travel experiences can empower travel agencies to offer targeted and personalized recommendations (Cho et al., 2022). The integration of data analytics and personalized marketing in travel agencies has the potential to significantly enhance the customer experience by providing tailored offers and suggestions aligned with each traveler's interests. Real-time access to personalized information and customer service is an expectation in the tourism and hospitality industry, highlighting the importance of personalized approaches (Buhalis & Sinarta, 2019) personalized approach not only enhances the customer experience but also showcases the agency's ability to provide relevant and valuable services (Xie et al., 2020).

4.5 Upskilling and Training for Travel Agency Staff

The upskilling and training of staff within travel agencies are essential for adapting to the changing landscape of independent tourism and ensuring a competitive edge in the industry. Ultimately, it is own responsibilities of travel agencies to improve and provide training to their staffs with a view of a competitive surrounding of the industry. Adapting to the changing landscape of independent tourism requires a well- equipped and knowledgeable staff (Beqiri & Trakaniqi, 2021). Travel agency employees should be trained to understand the needs of independent travelers and equipped with skills to provide relevant guidance (Angeloni & Rossi, 2020). Training can encompass using digital tools effectively, honing communication skills for remote interactions, and staying updated on the latest industry trends. An upskilled staff with better knowledge and good communication skills might potentially change the point of view of an independent traveler to trust travel agencies for a better service.

6. Conclusion

The rise of independent tourism presents both challenges and opportunities for travel agencies. Previous studies found that the increasing popularity of independent travel is driven by technological advancements, a shift in consumer preferences towards personalized experiences, and a growing desire for unique, authentic travel adventures (Lee et al., 2022). This trend necessitates a strategic response from travel agencies to remain competitive and relevant in the evolving market landscape. This paper highlights that travel agencies can leverage digital platforms and artificial intelligence to enhance customer engagement and meet the expectations of free independent travelers. By utilizing these technologies, agencies can offer personalized recommendations, streamlined booking processes, and real-time support, thereby increasing customer satisfaction and loyalty (Pillai & Sivathanu, 2020). Furthermore, the paper underscores the importance of effective communication strategies in fostering strong relationships with customers, which is crucial for retaining their business in a competitive market (Hollebeek & Rather, 2019).

Adapting to the rise of independent tourism requires travel agencies to develop specialized knowledge and expertise. The findings indicate that travel agencies should prioritize the development of tailored travel packages that address the unique preferences and requirements of independent travelers. This involves curating itineraries that provide distinctive and memorable experiences, such as exclusive access to local attractions and events that independent travelers may not easily discover on their own (Zhang et al., 2020). Additionally, the paper emphasizes the value of collaboration with local partners and tour operators. Such partnerships can enhance the agency’s offerings by providing unique services and insider knowledge, which are highly valued by independent travelers seeking authentic experiences. By forging strong local connections, travel agencies can deliver exclusive opportunities that set them apart from competitors (Islahuddin et al., 2022).

In conclusion, the paper indicates that to adaptation the challenge and opportunity in this industry, travel agencies must embrace a multifaceted approach to thrive in the era of independent tourism by integrating advanced

technologies, developing specialized expertise, and fostering local partnerships, agencies can effectively meet the demands of modern travellers. This strategic will not only enhance customer satisfaction but also ensure the long-term success and sustainability of travel agencies in a rapidly changing industry landscape.

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The Effectiveness of Work-Based Learning: A Case Study of Diploma Hotel Management, Polytechnic Malaysia

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Abstract

In the Malaysian Technical Vocational Education and Training (TVET) institution, work-based Learning (WBL) was introduced to enhance the education and training system. WBL refers to a type of learning that is frequently used in higher education to give students exposure to the workplace and job experience before choosing a career after graduation. This study aimed to evaluate how the students perceived four polytechnics in Malaysia's work-based learning program for a Diploma in Hotel Management. Politeknik Ibrahim Sultan, Politeknik Kota Kinabalu, Politeknik Merlimau, and Politeknik Metro Kuala Lumpur are the polytechnics involved in this study. In this study, 112 students from the tourism and hospitality departments of four polytechnics who had received WBL training in the previous semesters were surveyed using closed-ended questionnaires using a quantitative research methodology. The study used linear regression analysis and descriptive statistics to analyze the data gathered. The results of the study showed that students generally had a positive opinion of the effectiveness of WBL training. The study establishes the factors that influence WBL's effectiveness: pre-placement support, department support, and company support. The study suggests offering students the appropriate orientation before their placement to provide them with a better understanding of the WBL. Polytechnic should establish a feedback system that enables the department to oversee, track, and inquire about the progress of the WBL students.

Keywords: - work-based learning, perception, departmental support, company support

1. Introduction

Work-based learning (WBL) was implemented in Technical Vocational Education and Training (TVET) institutions in Malaysia to improve the quality of education and training. As part of the Malaysia Education 2020–2025 Blueprint, which intends to build an industry-led curriculum to increase graduates' employability and minimize skills gaps, the utilization of WBL, a TVET component, is bringing skilled workers to Malaysia without any support from the government. The WBL curriculum for hospitality education was introduced in 2011 by the Malaysia Centre for Tourism and Hospitality Education (MyCenTHE). Its goals are to give students an understanding of the real world of higher education while they are still enrolled in classes, as well as the skills they need to work in the hospitality sector after graduation.

According to Watisin (2017), work-based learning (WBL) is an approach to education that emphasizes experiential learning and promotes collaboration between academic and industry establishments. Similarly, WBL is also called the 2u2i program; academics and practitioners run it under tight supervision, and it occurs both on and off campus (Mohd Yusoff et al., 2020). Based on Ariffin (2009), the two biggest concerns influencing work-based learning programs are assessment and accreditation. For Work-Based Learning (WBL) to be recognized by the government, educators, employers, and society, it needs to be accredited and put through an extensive assessment process. Any growth in accreditation requires an evaluation of workplace learning, and the effectiveness of this evaluation depends on determining the experience's outcomes in terms of the learner's role and competency.

This study was intended to assess students' perceptions of the work-based learning program for a diploma in hotel management offered by four polytechnics in Malaysia. Politeknik Ibrahim Sultan, Politeknik Kota Kinabalu, Politeknik Merlimau, and Politeknik Metro Kuala Lumpur are the polytechnics involved in this study.

2. Literature Review

2.1 Work-based learning

According to Seufert (2000), WBL is distinct from traditional education in that it requires in -depth, thoughtful reflection on work-related experiences. The ability of the learner to build meta-competence and learn-to-learn skills becomes even more crucial than learning specific activities, in addition to acquiring particular skills and competencies. Attenborough et al. (2019) state that while WBL is present everywhere, it is frequently ignored by institutions, instructors, and students. According to this description, learning in this setting falls between informal and formal: "WBL comprises implicit, unintended, opportunistic, and uncontrolled learning, with the

absence of a teacher, at the informal end of the scale." Fergusson (2022) states that WBL is exemplified by practice under the formal guidance of a mentor or supervisor. Therefore, WBL includes both primary and secondary learning—where learning is an unforeseen, unintentional consequence of work—where learning is the thoughtful effect of an activity related to the workplace. Employees can learn in these settings by taking on the roles of both teacher and student. They can learn on the job through a variety of methods, including what Wofford et al. (2013) referred to as "learning on the fly". To promote employee learning, Boud and Solomon (2001) identified several unique characteristics of work-based learning that emphasized the significance of collaboration between an outside organization and the educational institution. Work-based learning programs are not based on the conventional ideas of the topic disciplinary curriculum but rather are negotiated and drawn from the demands of the company and the learner. The program s frequently contain work-based projects as a key component and build upon a structured review and evaluation of the students' visible learning. "Work-based learning programs are designed to promote professional and personal development and intended to benefit both learners and the workplace,". (Durrant et al.,2009). A significant feature of work-based learning initiatives is the connection between personal growth and organizational transformation. (Garnett et al.,2016).

Assessments of work-based learning programs indicate that they can effectively address particular workplace issues and offer chances for both professional and personal development (Gruppen et al., 2012). Students claimed advantages like developing their knowledge, abilities, and self-confidence; having the chance to consider and understand challenges in the industry; and being motivated to pursue further training and development (Costley and Stephenson, 2008). Employers have seen benefits for employees, inc luding enhanced productivity, greater willingness to take on more challenging jobs, and recognition from peers of the expertise and resources inside the team (Costley and Abukari, 2010). Strong educational experiences can result from combining learning independence with the chance to concentrate on relevant practice concerns supported and promoted through organizations (Clarke and Copeland, 2003). Stewart et al. (2019) state that students have to extend their thinking beyond their current responsibilities and ethical standards to consider how they could be improved or modified when selecting acceptable work-based learning goals and creating their learning plan. It was challenging for many students to organize their thoughts and choose specific, measurable goals that they could complete in the time frame given for the course. Generally speaking, goals were selected based on how well they related to their jobs and areas of interest, however many found it difficult to determine and characterize work-related activities that would improve their practicing skills.

In technical and vocational education and training (TVET) across all study levels, work-based learning (WBL) is one approach that has been extensively used and accepted. The Department of Education Polytechnic and Community College (JPPKK) first implemented the WBL approach in 2007 for the diploma program. This concept was developed into an advanced diploma and bachelor-level studies program at Polytechnics in 2009 based on the findings of benchmarking studies and visits in Australia, the United Kingdom, and Germany. Engaging the industry in the development of curriculum to ensure that study programs at community colleges and polytechnics are always current and relevant. This approach is known as an "industry-driven curriculum." The Education Development Plan Malaysia-Higher Education (PPPM- PT) 2015–2025, which requires sharing from educational institutions, strengthens this initiative even more. It consists of ten significant shifts in education that are thought to be able to support industries by providing professional and skilled labor in a variety of sectors while also promoting sustainable national economic growth. Shift 1: outputs holistic graduates with entrepreneurial and balanced qualities and Shift 4: success quality TVET graduates explicitly summarise the roles of polytechnics and community colleges. To meet the demands of the nation and industry while also making TVET graduates more marketable, several initiatives have been and are being launched in the field of technical TVET education.

2.2 Relevance of work-based learning programmes for polytechnic students

Nowadays, operating a hotel is regarded as one of the most popular companies in Malaysia's travel and tourism sectors. In recent decades, the hotel sector has experienced a significant technological and competitive shift. Hotels are a major part of Malaysia's tourism sector, and the industry has grown significantly in recent years. One of the major drivers of economic expansion in Malaysia is the tourism sector, which comes in second to the manufacturing industry and contributes at least 8 to 10 percent of the nation's yearly GDP. (Nasir et al.,2022). While the Malaysia Education Blueprint 2015–2025 (Higher Education) emphasizes the discrepancy between supply and demand for human capital, Malaysia attempts to improve the quality of its job market by expanding its supply of educated and skilled workers. Companies claim that graduates do not possess the necessary knowledge, abilities, and mindsets. Many initiatives have been implemented, including training and retraining, to lessen the gap in graduates' abilities. According to Bardan (2008), Executive Director of the Malaysian Employers Federation (MEF), "education institutions should prepare students who meet job market requirements in terms of hands-on knowledge and relevant skills as companies are not keen to train new employees," highlighting the significance of these training and retraining programs. Since it currently takes two years for

recent graduates to contribute to the organization, graduates must be able to do so right now. To help students get ready for work, the Ministry of Education and the Ministry of Higher Education can collaborate with companies to provide career guidance and training. It's interesting to note that Malaysia continues to endorse the idea that having a competent labor force is essential to building a stable economy.

Alfeld et al. (2013), recommend features of high-quality WBL in the industry. Firstly, it demonstrates to students how the WBL relates to certain education programs. The extent to which the students understand the connection between their WBL experiences and their academic work could have been clearer. Rather than preparing students for a specific career, the majority of WBL training providers appeared to be focused on providing them with some real-world experience in a field of interest to them. Second, it requires learners to reflect on what they have learned. The WBL training providers varied in terms of whether and how much they expected students to record their work-based learning experience. They were unable to determine whether or not students thought critically about their work. To make sure that the students were still having a good time, most locations requested that students report their activities and progress in journals or during meetings with the WBL coordinator. WBL may influence industrial transformation in more ways than one. These results are frequently connected to graduate education (Appiah et. al., 2023; Perusso and Wagenaar, 2022; Moldovan, 2019; Rowe et al., 2018). However, the flexibility of the work environment to adapt to those going through rapid personal and professional development is a determining factor in the value of active WBL to employers. Some work contexts thrive on this form of growth, particularly when trainees are already in positions of autonomy, according to evidence from organizational perspectives as well as evaluations of WBL (Appiah et. al., 2023; McGunagle and Zizka, 2020; Rowe et al., 2018). WBL seems to favor professionals (Appiah et. al., 2023; Lester and Costley, 2010; Booth, 2019). As a result, work experience can assist higher education students in gaining the confidence and ability to evaluate themselves and reflect on and learn from their experiences. When employees use certain skills and competencies in practice, they become aware of the need to develop them; at this point, developing these kinds of talents away from the real demands of a real workplace can be tough (Appiah et al., 2023; Ornellas et al., 2018; Crebert et al., 2004). As a result, WBL can help students develop various skills and behaviors.

2.3 Hypotheses development

i. Pre-placement support

H1: Pre-placement support has a positive relationship with the effectiveness of work-based learning.

Commey et al (2023) explain pre-placement support as guidance and advice given to students before their training starts. This support could take the form of guiding students through the training process, assisting them in finding suitable placements, organizing an introductory briefing to familiarize them with the requirements and expectations of the training, and making sure they are aware of their roles and responsibilities throughout the program. Hamdan et al (2020) state ineffective management of industrial training has been linked to a lack of oversight by universities. Both before and during placement, this takes place. Students at a Malaysian institution claimed that before visiting the placement industry, the coordinators from the industry had not provided them with enough information. To guide students undergoing industrial training to demonstrate desired work behaviors during their training, institutions should develop a smooth system of collaboration between departments and placement organizations. It is also important to provide academic and placement supervisors with a job description. According to Kalanda et al. (2020), universities must ensure that their curricula are in alignment before placing students in a way that ensures the knowledge and skills the students have acquired are applicable, relevant, and benefit the workplaces that they will be working in.

ii. Department support

H2: Department support has a positive relationship with the effectiveness of work-based learning.

According to Moo (2024), for students to gain more knowledge both before and during WBL, the essentials must be taught in the classroom and through independent study, especially the specific subject's theory. The largest obstacle to managing WBL is that students' weak foundation knowledge may have an impact on their learning outcomes. Department support refers to the help and resources that academic departments offer students to support them during their training. This support may take the form of conductin g assessments of performance, conducting regular communication and monitoring of progress, setting up visits by academic supervisors to offer guidance and address student challenges, arranging with the host organization to ensure an effective learning setting, and providing feedback and guidance to help students expand their knowledge and skills. (Commey et al, 2023)

iii. Company support

H3: Company support has a positive relationship with the effectiveness of work-based learning.

According to Merwe (2013), after the company takes part in the student placement program, the company should consider, the student's contribution to the placements to be meaningful and effective. The company must allow the students sufficient access to their facilities so that students can gain an understanding of real- world work practices and gain the expected benefits. Industry partners are in charge of student mentoring, technical assistance, and project assignments that enable the application of theoretical knowledge in a real- world setting. Frequent monitoring guarantees that students can complete assignments successfully without being overburdened with documentation. (Moo, 2024). According to Commey et.Al (2023), company support is the degree of support and guidance the organization gives when students perform their training. Providing relevant training and practical experiences, that involve students in useful projects or tasks that complement their course learning objectives, providing opportunities for networking and exposure to industry practices, assigning experienced instructors or supervisors to mentor and supervise students, and offering frequent feedback and performance evaluations are just some examples of this support.

2.4 Conceptual framework

The suggested conceptual framework comprises pre-placement support, department support, and company support as independent variables and effectiveness of work-based learning (WBL) as the dependent variable, once the variables that are relevant to the study have been identified.

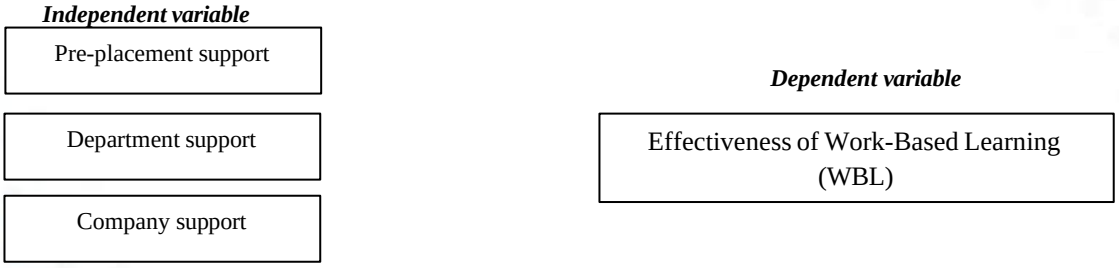

Figure 1: Conceptual Framework (Adapted from Commey et. Al, 2023).

3. Methodology

By employing a convenience sample technique, 112 respondents are found. To participate, the responder must scan the QR code or click on a link to complete the inquiry. By utilizing the features of Google Forms and scanning a QR code or link, researchers can expedite the data-collecting process and guarantee a greater degree of accuracy and dependability in the responses received. Using a quantitative research technique, the students from the tourism and hospitality departments at four polytechnics who had participated in WBL training in the previous semesters were surveyed using closed-ended questionnaires.

Investigating the efficacy of work-based learning (WBL) in terms of departmental, company, and pre-placement support is the goal of the study. Section B was created, and it is broken up into four sections. Section A was also developed. In general, Section A covers the respondents' demographic profile as well as generic information like age, gender, and polytechnic. Work-based learning effectiveness is the subject of the study question in section B, which is based on three criteria: pre-placement support, department support, and company support.

In section B, each component of the study was measured using a five-point Likert scale. This section aims to collect the necessary data to examine the relationships among each factor. Using a Likert scale, the responses are: (1) strongly disagree, (2) disagree, (3) neutral, (4) agree, and (5) strongly agree. The measurement scale of the variable was measured with 23 question items developed by Commey et. Al (2023). Every item used to measure the structure was gathered and adapted from Commey et.Al (2023) but the content was modified to suit the current study's context without deviating from its original objective.

The Cronbach's Alpha coefficient is used to assess the questionnaire's reliability. According to Table 1, the questionnaire consisted of 23 items, and the value for Cronbach Alpha for the questionnaire was $\alpha = 0.982$.

The Cronbach's Alpha ranges between 0 and 1, with the higher values indicating that the questionnaire is more reliable. The value of Cronbach's Alpha for $0.9 \leq \alpha$ determines the value as excellent.

Table 1. Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of items
.982	.982	23

Using SPSS software, data is analyzed to find any patterns or relationships once it has been collected. This study used descriptive analysis, Pearson correlation, and multiple regression analysis.

4. Findings and Analysis

The purpose of the descriptive analysis was to explain the respondents' work-based learning (WBL) experience by examining the factors of pre-placement support, department support, and company support. The percentage, mean, and standard deviation statistical tests were employed.

Table 2. Demographic of respondent

Variables	Category	Percentage (%)
Gender	Male	33
	female	67
Age	Less than 20	4
	20-25 year	90
	26-30 year	3
	31 above	3
Polytechnic	Politeknik Ibrahim Sultan	56
	Politeknik Merlimau	20
	Politeknik Metro Kuala Lumpur	19
	Politeknik Kota Kinabalu	5

Table 2 shows that 67% of the respondents were female, while 33% of the respondents were male. Based on age, the group with the highest percentage of respondents (90%) is followed by the age group with the second-highest percentage (4%) of respondents, and the age group with the lowest percentage of respondents (3%), comprises those 26-30 year and 31 above. For respondents from polytechnic, the highest from Politeknik Ibrahim Sultan (56%), followed by Politeknik Merlimau (20%), Politeknik Metro Kuala Lumpur (19%), and the lowest respondents from Politeknik Kota Kinabalu (5%).

4.1 Descriptive statistics for variable

Table 3. Perception of students on WBL pre-placement support
(N=112, Mean=4.37)

Scale: (1= Strongly disagree) (2= Disagree) (3= Neutral) (4= Agreed) (5= Strongly agreed)			
No	Item	Mean	Std.
1.	The WBL Coordinator provided detailed instructions before the WBL training.	4.29	.874
2.	The polytechnic assists students in getting companies for the WBL training.	4.53	.849
3.	Before the WBL started, the department provided a clear and precise briefing.	4.46	.858
4.	Before the WBL training begins, students must complete the placement process.	4.36	.837
5.	The department properly introduces the company before students start the WBL training.	4.23	1.004

The descriptive statistics regarding students' perceptions of WBL pre-placement support are displayed in Table 3. When everything is considered, students' perceptions of pre-placement support are quite positive (Mean=4.37). The item "Polytechnic assists students in getting companies for the WBL training" (Mean=4.53) has the greatest level of student perception.

Table 4. Perception of students on the effectiveness of department support
(N=112, Mean=4.32)

Scale: (1= Strongly disagree) (2= Disagree) (3= Neutral) (4= Agreed) (5= Strongly agreed)			
No	Item	Mean	Std.
1	An academic advisor visits student to identify their problems.	4.24	.970
2	An academic supervisor was available for assistance as required.	4.31	.949
3	An academic supervisor visits students to evaluate their performance.	4.40	.885
4	An academic supervisor and the company maintained a good relationship.	4.35	.887

Table 4 displays the descriptive statistics regarding students' perceptions of the efficacy of departmental help. In general, students' perceptions of the effectiveness of department support are likely to be pretty acceptable (Mean=4.32). Item number 3, which reads, "An academic supervisor visits student to evaluate their performance," has the highest mean. Item number 1 has the statement "An academic advisor visits student to identify their problems," which is a mean of 4.24.

Table 5. Perception of students on the effectiveness of company support
(N=112, Mean= 4.29)

Scale: (1= Strongly disagree) (2= Disagree) (3= Neutral) (4= Agreed) (5= Strongly agreed)			
No	Item	Mean	Std.
1	The training provided by the company was related to the WBL course.	4.28	.862
2	The training was planned well.	4.26	.878
3	An evaluation of my performance was conducted.	4.36	.909
4	I have a good relationship with the employees of the company.	4.37	.870
5	This company offered the chance to work across different departments.	4.23	.870
6	The training was very flexible.	4.26	.888

The descriptive statistics regarding students' perceptions of students on the effectiveness of company support are displayed in Table 5. Taking everything into account, the fourth item, "I have a good relationship with the company's employees," has the highest effectiveness level. (Mean = 4.37).

Table 6. Perception of students on the effectiveness of work-based learning (WBL) training
(N=112, Mean= 4.35)

Scale: (1= Strongly disagree) (2= Disagree) (3= Neutral) (4= Agreed) (5= Strongly agreed)			
No	Item	Mean	Std.
1	The training enhanced my creativity.	4.30	.879
2	The training enhanced my leadership and managerial abilities.	4.37	.880
3	The training enhanced my problem-solving abilities.	4.40	.864
4	The training helped me to develop self-confidence.	4.38	.881
5	I could work independently with little support.	4.25	.885
6	I develop better interpersonal skills and teamwork abilities.	4.36	.837
7	I was able to apply theories in training.	4.31	.870
8	I acquired working experience in the industry.	4.45	.889

Students' perceptions of the effectiveness of work-based learning (WBL) training are displayed in Table 6. Item 8, "I acquire working experience in the industry," displays the highest level of effectiveness (Mean=4.45). Item number five, "I could work independently with little support," had the lowest effectiveness level (Mean=4.25).

4.2 Pearson Correlation Analysis

Table 7. Correlations

		Effectiveness of WBL
Pre-placement support	Pearson Correlation	.821**
	Sig. (2-tailed)	<.001
	N	112
Department Support	Pearson Correlation	.766**
	Sig. (2-tailed)	<.001
	N	112
Company Support	Pearson Correlation	.911**
	Sig. (2-tailed)	<.001
	N	112

**. Correlation is significant at the 0.01 level (2-tailed).

Table 7 demonstrates a statistically significant positive correlation between the dependent variable (WBL effectiveness) and the independent variables (pre-placement support, department support, and company support). Compared to other components, company support has a beta value of 0.911, suggesting that it is now the most significant independent variable determining WBL effectiveness. Consequently, the outcome demonstrates that all independent variables and WBL effectiveness have a statistically significan t connection. Each variable has a value in the range of 0.766 and 0.911. The pre-placement support ($r=0.821$, $p<0.01$), department support ($r=0.766$, $p<0.01$), and company support ($r=0.911$, $p<0.01$) correlation coefficient values are as above.

Table 8. Multiple Regression Analysis

(Model Summary [b])

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.921[a]	.848	.844	.32127

a. Predictors: (Constant), Company Support, Department Support, Pre-placement Support
b. Dependent Variable: WBL effectiveness

(ANOVA [a])

Model		Sum of Squares	df	Mean Square	F	Sig
1	Regression	62.213	3	20.738	200.925	< .001[b]
	Residual	11.147	108	.103		
	Total	73.360	111			

Dependent Variable: WBL effectiveness
Predictors: (Constant), Company Support, Department Support, Pre-placement Support

The results of the multiple regression testing for company, department, and pre-placement support are displayed in Table 8. A value of 0.921, in this example, indicates a good level of prediction. R=0.921 means this is the correlation coefficient, indicating a strong positive correlation between the predictors and the dependent variable (WBL Effectiveness). R Square = 0.848 indicates that approximately 84.8% of the variance in the dependent variable (WBL Effectiveness) is explained by the independent variab les (company Support, Department Support, Pre-placement Support). Adjusted R Square = 0.844, adjusted for the number of predictors, this value indicates that the model still explains about 84.4% of the variance in WBL. F = 200.925, sig < 0.001, The model is statistically significant, meaning that the independent variables (Company Support, Department Support, Pre-placement support) collectively predict WBL significantly better than a model without predictors. Overall, there is a high degree of department, company, and pre-placement support for the effectiveness of WBL. The success of WBL training and all forms of pre-placement, department, and company

support are significantly positively correlated.

5. Discussion

The effectiveness of WBL was positively and significantly impacted by pre-placement support. Pre- placement support from the four polytechnics involved in this study can be useful in helping students find appropriate placements, explore the WBL process, and become familiar with the expectations and requirements of the WBL training. It also ensures that students are aware of their roles and responsibilities throughout the program. It follows the opinion of Commey et al (2023) as counseling and advice provided to students before the start of their training is needed. This help could come in the form of assisting students in finding appropriate placements and guiding them through the WBL training process, setting up an orientation briefing to familiarize the students with the requirements of WBL training.

Department support has a positive and significant relationship with the effectiveness of work-based learning. An academic advisor visits the students and keeps an eye on their placement to ensure that the training is going well. This is supported by Moo (2024) explains if students need to gain more information both before and during WBL training, the essentials must be taught in the classroom and through individual study. The biggest challenge in implementing WBL is the possibility that student's knowledge would affect their learning objectives.

Company support has a positive relationship with the effectiveness of work-based learning. The students have a good relationship with the staff at the organization placement. The company also conducted a required assessment of student performance very well. These findings support Merwe (2013) that explain industry partners oversee project assignments, technical support, and mentorship for students. I also allow students to apply the theory in practical situations.

The literature indicates that the success of work-based learning is primarily dependent on how the polytechnic prepares and orientations students before their training, how the department supports students during their WBL training, and how the company provides the support and enabling environment for WBL students. Based on the results of these studies, it can be said that pre-placement, department, and company support all have an impact on how effective WBL training works.

6. Conclusion

The importance of WBL programs in giving students in the Diploma in Hotel Management a real -world exposure to apply the theories, models, and concepts they have acquired in the classroom to real-life job circumstances has been the subject of numerous arguments. Through relationships, these programs provide students with a vital opportunity to improve their employable abilities and make connections in the job market. It is imperative to underscore that the achievement of these highlighted advantages is significantly contingent upon the effectiveness of the programs. Conversely, the analysis concludes that the environment and assistance offered by the hotel from four polytechnics are generally excellent. Students can therefore improve their employability skills while undergoing WBL training at different hotels. The study's conclusions suggest that the polytechnic creates guidelines that will allow academic supervisors to attend and closely observe the workplace. By doing this, the academic supervisor will be able to get input on the difficulties and development of WBL students. The study was restricted to four polytechnics that offered the Diploma in Hotel Management, thus it was unable to make any generalizations about the quality of pre-placement and department support for other WBL programs. Additional study in the field of other polytechnics that offer WBL programs is necessary to supplement the existing perspective on the effectiveness of WBL program support offered in Malaysia

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Youth's Satisfaction in Using Online Food Delivery (OFD) Services in East Malaysia

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Abstract

Online food delivery, or OFD, has become popular, and transformed the food industry which offering convenience and variety to consumers. This study examines the relationship between assurance, traceability, meal quality, and youth satisfaction in East Malaysia when using an online food delivery service. The study employed a quantitative methodology, focussing on youths aged 18 to 40 who are potential users of online food delivery services. The survey questionnaire from previous studies was made with minor modifications, validated, and pilot tested. The online questionnaire was analysed and responses were received from 386 people using descriptive and correlational analysis in SPSS. The results indicated all the predictors (assurance, traceability, and meal quality) significantly affect youth's satisfaction with using OFD services.

Keywords: Online food delivery; East Malaysia; satisfaction; youth

1. Introduction

Humans have created numerous innovations throughout history to enhance their quality of life. One of the most evident elements contributing to progress is technology. According to Turner (2023), technology has affected almost every aspect of 21st century life, from transport efficiency and safety to access to food and healthcare, socialisation, and productivity. The COVID-19 incident restricted dine-in service, prompting many restaurants to switch to contactless online food purchasing or delivery (Jun et al ., 2021). This led to citizens actively using online food delivery applications, despite the movement restrictions imposed by COVID-19 (Mat Nayan & Hassan, 2020). There are a few applications consumers may choose from, and the ones with the best reputation are GrabFood and Food Panda. Most people use online food delivery because it is not only time-saving but also gets rid of the cost of commuting to purchase a meal (Treep, 2022).

Despite receiving food and beverages, some consumers express dissatisfaction with online food delivery (OFD). Some customers' dissatisfaction stems from service factors that fall short of their expectations. For instance, Zhongcao (2022) asserted that consumers who struggle to locate food in online food delivery applications may experience a decrease in their satisfaction with these applications. Saad (2020) also supported that delivery time, service quality, price, and condition of food delivered are facto rs that directly affect the success of online food delivery services. It can be concluded that factors affecting online food delivery services are crucial in this industry, as they not only impact the service itself but also impact customer satisfaction. Therefore, sometimes consumers will think twice before using online food delivery. According to the Statista Research Department (2023), a survey conducted in Malaysia by Rakuten Insight stated that 21 percent of respondents who were between 25 and 34 years old ordered from food delivery apps once or twice a week, and four percent of respondents between 16 and 24 years old ordered several times a day. Hence, this study is conducted to fill the gap in past research that has been done in West Malaysia regardin g satisfaction in using OFD services by analysing the relationship between satisfaction of youth from 18 to 40 years old with assurance, traceability, and meal quality in East Malaysia only.

2. Literature Review

2.1 Introduction to Online Food Delivery

OFD refers to an online channel that consumers use to order food from certain restaurants and fast -food retailers (Elvandari et al., 2018). Restaurants and fast-food retailers can increase their reach among customers by adopting OFD in a cost-effective manner, while consumers can order their chosen meal without spending

much time and effort (Ray et al., 2019). These deliveries can be done by several online platforms, such as websites or applications, such as Foodpanda, GrabFood, KFC, and McDonald's official websites.

2.2 Variables in OFD -Traceability, assurance, meal quality

a) Assurance

OFD refers to an online channel that consumers use to order food from certain restaurants and fast -food retailers (Elvandari et al., 2018). Restaurants and fast-food retailers can increase their reach among customers by adopting OFD in a cost-effective manner, while consumers can order their chosen meal without spending much time and effort (Ray et al., 2019). Several online platforms, including websites or applications like Foodpanda, GrabFood, KFC, and McDonald's official websites, can facilitate these deliveries.

H1. Assurance has a positive relationship with satisfaction with service quality when using OFD services.

b) Traceability

The ability to know the delivery progress and location during the OFD service is known as traceability (Cheng et al., 2021). One crucial aspect to keep in mind when making app-based purchases is the capability to monitor orders. This reduces the mental strain associated with product concerns, thereby enhancing the overall consumer experience. Delivery delays that exceed the promised delivery time can cause dissatisfaction. For instance, Saad (2020) discovered that the delivery time significantly influences consumers' decisions to select an OFD service provider. Alalwan (2020) asserts that online tracking has a positive impact on customer satisfaction and their intention to use mobile food delivery apps.

H2. Traceability has a positive relationship with satisfaction with service quality when using OFD services.

c) Meal Quality

It is a necessary component for satisfying restaurant customers. Despite delivery being the industry's primary service, we should take the quality of the delivered meal seriously. It is the responsibility of the delivery men to maintain the meal quality during the delivery process because it can affect customers' decisions about which OFD service provider to use. Annaraud & Berezina (2020) reported that food quality significantly influences customer satisfaction with OFD. In casual dining, Mattila (2001) asserts that meal quality significantly influences customer loyalty. Referring to past research that has been conducted and the findings, it is reasonable to conclude that meal quality indeed influences customer loyalty towards online food delivery (OFD) services.

H3. When using OFD services, meal quality has a positive relationship with service quality satisfaction.

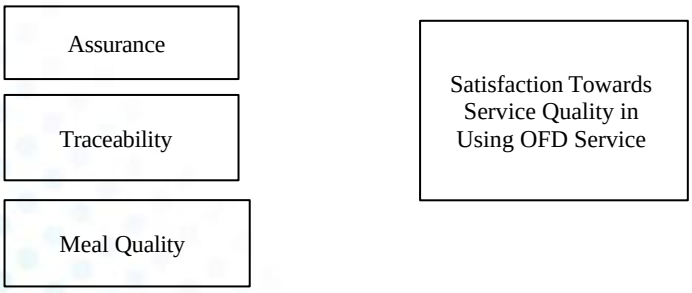

Fig. 1. Researh Framework Model. Adapted from Kian, Y.K., Chee, W.C., Yi, X. C. (2022)

3. Methodology

This study employed a descriptive and quantitative research design. The researcher has conducted a study on the characteristics that influence the satisfaction of youth in East Malaysia with service quality when they use OFD services. The purpose of this study is to examine the relationship between the dependent variable, which is the satisfaction of youth in East Malaysia with service quality when using OFD services, and the three variables of assurance, traceability, and meal quality. According to Miwil (2022) and The News Strait Times (2022), based on data issued by the Malaysian Youth Development Research Institute for 2022, the population of Sabah youth aged between 15 and 40 was 2,071,400 people. Meanwhile, in Sarawak, according to The Borneo Post (2018) by Editoron (2018), based on records from the Statistics Department for this year to date, the youths make up 42% of Sarawak's 2.8 million population, which is around 1,176,000 people. Based on the above records, we estimate the number of youths in East Malaysia between 15 and 40 years old to be 3,247,200.

Researchers decided to collect only data from respondents aged 18 to 40. To achieve the research objectives, researchers developed an online questionnaire, validated it, and conducted a pilot test before the actual survey began. The questionnaire consisted of two parts: Part A is the respondents' demographic information, and Part B includes the questions relating to the variable's assurance, traceability, meal quality, and service quality satisfaction of using OFD, which were measured using a 5-point Likert scale of 1-strongly disagree to 5-strongly agree. The researchers conducted a pilot test with 30 samples in November 2023 to confirm the suitability of the questionnaire and the reliability of its items. The researchers also conducted the questionnaire in both Malay and English to ensure the respondents understood the provided questions. Next, the researchers designed and entered a self-administrated questionnaire into Google Forms, then shared it with youths residing in East Malaysia via online social media platforms like WhatsApp, Facebook, and Instagram. A total of 385 people completed the online questionnaire. The researchers used the Statistical Package for Social Sciences (SPSS) software to analyse the questionnaire's reliability, as well as the mean, frequencies, and standard deviation of the variables. Finally, the researchers performed a correlation analysis to test the relationships among the variables in this study and the hypothesis.

Respondent' Demographic Profile

Table 1 is about the demographic profile of the respondents, who are east Malaysian (N = 386). Most of the respondents were female (67.4%), aged from 18 to 25 years old, and single (87.6%). The majority of the respondents (91.5%) have a university education background. For the occupation, the largest respondents are still students, while the lowest are retirees.

Table 1. Demographic Frequency Analysis

Variables	Categories	Frequency	Percentage (%)
Gender	Female	260	67.4
	Male	126	32.6
Age	18-25 years old	303	78.5
	26-35 years old	62	16.1
	36-40 years old	21	5.4
Marital Status	Single	338	87.6
	Married	48	12.4
Level of Education	Secondary School	30	7.8
	University	353	91.5
	Other	3	0.8
Occupation	Student	260	67.4
	Self-employed	23	6.0
	Government	47	12.2
	Private	43	11.1
	Retiree	1	0.3
	Others	12	3.1

Descriptive Analysis

Table 2 shows the minimum and maximum responses, as well as the mean and standard deviations for all questions under study. The study used Cronbach's alpha test to assess and gauge the internal consistency of a group of items. Table 2 also shows the results of the Cronbach Alpha, with values ranging from 0.763 to 0.909. All the numbers exceed 0.7, and it is considered acceptable (Hulin et al. 2001).

Table 2. Variables' Descriptive Analysis

Variables' Items	Min	Max	Mean	SD
Assurance				
The delivery provider delivers the order immediately once the order is accepted.	1	5	3.81	0.925
The delivery provider delivers the correct order.	1	5	4.19	0.773
The delivery provider delivers according to the delivery time.	1	5	3.86	0.932
The quantity of its meal ordered is accurate	1	5	4.10	0.858
The delivery provider delivers the meal safely.	1	5	4.19	0.897
The delivery charge is reasonable.	1	5	3.59	1.115
Cronbach Alpha Value 0.782				
Traceability				
The delivery provider notifies the customers about the expected delivery time.	1	5	4.10	0.906
The OFD application alerts customer about the delivery duration.	1	5	4.29	0.803
The delivery provider knows the location to deliver the meal.	1	5	4.15	0.869
The traceability system of OFD provides accurate information.	1	5	4.05	0.866
The traceability system enables tracking meals in OFD.	1	5	4.20	0.758
The traceability system can provide the right information.	1	5	4.06	0.875
Cronbach Alpha 0.868				
Meal Quality				
The meals look appetising once delivered.	1	5	3.83	0.910
The OFD offers different ranges of prices according to the types of meals.	1	5	4.19	0.814
The OFD offers a different range of meals.	1	5	4.15	0.857
The delivery provider practises good hygiene when delivering the meals.	1	5	4.11	0.825
The meals are delivered in suitable packaging.	1	5	4.06	0.906
Cronbach Alpha Value 0.763				
Satisfaction				
The overall experience in using OFD is satisfying.	1	5	4.06	0.752
The decision to use OFD is convenient for youths.	1	5	4.35	0.787
The overall OFD services met my expectations.	1	5	3.97	0.797
I was satisfied with the assurance provided by the OFD services.	1	5	3.99	0.870
The OFD services' traceability system satisfied me.	1	5	4	0.812
The quality of the meals provided by the OFD services exceeded my expectations.	1	5	3.98	0.866
Cronbach Alpha Value 0.909				

The researchers conducted descriptive analysis to obtain the mean values and standard deviations of these

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four variable groups. The conducted research analyses the data to determine the average (mean) value and standard deviation of each variable. The results in **Table 2** show that the delivery provider's ability to deliver the correct order (4.19) and safely deliver their meal (4.19) has the highest mean value for assurance. The data in **Table 2** indicates that the delivery provider's assurance of delivering the correct order and ensuring the meal arrives safely is the aspect with the highest average, with both aspects having the same mean of 4.19. For traceability, the highest mean is (4.29) when the OFD application alerts customers about their delivery duration, followed by the traceability system that enables tracking meals in OFD services. (4.20). Regarding meal quality, nearly all mean values are 4, indicating a strong correlation with meal quality. In terms of satisfaction, all of the mean values are approximately 4, indicating that respondents generally express satisfaction when using online food delivery (OFD) services.

Correlation Analysis

This study was conducted to determine whether assurance, traceability, and meal quality can influence youth's satisfaction with using online food delivery (OFD) services in east Malaysia. It was hypothesised that all three independent variables would positively affect youth's satisfaction with using OFD. **Table 3** shows the results of the correlation coefficient.

Table 3. Correlation Analysis

ITEMS	SATISFACTION (DV)
Assurance (IV)	
Spearman's Correlation Coefficient	0.643
Sig (P-value)	<.001
N	386
Traceability (IV)	
Spearman's Correlation Coefficient	0.699
Sig (P-value)	<.001
N	386
Meal Quality (IV)	
Spearman's Correlation Coefficient	0.765
Sig (P-value)	<.001
N	386

Table 3 demonstrates a positive relationship between the three independent variables - assurance, traceability, and meal quality - and the dependent variable, satisfaction, with all significant levels being less than 0.05. Thus, all the tested hypotheses exhibit a positive relationship with each other. Other than that, if the r value ranges from 0.5 to 1.0, it indicates that the relationship between the independent variable and the dependent variables is strong, as stated by Cohen (1988). Table 4 presents the proposed hypothesis testing.

The r value for assurance and satisfaction is positive, at 0.643. This indicates the relationship between the variables is strong. Furthermore, a p-value less than 0.05 indicates a statistically positive significance level between the two. Hence, Hypothesis 1 (H1) was accepted.

As for traceability and satisfaction, the r value is 0.699, and the p value is less than 0.05. The r value shows there is a strong relationship between the variables; the same goes with the significance level, where it shows a positive relationship. Therefore, Hypothesis 2 (H2) was accepted.

Meal quality and satisfaction have the highest r value, which is 0.765, and the p value is less than 0.05. The r value shows similar results to the other variables where there is a strong relationship. As for the p value, it shows a positive significance level between the meal quality and satisfaction variables. This indicates the acceptance of the proposed Hypothesis 3 (H3).

Table 4. Hypothesis Testing

HYPOTHESIS	FINDINGS
Hypothesis I (H1) Assurance has a positive relationship with satisfaction with service quality when using OFD services. H1 (Assurance -> Satisfaction)	Supported
Hypothesis II (H2) Traceability has a positive relationship with satisfaction with service quality when using OFD services. H2 (Traceability -> Satisfaction)	Supported
Hypothesis III (H3) Meal quality has a positive relationship with satisfaction with service quality when using OFD services. H3 (Meal Quality -> Satisfaction)	Supported

4. Discussion

The results corroborated hypothesis (H1), indicating that assurance positively influences the intention to use OFD. The results align with the studies conducted by Cheng et al. (2021). In this study, the youth found that OFD applications provide them with assurances regarding correct order placement, delivery time, and delivery charge. The result also aligns with the statement by Banerjee et al. (2019), which said assurance has an important influence on customer satisfaction when using OFD service. This demonstrates that users perceive the OFD application as trustworthy, as it enables them to order their preferred food at any time and location, without the fear of receiving the wrong order or not receiving it at all. The assurance provided by the OFD services will encourage users to make online food purchases. As a result, online food providers and marketers should ensure that their delivery providers are highly skilled workers who can ensure that the meal is delivered correctly, safely, and on time to the customers. In the OFD context, according to Cheng et al. (2021), assurance indicates "the ability to win customer trust during the OFD service." The results show that consumers evaluate the quality of assurance based on how fast the delivery provider can deliver their order, verifying if the food and its amount are accurate, and assessing whether the charges are reasonable. Customers expect delivery providers to deliver their orders accurately and promptly, without any cancellations once accepted. Moreover, it clearly shows that in order for food companies or restaurants to be more successful, they need to ensure the production of safe food that complies with the regulations. Hence, assurance, which includes maintaining high product quality, is equally crucial for securing customer loyalty to OFD and fostering company expansion.

Moreover, the results above indicate that the traceability hypothesis contributed to the youths' satisfaction with OFD services, thereby confirming the hypothesis (H2). The results support Saad's (2020) claim that traceability positively correlates with the use of OFD services. Traceability fosters trust, provides assurance, and simultaneously enhances consumers' confidence in the food system. Consumers tend to pay a premium for traceable food products (Zhang & Bhatt, 2014). Furthermore, today's youth exhib it concern and a lack of desire to trust online delivery services' tracking systems. We can develop the tracking system to offer more detailed information about the delivery provider. Therefore, Engelseth et al. (2014) stated that a traceability system offers crucial information for ensuring the quality of a food product, a vital aspect when purchasers seek to validate the quality. This is especially important in upscale and specialised market segments, where the marketability of a product depends on the information about its features provided through the traceability system. This shows that a traceability system can impact both delivery providers and customers' satisfaction. Furthermore, its role in enhancing food safety is another incentive for implementing traceability. To illustrate, modern traceability systems provide additional information about suppliers, allowing the identification of issues related to food safety or other aspects of product quality (Pouliot & Sumner, 2008). Food quality plays a crucial role in out-of-delivery (OFD) services, as it ensures that the packaging and safety of the product or package meet the expectations of consumers, particularly the younger generation. Young people often prioritise the packaging of their food, anticipating a favourable delivery environment. Traceability systems enable the collection and dissemination of information about food origins, characteristics, and processing methods throughout a supply chain. The implementation of traceability contributes to demonstrating supply chain transparency by utilising verifiable records and labelling (Morreale et al., 2011). Therefore, OFD must ensure their applications are convenient for consumers to track their food regardless of time, place, and more.

When youths use OFD services, meal quality has a positive effect on their satisfaction. Annaraud and Berezina (2020) asserted that food quality has a significant impact on customers' satisfaction with OFD when they receive their meal. Saad (2020) also affirmed that food quality, specifically the conditions of the meal, plays a significant role in influencing customers' choices of OFD service providers. This means that customers trust the OFD service provider to handle their food. Other than that, hygiene is also vitally important in terms of handling

food because some customers are concerned with hygiene issues (Mehrolia et al., 2020). For example, the delivery man should deliver the food in appropriate attire and not leave it exposed to contamination. When engaging with the customer, the delivery man should maintain his or her hygiene by avoiding exposure to dirt or anything that could diminish the customer's appetite. The delivery man should also keep the food in its original state, not upside-down, which can reduce the food quality. Despite preparing the food in an unappealing condition, food delivery providers must ensure it reaches the customer. Overall, customers' perceptions of meal quality are crucial as they significantly influence their level of satisfaction. By referring to the results, it proves that the numbers from the results prove that meal quality is significantly important in order to influence customers' satisfaction with using OFD service providers.

In the aspect of limitations, time constraint is one of the challenges which can hinders the comprehensive analysis of all the potential predictors. In fact, this study only employed three predictors, (i.e., assurance, traceability and meal quality) despite the existence of other potential predictors that could be relevant to its findings. Hence, this study suggests that future research should include other predictor such as sustainability practices which assess the environmental impact of OFD – focusing on packaging, waste management and best practices for sustainability. Another predictor suggested for future study should include consumer behaviour trends which investigate how changing consumer preferences can influence food delivery choices . Perhaps the further predictors can enhance the depth of the study and broaden the perspective of youths' satisfaction in using OFD. Future study could also investigate the satisfaction using OFD in West Malaysia as this current study only addresses East Malaysia.

5. Conclusion

This study was conducted to examine the youth's satisfaction with using online food delivery services (OFD) in East Malaysia (Sabah and Sarawak). The goal of this study is to investigate the relationship between assurance, traceability, meal quality, and youth satisfaction with using online food delivery (OFD) services. Hence, correlation analysis results indicated that the three factors (i.e., assurance, traceability, and meal quality) had a significant impact on the youth's satisfaction with using OFD services. Presently, the number of users using OFD services continues to rise. According to Durai (2023) in The Star News, there has been a notable surge in spending power, as well as a simultaneous 18% growth in food deliveries from 2019 to 2022. This increase in spending is particularly responsible for the rising food delivery market. Furthermore, the results indicate that the OFD provider should prioritise the delivery of food to the customer, the customer's ability to track their order location, and the quality of the meal upon delivery. Based on the findings, the majority of respondents take this factor very seriously, agreeing that it can significantly affect their satisfaction. The hypothesis results (see **Tables 2 and 3**) illustrate these factors in detail. Thus, assurance, traceability, and meal quality should improve more and provide better performance in the delivery industry.

This research aims to provide benefits to both online food delivery (OFD) services and delivery providers, particularly in East Malaysia (Sabah and Sarawak). It can give them an idea of what consumers' demands are when using OFD services. For instance, ensuring the arrival of a consumer's order eliminates any uncertainty about the safety of their food. When it comes to traceability, if consumers have the ability to track the whereabouts of their food, they will feel reassured as they won't have to waste time waiting, and they can also track their meals through the services provided by OFD. The food condition plays an important role in determining meal quality. Even though consumers receive their ordered meal, they may feel dissatisfied if the meal is not in good condition, or if it is not presentable. This is because meal conditions may affect a consumer's appetite if they receive a meal with an unpleasant appearance.

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The Insight of Sabahan Youths' Intention to Visit Dark Tourism Destination -The Case of Agnes Keith House, Sandakan, Sabah

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Abstract

The practice of visiting locations linked to tragedy and death, commonly referred to as dark tourism, has witnessed a notable surge in popularity in recent times. However, it remains a complex and under-researched spectacle. This study centers on the Agnes Keith House, a site of historical importance that has been repurposed as a destination for dark tourism. The primary objective of this research is to apply the Theory of Planned Behavior (TPB) to gain insights into the behavior of youths' in Sabah, specifically focusing on their visits to the Agnes Keith House in Sandakan, Sabah. The study aims to examine the behavioral intentions, perceived behavioral control, attitudes, and subjective norms of Sabahan youths' who participate in dark tourism. Additionally, it seeks to uncover the motivations driving Sabahan youths' involvement in this type of tourism. Furthermore, the study intends to provide insights into the evolving landscape of dark tourism, including operational site management, program development challenges, and opportunities at the Agnes Keith House. Moreover, it delves into the motivations, expectations, and experiences of the youths' population in Sabah, Malaysia, within the context of dark tourism. This comprehensive exploration aims to shed light on the intricate dynamics of dark tourism and its impact on the youths' in Sabah.

Keywords: Dark Tourism; Theory of Planned Behavior (TPB); Sabahan Youths'; Agnes Keith House; Behavioral Intentions

1. Introduction

Dark tourism, while receiving recent attention, is not a new phenomenon. It has gained popularity as a topic of study in recent years. Dark tourism is characterized by the exploration of sites associated with death, tragedy, and suffering, and has gained significant attention within the realm of tourism (Stone, 2006). Foley and Lennon (1995), who introduced the idea of dark tourism, described it as "the phenomenon which encompasses the presentation and consumption (by visitors) of real and commodified death and disaster sites." According to Seaton (1996), "Dark Tourism" or "Thana tourism" is defined as "travel to a location wholly or partially motivated by the desire for actual or symbolic encounters with death." The word "Thanatos," derived from ancient Greek, signifies "death" in English. Meanwhile, Chakraborty (n.d.) describes Thanatos as "the personification of death, more specifically violent death." Sharpley and Stone (2009) frequently use the term dark tourism to describe the form of tourism that includes traveling to locations associated with death, pain, and the macabre, a widely accepted characterization. The definition of the word "dark" or "darkness" includes the absence of light, the presence of evil, devastation, and grief (Benedetto, 2018). Tourists have been visiting death-related sites since the 11th century (Biran et al., 2011). Although dark tourism has grown in popularity over the past century, there is still minimal knowledge of the phenomenon (Biran & Buda, 2018). To further explore this sentiment, the researchers conducted a study to understand the planned behaviors of tourists regarding this type of activity. This study thus expanded to Agnes Keith House in Sabah, Malaysia. Despite mixed feelings among the community and tourism operators in Sabah about whether to include an additional dark tourism product for Agnes Keith's House (Anjumin, 2021), this study aims to explore the youth's perspective on the subject matter. Additionally, the study site is significant to Sabah's history and cultu re, making the current situation particularly interesting to examine. It is essential to undertake this study, as the site could provide youths' in Sabah with the opportunity to learn about their history and culture while acknowledging their interest in dark tourism.

Previous studies have shown that a variety of factors, including curiosity, interest, and intrigue, could influence visitors' intentions and motivations for visiting dark tourism sites. However, these studies have limitations; they did not take into account the actual destinations that the participants visited, and the results, particularly from visitors' perspectives, may not be completely reliable. As a result, there is minimal understanding of this phenomenon, and further study is needed (Biran et al., 2011). Furthermore, a recent study claims that young travelers' experiences in specific dark tourism interactions have largely gone unstudied. This is especially important given their evolving understanding of death, vulnerability, suffering, and increased visits to memorial

sites (Kerr et al., 2016). Although it is acknowledged that young visitors also visit dark sites for enjoyment, this experience needs to be conceptualized separately. To address these limitations, the Theory of Planned Behavior (TPB) constructs will be used in this study to enhance understanding of the behavior of Sabahan youths' visiting the dark tourism site at Agnes Keith House in Sandakan.

To address the issue, this study will employ the constructs of the Theory of Planned Behavior (TPB) to determine the attitudes, subjective norms, perceived behavioral control, and behavioral intentions of Sabahan youths' regarding their intention to visit the dark tourism site at Agnes Keith House in Sandakan. The study aims to provide insights into the behavior of Sabahan youths', and the results could be used to develop strategies to increase the number of visitors if Agnes Keith House is established as a dark tourism destination. This research seeks to understand the planned behavior of youths' in Sabah, Malaysia, by assessing the subjective norms, attitudes, behavioral controls, and intentions that drive them to visit dark tourism sites such as Agnes Keith House. This form of tourism is incredibly unique, and the perspectives of a targeted group of individuals will be explored.

2. Literature Review

2.1 Agnes Keith House: Historical Background

The Agnes Keith House is a museum located on a hill near Sandakan, Malaysia. Originally built in 1946/47, it was the first timber house constructed after World War II. The house was home to Mr. Harry Keith, his wife Agnes Newton Keith, and their son George. In 2001, the Sabah Museum Department and the Federal Department of Museums and Antiquities restored the house, which opened to the public in 2004 as a tribute to Agnes Keith, a famous American author known for her book Land Below the Wind. The house is furnished with colonial-style furniture and genuine antiques and features a gallery that tells the story of Agnes Keith and her family, along with displays of war artifacts. The Agnes Keith House holds historical significance as a dark tourism destination, inviting visitors to engage with the darker aspects of history (Mu, 2021). Agnes Keith, originally from the United States, once lived in the house. According to Mohammad (2022), the Agnes Keith House in Sandakan, Sabah, has a rich history tied to the renowned writer. She resided there with her husband, Henry Keith, during World War II. The house was rebuilt in 1946 after the war and became the first permanent government timber dwelling. Agnes Keith is known for her book Land Below the Wind. The house was restored in 2001 through collaboration between the Sabah Museum Department and the Federal Department of Museums and Antiquities and opened as a museum in 2004. The museum features colonial- style furniture and antiques, with a gallery that tells Agnes's story and that of her family. During the Japanese occupation, Agnes and her son were imprisoned, and she secretly documented her experiences. Her book Three Came Home is a significant source for depictions of women in Japanese camps during World War II. Agnes Keith's Land Below the Wind became Sabah's unofficial motto, and her writings continue to be an important part of the region's history. The house currently serves as a museum showcasing the lives of Agnes Keith and her family (Sabah Tourism Board, n.d.).

2.2 Types of Dark Tourism Activity

Dark tourism refers to the practice of visiting sites associated with death, tragedy, suffering, and the macabre. It offers a unique and often controversial way to engage with history, culture, and human experiences. Each type provides a different lens through which to explore the complexities of past events and often challenges visitors to reflect on the darker aspects of benevolence while fostering a deeper understanding of human history and culture. There are five different forms of dark tourism trip act ivities, as outlined by Seaton (1996) and Stone (2006), that could occur, which are:

Travel to witness public enactments of death

Public enactments of death were not merely spectacles but integral parts of societal life. Executions, for instance, were public events designed to serve as a deterrent to crime and reinforce societal norms. These events were not only about punishment but also served as a form of communal experience, binding the community through a shared confrontation with mortality. The visitors' interest in death has not waned; instead, it has found new expressions, such as historical reenactments, death-themed festivals, and tours of execution sites. These events allow individuals to confront death in a controlled environment, often framed as educational or commemorative activities. One example is the annual reenactment of the Battle of Hastings in England, where participants recreate the 1066 conflict that led to significant bloodshed.

Travel to witness re-enactments of death

Traveling to witness re-enactments of death allows travelers to engage with themes of mortality, suffering, and historical events through staged performances. These re-enactments can range from historical battles to executions and other significant events marked by death and violence. The phenomenon reflects a broader societal

fascination with death, a desire for connection with historical events, and even a form of cultural or social purification. These dark stories are offered in a controlled environment, allowing for the exploration of the macabre aspects of human history and nature. The re-enactments enable visitors to engage with history and death in a way that can be both educational and transformative, providing insights into the human condition and our collective memory of past tragedies. For example, battle re-enactments occur at sites like Gettysburg in the United States.

Travel to the sites of individual or mass deaths

Traveling to sites associated with individual or mass deaths is a form of tourism that blends elements of history, memory, and human curiosity about mortality. Travelers are drawn to these sites for various reasons, including the desire to witness and understand tragic events, pay respects, or engage in reflective or educational experiences. The appeal of dark tourism often stems from a combination of psychological factors, including curiosity, thrill-seeking, and a deep-rooted cultural fascination with death and disaster, all within the context of a deeply impactful experience that serves various purposes, from education to personal reflection. Activities include visiting places of mass murder, such as Auschwitz, Culloden, the Colosseum in Rome, and Lockerbie, as well as sites of individual deaths, like the Dallas Book Depository where Kennedy was shot, the chamber where the Princes of the Tower of London were killed, and the street where pop icons like Marc Bolan, James Dean, or Eddie Cochran died. Additionally, visitors may explore sites associated with the haunts of infamous murderers and serial killers, such as where Jack the Ripper stalked his victims.

Travel to see symbolic representations of death and suffer

Traveling to see symbolic representations of death and suffering has become a significant facet of contemporary tourism. This phenomenon often involves visiting locations like concentration camps, disaster sites, museums, or preserved sites of historical atrocities that depict past tragedies. The motivations for such travel are complex, ranging from educational interests and a desire for personal connection to cultural heritage to sheer curiosity about death. It includes establishments that exhibit the attire of murder victims, weapons of death, and other items. The blood-spattered, bullet-riddled attire of Revolutionary War heroes is displayed in a Cuban museum. Famous killers have long been represented in wax at Madame Tussaud's in London, and at Ground Zero in New York City, the site of the 9/11 terrorist attacks. These representations serve as both educational tools and places of reflection, where visitors can confront the harsh realities of human history and contemplate the nature of mortality and human cruelty.

Travel to the memorials or internment sites

Memorials and internment sites, such as concentration camps, battlefields, and memorial museums, hold a particular allure for dark tourists. These locations serve as powerful reminders of humanity's capacity for cruelty, the consequences of conflict, and the importance of remembering history to prevent future atrocities. The motivation for visiting these sites varies among individuals. Some tourists are driven by a desire for education, seeking to learn about the historical events that have transpired. Others may visit out of a sense of duty to honor the victims or to engage in personal reflection. The emotional impact of such visits can be profound, often leaving visitors with a heightened awareness of the fragility of human life and the importance of peace. It is essential to present these experiences with sensitivity, ensuring that the primary focus remains on education, reflection, remembrance, and the respectful commemoration of the past. Examples of such sites include Auschwitz-Birkenau in Poland, the Hiroshima Peace Memorial in Japan, and the Killing Fields in Cambodia, where the memories of the deceased are preserved, and the horrors of the past are recounted.

2.3 Theory of Planned Behavior

Fishbein and Ajzen (1975) formulated the Theory of Planned Behavior (TPB), which is founded on three fundamental components: attitudes, subjective norms, and perceived behavioral control. The TPB is an extension of the Theory of Reasoned Action aimed at predicting intentional behavior. While the Theory of Reasoned Action focuses on voluntary actions, TPB extends its application to behaviors with varying degrees of volitional control (Ajzen, 1988). TPB introduces perceived behavioral control as a core elemen t that determines behavioral intention (Han et al., 2010). This control factor predicts behavior in two ways: by indirectly influencing behavior through intentions and by having a direct link to behavior (Madden et al.,1992). If individuals lack confidence in their ability to perform a behavior due to limited resources, their intention to engage in the behavior might be low, despite maintaining a positive attitude toward it. Purchases involving tourism services often demand more resources, making them high-involvement decisions influenced by significant costs—both monetary and non-monetary—associated with travel choices (Sirakaya & Woodside, 2005). The TPB has gained widespread use in tourism research due to its adaptability and versatility (Ajzen & Driver, 1992; Lam & Hsu, 2004; Han et al., 2010; Han & Kim, 2010). For instance, Lam and Hsu (2004; 2006) applied TPB to unveil the motivations

of Taiwanese and Chinese travelers visiting Hong Kong, and the findings demonstrate a direct relationship between attitude, perceived behavioral control, subjective norm, and travel intentions among survey participants. In essence, visits to Hong Kong strengthened the intention to return if driven by positive experiences. This approach, relevant for gauging intentions toward dark tourism sites, aligns with the study's objective of assessing behavioral intentions.

The Theory of Planned Behavior (TPB) is a useful tool for forecasting and examining tourists' behavioral intentions (Lewis, 2021). In the context of dark tourism, attitudes refer to an individual's opinion about visiting such places. The TPB will be applied to determine why and how youths' in Sabah choose to visit dark tourism destinations. According to the TPB, the likelihood of intending to engage in an activity increases when one has a favorable attitude toward it. By analyzing their attitudes regarding dark tourism, including their views on the sites' historical or educational relevance, it is possible to predict Sabahan youths' desire to visit these places. The theory also examines how behavior is influenced by social norms and perceived social pressure . The opinions of family, friends, and the general public about dark tourism may impact Sabahan youths'. Thus, one can understand how social influences shape the places they intend to visit. Applying the Theory of Planned Behavior (TPB) to study the motivations and intentions of Sabahan youths' in visiting dark tourism sites offers an organized and comprehensive method for understanding the purposes and motivations behind their actions. A thorough understanding of these fundamental behavioral processes enables researchers and policymakers to make informed decisions and responses.

In the context of dark tourism, the relationship between attitudes, subjective norms, perceived behavioral control, and behavioral intention can be examined using the Theory of Planned Behavior (TPB). According to the research study conducted by Lewis et al. (2022), tourists who have visited or intend to visit dark tourism destinations are attracted to the idea of having a dark experience involving paranormal activity. As a result, they make their travel decisions primarily based on their own beliefs and preferences, with minimal influence from others. The term "dark experience" describes the emotional and psychological impact of visiting a dark tourism site, such as feelings of fear, anxiety, or sadness. According to the study, "dark experience" was the dark tourism concept that had the greatest influence on attitudes and subjective norms. This indicates that tourists who had a positive dark experience were more likely to develop favorable attitudes toward dark tourism and perceive it as socially acceptable, which, in turn, influenced their behavioral intentions.

3. Methodology

The dark tourism study site is at Agnes Keith House in Sandakan, Sabah. The study focuses on assessing the intention to visit, attitudes, subjective norms, and perceived behavioral control of youths' residing in Sabah. The study's sample concentrates on the youths' category, which encompasses individuals within the age range of 18 to 40, as most previous research has only used the age range above 18 (Lewis et al., 2022). The question items were adapted from previous studies and suit the context of this research. This study adopted a closed-question design with a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The questionnaire is divided into five distinct sections: respondent profiles, intention to visit, attitudes, subjective norms, and perceived behavioral control. The variables of intention to visit, attitudes, subjective norms, and perceived behavioral control are adapted from Lewis, Schrier, and Xu (2021).

Based on the number of youths' in Sandakan registered with the KBS Youth Management System, there are 11,858. The sample size is determined using the Krejcie and Morgan (1970) table, therefore, the number of samples planned to be collected is 375 respondents. The study, however, intends to collect more respondents than initially determined as to mitigate potential issues such as non-response bias. Additionally, it is to ensure the sample better represents the population and improves the robustness of the st udy's findings (Israel, 1992). Non-probability convenience sampling is employed in this study, and the questionnaire is distributed to the targeted population of Sabahan youths' living in Sandakan. A self-administered questionnaire is used, with a data collection period of four months, from February to June 2024. The collected data are analyzed using SPSS 24.0 software. A total of 483 respondents were collected; however, only 399 responses are reliable for data analysis.

4. Findings

4.1 Descriptive Analysis of Sabahan Youths' Demographic Profile

Table 1 presents the demographic characteristics of the respondents across various categories, including gender, age, marital status, education level, and employment status. The finding showed that the majority of the Sabahan youths' respondents are female which represent 66.2% of the total respondents. Most of the respondents were at the age 18-24 years old (80.7%) and followed by the lowest of the respondents at age 35 - 40 (7.5%). This suggests that the majority of participants were relatively young, with a significant skew towards the 18-24 age bracket. Next, the majority of the respondents were unmarried individuals which represent mostly single (90%). The education level is predominantly with Bachelor's Degree (50.1%). Meanwhile, the employment status of respondents in this study is diverse. More that half of the respondents are still studying which represent 51.4% of the total respondents, and followed by working in the private sector (28.6%), government sector (7.3%), self-employed individuals and those categorized under "Others" represented 7% and 5.8%, respectively.

Table 1: Respondent's Demographic Analysis

Items	Categories	Frequency	%
Gender	Male	135	33.8
	Female	264	66.2
Age	18-24	322	80.7
	25-34	47	11.8
	35-40	30	7.5
Marital Status	Single	359	90
	Married	38	9.5
	Single Parent	2	0.5
Education Level	No formal education	9	2.3
	STPM	32	8
	Diploma	116	29.1
	Bachelor Degree	200	50.1
	Masters Degree	8	2
	PhD Degree	1	0.3
	Others	33	8.3
Employment Status	Student	205	51.4
	Self-employed	28	7
	Government sector	29	7.3
	Private sector	114	28.6
	Others	23	5.8

Note: N=399

4.2 Descriptive Analysis of Respondent's Attitude

Table 2 presented Sabahan youths' respondents' attitudes toward visiting dark tourism sites. The items evaluated include enjoyment, positivity, pleasantness, and excitement associated with visiting such sites. The findings showed that the majority of respondents agreed that visiting dark tourism sites is enjoyable, with 31.8% selecting "Agree" and 19.5% selecting "Strongly Agree." The mean score for this item is 3. 4, indicating a tendency toward agreement on the enjoyment aspect. The standard deviation of 1.2 suggests a moderate variation in responses. On the other hand, responses were more evenly distributed, with 27.3% selecting "Neither Disagree nor Agree" and 25.1% disagreeing towards positivity of visiting dark tourism sites. The mean score of 3.0 reflects a neutral to slightly positive overall perception of a positive experience. The standard deviation is 1.2, indicating moderate variability in opinions among the respondents. The largest group, 31.1%, agreed that visiting dark tourism sites is pleasant, while 28.3% neither agreed nor disagreed. The mean score is 3.1, indicating a generally neutral but slightly positive perception of pleasantness. The standard deviation of 1.1 shows a moderate range of responses pleasantness of visiting dark tourism sites. Meanwhile, 36.8%, agreed that visiting dark tourism sites is exciting, and 19.8% strongly agreed. The mean score for excitement is 3.4, suggesting a positive inclination towards the excitement factor of dark tourism. The standard deviation suggests a moderate degree of variation (1.2) in respondents' views excitement of visiting dark tourism sites. The Sabahan youths' generally perceive dark tourism of Agnes Keith as an enjoyable and exciting experience, with a neutral to slightly positive view on its pleasantness and positivity. The variability in responses across all items indicates diverse opinions, though the tendency leans towards agreement on the enjoyment and excitement of visiting dark tourism sites.

Table 2: Respondent's Attitude Analysis

Items	Likert Scale	Frequency	%	Mean	Standard Deviation
Visiting dark tourism site is enjoyable	Strongly Disagree	38	9.5		
	Disagree	69	17.3		
	Neither Disagree nor Agree	87	21.8	3.4	1.2
	Agree	127	31.8		
	Strongly Agree	78	19.5		
Visiting dark tourism site is positive	Strongly Disagree	38	9.5		
	Disagree	100	25.1		
	Neither Disagree nor Agree	109	27.3	3.0	1.2
	Agree	90	22.6		
	Strongly Agree	62	15.5		
Visiting dark tourism site is pleasant	Strongly Disagree	46	11.5		
	Disagree	69	17.3		
	Neither Disagree nor Agree	113	28.3	3.1	1.1
	Agree	124	31.1		
	Strongly Agree	47	11.8		
Visiting dark tourism site is exciting	Strongly Disagree	33	8.3		
	Disagree	62	15.5		
	Neither Disagree nor Agree	78	19.5	3.4	1.2
	Agree	147	36.8		
	Strongly Agree	79	19.8		

Note: N=399

4.3 Descriptive Analysis of Respondent's Subjective Norm

Table 3 presented Sabahan youths' respondents on subjective norm dark tourism sites. The statements estimate the perceived expectations, approval, and behaviors of people who are important to the respondent with respect to visiting dark tourism sites. On the social expectation, the distribution shows that 30.1% neither agree nor disagree, while a combined 34.1% agree or strongly agree. However, a significant proportion (35.8%) disagrees or strongly disagrees, indicating mixed perceptions about social expectations. The mean score (3.2) suggests that, on average, respondents slightly lean towards agreement with the idea that important people in their lives think they should choose a dark tourism location to visit. The standard deviation (1.1) suggests moderate variability in responses. Meanwhile, the social approval showed that the largest group (32.1%) neither agrees nor disagrees, while a combined 37.1% agree or strongly agree, indicating a fair amount of social support or neutrality. The responses also reveal that 30.9% of respondents feel some level of disagreement, showing a similar pattern to the first assertion. The mean score (3.1) reflects a neutral to slightly positive perception regarding social approval for visiting dark tourism locations and the standard deviation (1.1) indicates a moderate level of dispersion in the responses. In term of social behaviour, mos t 45.9% of respondents either disagree or strongly disagree with the statement, while only 29.1% agree or strongly agree. This reflects with the mean score of 2.7 suggests that respondents generally disagree with the notion that people they know would choose Agnes Keith as dark tourism trip. This is supported by the fact that the relatively lower mean and higher standard deviation (1.2) compared to the other statements indicate greater disagreement and variability in responses. The Sabahan youths' generally perceive as moderate to neutral regarding visiting dark tourism of Agnes Keith, but they are less likely to believe that people they know would actively choose such destinations for vacation purposes. In addition, these findings suggest that while there is some level of social influence in the consideration of dark tourism, it is not overwhelmingly strong, especially in terms of social behaviour

Table 3: Respondent's Subjective Norm Analysis

Items	Likert Scale	Frequency	%	Mean	Standard Deviation
People who are important to me think I should choose a dark tourism location to visit	Strongly Disagree	36	9	3.2	1.1
	Disagree	107	26.8		
	Neither Disagree nor Agree	120	30.1		
	Agree	87	21.8		
	Strongly Agree	49	12.3		
People who are important to me would approve my visit to a dark tourism location	Strongly Disagree	27	6.8	3.1	1.1
	Disagree	96	24.1		
	Neither Disagree nor Agree	128	32.1		
	Agree	98	24.6		
	Strongly Agree	50	12.5		
People I know would choose a dark tourism location for vacation purposes	Strongly Disagree	79	19.8	2.7	1.2
	Disagree	104	26.1		
	Neither Disagree nor Agree	100	25.1		
	Agree	90	22.6		
	Strongly Agree	26	6.5		

Note: N=399

4.4 Descriptive Analysis of Respondent's Perceived Behavioural Control

The findings in Table 4 represent the descriptive analysis of respondent's perceived behavioral control among Sabahan youths'. The first statement examined was whether individuals feel they have control over their decision to visit dark tourism destinations. The majority of respondents (59.9%) either "Agree" or "Strongly Agree" with this statement, indicating a general sense of personal agency in deciding whether to visit such destinations. The mean score 3.6) suggests that on average with respondents tend to agree that they are in control of whether they visit a dark tourism destination. The standard deviation (1.2) indicates some variability in responses, suggesting that while most feel in control, there is still a significant portion of the population with differing views. The second item in the survey focused on the availability of dark tourism locations within reasonable driving distance from the respondents' homes. The responses are quite varied, with no single category dominating the results. About 42.6% of respondents "Disagree" or "Strongly Disagree," indicating a significant portion does not believe such sites are nearby, while 38.3% "Agree" or "Strongly Agree" that such locations are within reasonable driving distance. The mean score (2.9) suggests that respondents are on average, neutral about the proximity of dark tourism locations to their homes. Meanwhile, the standard deviation (1.3) shows greater variability in responses compared to the first statement, reflecting diverse opinions on this matter. Lastly, the survey examined the perceived financial accessibility of visiting dark tourism locations. The results show a mixed but generally with positive responses. A notable 55.1% of respondents "Agree" or "Strongly Agree" with the statement suggesting a majority feel they have the financial means to engage in dark tourism if they desire. The mean score (3.4) indicates that respondents generally feel they could afford to visit a dark tourism destination with the average leaning toward agreement. The standard deviation (1.2) reflects moderate variability implying that while affordability is a concern for some, the majority are confident in their financial capacity to visit such locations.

Table 4: Respondent's Perceived Behavioral Control Analysis

Items	Likert Scale	Frequency	%	Mean	Standard Deviation
I am in control of whether or not I visit a dark tourism destination	Strongly Disagree	18	4.5	3.6	1.2
	Disagree	73	18.3		
	Neither Disagree nor Agree	69	17.3		
	Agree	110	27.6		
	Strongly Agree	129	32.3		
There are dark tourism location within reasonable driving distance from my home	Strongly Disagree	75	18.8	2.9	1.3
	Disagree	95	23.8		
	Neither Disagree nor Agree	76	19		
	Agree	95	23.8		
	Strongly Agree	58	14.5		
If I wanted, I could easily afford to visit dark tourism location	Strongly Disagree	39	9.8	3.4	1.2
	Disagree	55	13.8		
	Neither Disagree nor Agree	85	21.3		
	Agree	139	34.8		
	Strongly Agree	81	20.3		

Note: N=399

4.5 Descriptive Analysis of Respondent's Behavioral Intention

The findings in Table 5 represent the descriptive analysis of respondent's behavioral intentions regarding dark tourism over the next 12 months. The first item assesses the likelihood of respondents visiting a dark tourism location. The frequency distribution shows that 23.3% of participants strongly disagreed, while 10.3% strongly agreed. The mean score (2.7), alongside a standard deviation (1.2), suggests that the overall inclination leans towards disagreement with the intention to visit. A significant proportion (70%) of respondents indicated a neutral to negative stance, suggesting barriers to engagement in dark tourism. Meanwhile, the findings of second item measures the desire to visit a dark tourism location reveals that 18.5% of respondents strongly disagreed, while 13.3% strongly agreed. With a mean of 3.4 and a standard deviation of 1.3, the results suggest a more favorable compared to the first item which inclination more on disagreement. This indicates that while a considerable number of respondents are indifferent perspective about the intention to visit, there is a moderate level of interest that could potentially be leveraged by tourism marketers. On the third item evaluates the intention to revisit dark tourism location. The findings show that 19.8% strongly disagreed and 10% strongly agreed, resulting in a mean score of 2.9 and a standard deviation of 1.2. These results reflect a mixed intention toward revisitation, with a substantial proportion of respondents expressing neutrality or disagreement. This could be pointed out that an experience-based hesitation that may affect repeat visitation in dark tourism. Lastly, the final item assesses the likelihood of recommending dark tourism to friends or family indicate that 14.5% strongly disagreed, while 13.5% strongly agreed, with a mean of 3.2 and a standard deviation of 1.2. The fact that a larger portion of respondents is inclined to agree with recommending such experiences (35.1%) suggests that those who do engage with dark tourism are likely to advocate for it, highlighting a potential avenue for increasing participation through social influence.

Table 5: Respondent's Behavioral Intention Analysis

Items	Likert Scale	Frequency	%	Mean	Standard Deviation
I will visit dark tourism location in the next 12 months	Strongly Disagree	93	23.3	2.7	1.2
	Disagree	70	17.5		
	Neither Disagree nor Agree	116	29.1		
	Agree	79	19.8		
	Strongly Agree	41	10.3		
I want to visit dark tourism location in the next 12 months	Strongly Disagree	74	18.5	3.4	1.3
	Disagree	54	13.5		
	Neither Disagree nor Agree	106	26.6		
	Agree	112	28.1		
	Strongly Agree	53	13.3		
I would revisit the most recent dark tourism location I visited or plan to visit again in the future	Strongly Disagree	79	19.8	2.9	1.2
	Disagree	67	16.8		
	Neither Disagree nor Agree	105	26.3		
	Agree	108	27.1		
	Strongly Agree	40	10		
I would recommend visiting any dark tourism location to a friend or family member	Strongly Disagree	58	14.5	3.2	1.2
	Disagree	42	10.5		
	Neither Disagree nor Agree	105	26.3		
	Agree	140	35.1		
	Strongly Agree	54	13.5		

Note: N=399.

5. Discussion

The overall evaluation aims to determine how Sabahan youths' feel about carrying out a certain behavior, whether responding positively or negatively to their attitudes upon visiting. It encompasses both the individual's beliefs about the outcomes and their evaluation of the behavior's consequences. In other words, attitude represents how the individual feels about the behavior, whether positively or negatively (Ajzen, 1991). The mean score for each item ranged from 3.0 to 3.4, indicating a generally positive tendency towards visiting dark tourism sites for attitudinal reasons. The highest mean score of 3.4 suggests that visiting dark tourism sites is enjoyable and exciting. Visiting dark tourism sites can be pleasant and stimulating for individuals drawn to curiosity, history, and a desire for education (Lewis et al., 2022). It can also be engaging for those who want to connect with historical events and gain a unique perspective on the past, as suggested by Mora et al. (2023). Moreover, these experiences allow visitors to choose their destinations based on personal beliefs, which enhances their enjoyment of the sites. Nevertheless, it is important to recognize that dark tourism is a personal choice that should be approached carefully and sensitively, acknowledging that it might not be suitable for everyone. Furthermore, most respondents expressed mixed feelings, neither disagreeing nor agreeing that visiting dark tourism sites is a positive experience. According to Stone (2006), some people may have mixed emotions about visiting dark tourism sites, as it can be emotionally intense. The experience could be overwhelming and might evoke feelings of sadness, grief, or discomfort. Lastly, most respondents agreed that visiting dark tourism sites is pleasant. However, no existing studies were found to explain why visiting dark tourism sites is considered pleasant. Based on the findings of this study, we suggest that the pleasure may arise from the fulfillment of intellectual curiosity. This involves sparking interest in sp ecific historical events and motivating individuals to seek knowledge about tragic events at the dark tourism site.

The subjective norm is a person's perception of societal expectations to engage in a specific behavior, influenced by their normative views and drive to conform (Ajzen, 1991). Normative views concern the possibility that significant others would approve or disapprove of a behavior, while motivation to comply reflects the importance placed on gaining the approval of these important others. The mean score for each item ranged from 2.7 to 3.2, indicating a generally positive tendency towards visiting dark tour ism sites in terms of subjective norms. The highest mean score of 3.2 reflects the statement, "People who are important to me think I should choose a dark tourism location to visit." The questionnaire results revealed a mixed response, with participants either agreeing or disagreeing with both questions. We concluded that this ambivalence may stem from the emotional impact of dark tourism. Visiting locations associated with death and suffering can be emotionally challenging, evoking feelings ranging from grief and sadness to anger and indignation. There is also concern that

dark tourism might foster a culture of voyeurism and the commercialization of human suffering (Bradford, 2023). Consequently, many respondents are reluctant to place their loved ones in situations that could be emotionally distressing. Another factor contribut ing to the mixed reactions is that some people do not fully understand the term 'dark tourism,' often misconstruing it as an ethical or safety issue (Administrator, n.d.). The final question in this section showed that most respondents would not choose dark tourism as a vacation destination. This may be because dark tourism is not well-known, and people unfamiliar with its complexities are unlikely to visit such sites. From this section of the assessment, we conclude that most respondents are divided, with about half expressing approval and the other half disapproval of their loved ones exploring a dark tourism site such as the Agnes Keith House.

The findings presented in Table 4 highlight the youth's perceived behavioral control over dark tourism in Sabah and the complex ways in which youths' in Sabah perceive their ability to manage their behavior when participating in dark tourism. The ability to control behavioral barriers and the availability of sufficient resources both affect how well a behavior is performed. People's perceived behavioral control and willingness to engage in behaviors are positively correlated with the number of resources available and the perceived lack of obstacles (Ajzen & Madden, 1986). The mean score for each item ranged from 2.9 to 3.6, indicating a generally positive tendency towards visiting dark tourism sites in terms of perceived behavioral control. The highest mean score of 3.6 indicates that respondents felt strongly in control of whether or not they visit a dark tourism destination. Hence, most respondents strongly agree that they are in control of their decision to visit a dark tourism destination. Additionally, the responses to the second question show an equal level of agreement and disagreement regarding the presence of a dark tourist location within their home area. An example of such a location could be a cemetery site, which may have been built on an old residential site or near abandoned buildings where people still live. According to Afla et al. (2023), dark tourism has informally occurred at Jalan Ampang Muslim Cemetery in Kuala Lumpur, despite the administration's official lack of support or promotion for such activities within any urban cemeteries in the Kuala Lumpur metropolitan area. Lastly, the findings show that most respondents agree they can afford to visit a dark tourist destination if they choose to. Since each person has their own preferences for places to visit, it is ultimately up to them to decide whether or not to go. These findings suggest a strong sense of control over the choice to visit dark tourism destinations, but they also highlight differences in perceptions about the proximity of these locations. These observations provide significant insights into the factors influencing youths' participation in dark tourism in Sabah.

Behavioral intentions refer to the motivational factors that influence a given behavior, where stronger intentions to perform the behavior increase the likelihood of its execution (The Theory of Planned Behavior, n.d.). There is significant insight into the behavioral intentions of youths' in Sabah regarding dark tourism. The mean scores for each item ranged from 2.7 to 3.4, indicating a generally positive tendency towards visiting dark tourism sites. The highest mean score of 3.4 corresponds to the statement, "I want to visit dark tourism locations in the next 12 months." However, most respondents had mixed feelings or neither agreed nor disagreed with this statement. Visiting dark tourism sites could evoke mixed emotions due to the challenging nature of experiences associated with death, tragedy, and suffering. These emotional challenges could be influenced by personal beliefs and cultural background (Lewis et al., 2022). For those still interested in visiting dark tourism sites, it is crucial to assess personal comfort and preferences and consider visiting with a trusted companion for emotional support during the visit. These insights offer a comprehensive understanding of youths' desire to engage in such experiences, return to these places, and recommend them to others. The findings contribute to our growing knowledge of the variables affecting the acceptance and popularity of dark tourism among the intended audience. Therefore, most respondents reacted positively to their behavioral intention to visit a dark tourism site, specifically Agnes Keith House.

6. Conclusion

Dark tourism involves exploring sites associated with death, tragedy, and suffering, and it has gained attention in recent years. Some examples of dark tourism destinations in Malaysia are the Penang War Museum in Pulau Pinang, Kellie's Castle in Perak, Villa Nabila in Johor Bahru, Pulau Bidong, Batu Lintang, the Ranau Death March, and Jerajak Island (Loke, 2013). This study focuses on a dark tourism site, specifically Agnes Keith House in Sandakan, Sabah. The Theory of Planned Behavior (TPB) is applied to investigate Sabahan youths' intentions to visit Agnes Keith House as a dark tourism site. By analyzing the Theory of Planned Behavior, this study aims to understand how it can affect one's decision or intention to visit a dark tourism site. This contribution advances to the understanding of how different age groups engage with dark tourism, benefiting both academic research and practical site management strategies.

The findings from this study indicate that most youths' find visiting a dark tourism site enjoyable, particularly in relation to the subjective norms based on the first question of the section. However, many youths' have mixed feelings about allowing their loved ones to visit such sites. The study also shows that most youths' have the

opportunity to visit a dark tourism site, which is why many of them intend to visit a dark tourism site in the future, specifically the Agnes Keith House. By gaining insights from this study, the Agnes Keith House could strategically tailor its experiences to align with the motivations and intentions of Sabahan youths'. This alignment can lead to a more engaging and meaningful visit, as the site will be better equipped to provide experiences that resonate with the specific interests and curiosities of the younger demographic. Additionally, the study provides insights that can enhance how dark tourism sites cater to the preferences of youth visitors. The tourism site management and tourism program development may consider integrating narratives that provoke thought and reflection, such as survivor stories or debates surrounding historical events which will make the dark visit intellectually stimulating.

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The Effect of Length of Membership on Value Co-Creation Behavior and Loyalty of Cooperative Members: A Proposed Conceptual Framework

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Abstract

In recent years, there has been considerable interest among researchers in studying value co-creation behaviors. Research indicates that value co-creation is vital for the growth and sustainability of the retail industry. Although recent studies mainly focus on identifying the dimensions of value co-creation and its antecedents, there remains a gap in understanding its impact on relational marketing. Applying the Service-Dominant (S-D) Logic theory and supported by Experiential Learning theory, this paper aims to propose a value co-creation behavioral framework that incorporates length of membership and member loyalty, specifically in the context of consumer cooperatives in Sarawak. Although previous research has explored the relationship between value co-creation behavior and loyalty, there have been few studies that specifically examine the role of member, particularly length of membership, as a moderating factor. Furthermore, the application of these concepts within the context of cooperatives in developing markets remains unclear. To address this gap, this conceptual paper aims to propose a value co-creation behavioral framework that incorporates length of membership and member loyalty, specifically viewed through the lens of consumer cooperatives in developing markets.

Keywords: Value Co-Creation Behavior, Length of Membership, Loyalty, SD-Logic, Experiential Learning Theory

1. Introduction

A fundamental objective for any business organization is to generate value for customers by providing products and services. As a crucial indicator of business performance, value contributes significantly to customer satisfaction and loyalty (Yi, 2014). Both customers and employees play pivotal roles in shaping valuable experiences within the processes of value creation (Grönroos and Ravald, 2011). The interaction between customers and firms is integral to this value creation (Vargo and Lusch, 2004; Yi and Gong, 2013). Customers contribute to value creation by engaging in behaviors that benefit the firm, such as sharing information and interacting with employees or other customers (Kim, Tang, and Bosselman, 2019). According to Rubio, Villaseñor, and Yagüe (2020) value co-creation remains a central issue in the Marketing 4.0 era. Despite growing research in this area, considerable ambiguity persists regarding the use of certain concepts (Rubio et al., 2020). The conceptualization of value co-creation has gained increasing significance in recent years, necessitating a unified understanding between scholars and practitioners (Rubio et al., 2020). Cooperatives continue to be positioned in a critical portfolio in the socio- economic development of the country. This is evidenced by the growth performance of cooperatives in the country. Furthermore, cooperatives are foreseen to be a most important contributor to the economic growth of the country through their trajectory performance history.

Nowadays, tangible products cannot thrive without the integration of services. Under the service-dominant logic (Vargo and Lusch, 2004), value creation is not solely the domain of companies; stakeholders, including customers, also play a vital role in the value creation process. Expanding on this idea, Yi and Gong (2013) introduced a two-dimensional construct of 'customer value co-creation behavior,' which consists of customer participation behavior and customer citizenship behavior. This service-dominant logic highlights the significance of customer engagement and dialogue in the co-creation process. In recent years, value co- creation (VCC) has garnered substantial attention and recognition as an effective approach, driven by growing interest from both professionals and scholars worldwide (Saha, Goyal, and Jebarajakirthy, 2022). In a cooperative context, members, as customers of the cooperative, play a crucial role in ensuring that value co - creation can be strategically implemented. This demands active participation from members in service delivery, along with additional involvement in both economic and social activities within the cooperative. As a democratically controlled and member-based organization, cooperatives expect their members to undertake significant extra roles in service co-creation to achieve their long-term objectives (Yacob, Ali, Roslin, and Lajuni, 2020). The growth of cooperatives as economic organizations providing public services is essential to a country's economic development, making the application of Service-Dominant (S-D) Logic particularly relevant in this context.

However, limited research has been conducted on the cooperative industry, particularly regarding its business functions and activities.

One of the main challenges faced by many cooperatives today is securing support from members, which can also be viewed as loyalty. According to Harisudin, Adi, and Pratama (2020), cooperatives encounter substantial difficulties, including intense competition, a reduction in membership numbers, and a lack of member loyalty. These issues have been identified as significant obstacles impacting cooperatives. Additionally, there is a notable absence of cross-industry analyses examining the influence of Value Co- Creation (VCC) on customer behavioral outcomes, such as loyalty and commitment. This gap in the VCC literature remains unaddressed (Saha et al., 2022). Furthermore, despite the increasing number of cooperatives and total membership each year, these statistics do not necessarily reflect the sector's overall success (Musa et al., 2020).

Moreover, according to Malaysia Cooperative Societies Commission (MCSC, 2023), in the Malaysian Cooperative Transformation Plan (TransKoM) (2021-2025), there are 10 major challenges identified and need to be addressed through this plan for a conducive cooperative development and regulatory ecosystem can be created to empower the cooperative movement to compete at the national and global level. One of the challenges is the involvement of cooperative members. As stated in Malaysian Cooperative Transformation Plan (TransKoM) (2021-2025), the spirit of 'ownership' needs to be enhanced through the involvement of more active members in economic activities carried out by cooperatives (MCSC, 2023). Despite the cooperative society's major contribution to the nation's economic progress, Malaysia's cooperative society movement is still seen as less developed than those of other nations (Yacob, Ali, Ting, Lajuni and Hussin, 2017).

Furthermore, Yen, Teng, and Tzeng (2020) investigated how innovativeness impacts customer value co - creation behaviors indirectly through customer engagement. However, their study did consider for the moderating effects of other variables, such as consumer involvement or the duration of customer relationships (Clauss, Kesting, and Naskrent, 2018; O'Cass, Boisvert, and Ashill, 2011). Future research could explore whether factors like consumer involvement or duration of customership and customer value co-creation behaviours are affected by moderating variable. Therefore, this study aims to examine the impact of the length of membership as a moderating variable.

Experiential Learning Theory (ELT) is purposefully crafted as a comprehensive and adaptable approach to learning, encompassing the integration of experience, perception, cognition, and behavior (McCarthy, 2016). As a dynamic and holistic framework, ELT provides insight into how adults gain knowledge through their experiential encounters (Kolb and Kolb, 2017).

2. Literature Review

2.1 Value Co-Creation Behaviour

In this study, value co-creation behavior is conceptualized as a multidimensional construct, consisting of two higher-order factors, each with several dimensions: customer participation behavior and customer citizenship behavior (Yi and Gong, 2013). Within the context of cooperatives, where customers are also members, these dimensions are specifically defined as member participation behavior and member citizenship behavior.

2.2 Service-Dominant (S-D) Logic Theory

Service-Dominant Logic (S-D Logic) suggests that value is co-created through the interactive process between service providers and customers during the consumption phase, rather than being produced through a one-way exchange (Vargo and Lusch, 2016). Vargo and Lusch (2004) introduced Service-Dominant Logic Theory, which offers a comprehensive perspective on marketing by asserting that service is not merely a form of exchange but the fundamental basis of all exchanges, with goods serving as a means to deliver service (Vargo and Lusch, 2016). According to S-D Logic, service involves a process of value creation that integrates various resources, including those from customers, to develop value propositions that address customer needs and desires (Lusch and Nambisan, 2015). Vargo and Lusch (2016) highlight that the co-creation of value is a core principle of Service-Dominant Logic, emphasizing the critical role customers play in the value creation process. Without active customer participation in service interactions, firms miss the opportunity to engage in value co-creation, leading to a failure in generating value.

2.3 Experiential Learning Theory (ELT)

Experiential Learning Theory (ELT) is conceptualized as the process through which knowledge is derived by transforming experiences. This knowledge emerges from the dual processes of comprehending and reconfiguring these experiences (Kolb, 1984, p. 41). ELT was developed by integrating insights from Kurt Lewin's research and John Dewey's principle of "learning by doing," aiming to produce scientific knowledge by conceptualizing and

applying experiences (García-Sánchez and Luján-García, 2016). The theory is designed as a comprehensive and adaptable learning framework that incorporates experience, perception, cognition, and behavior (McCarthy, 2016). ELT serves as a dynamic and inclusive model that explains how adults acquire knowledge through experiential learning (Kolb and Kolb, 2017). Experiential learning differs significantly from behavioural learning theory in its perspective on the learning process. It considers life experiences to be a core and essential component of learning, asserting that "knowledge i s formed by changing experiences" (Kolb, 2015, p. 49). According to Kolb (2015), research on experiential learning theory has seen a remarkable growth over the past two decades and it has expanded more than fourfold across various fields including management, education, information science, psychology, medicine, nursing, accounting, and law.

According to Chan (2022), Kolb's theories revolve around three key components, all rooted in constructivist principles. The first component comprises the guiding principles of the theory. These principles are based on six fundamental assumptions about learning, drawing from the work of educational scholars and these assumptions provide the foundation for Kolb's experiential learning theory (Chan, 2022). The second component is the experiential learning theory itself, which consists of four stages that learn ers move through as they absorb knowledge and skills during their learning encounters (Chan, 2022). The final component pertains to the four basic learning styles, which are integral to understanding how individuals prefer to engage in the learning process (Chan, 2022).

Experiential Learning Theory designed to be a comprehensive and adaptable approach to learning, blending together experience, perception, cognition, and behaviour. (McCarthy, 2016). Previous research has revealed that individuals' learning styles are shaped by factors such as their personality type, educational focus, career preferences, current job responsibilities, and cultural background (Kolb and Kolb, 2005).

Experiential learning theorists, starting with Dewey, have acknowledged that learners must actively engage with their environment to acquire practical knowledge (Yardley, Teunissen and Dornan, 2012). ELT is a dynamic and comprehensive theory that explains how adults learn through their experiences and it also serves as a multi-dimensional model for understanding adult development (Kolb and Kolb, 2017). This dynamic perspective of learning revolves around a learning cycle propelled by various factors and pro cesses (Kolb and Kolb, 2017). The theory of experiential learning aligns with value co-creation by emphasizing the dynamic interplay between instructional inputs and learner reactions, as elucidated by the service -dominant logic in marketing (Geddes, Cannon, Cannon and Feinstein, 2015).

2.4 Customer participation

Customer participation behavior refers to the in-role actions of customers actively engaging with a company to co-create products or services (Yi and Gong, 2013; Foroudi et al., 2019). The extent of customer participation can range from minimal to extensive, depending on the type of serv ice (Ida, 2017). According to Naeem and Di Maria (2021), a participating customer typically demonstrates a particular attitude and behavior by contributing resources to the value co-creation process. This participation is considered a crucial component for successful value co-creation. The original model identifies four key dimensions of customer participation behavior: information seeking, information sharing, responsible behavior, and personal interaction (AbdelAziz, Md Saad, and Thurasamy, 2023).

Roy, Balaji, Soutar, and Jiang (2020) note that customers actively seek information to better understand the services they are to receive, including their roles and responsibilities in the value co-creation process. This information-seeking behavior helps reduce uncertainty and supports the acquisition of the necessary knowledge and skills for effective resource integration (Lee, Hsiao, and Chen, 2017). Information sharing is also critical; without it, service providers cannot perform their duties effective ly (Yacob et al., 2018). Failure to share accurate information can impair the value co-creation experience (Khan and Hussainy, 2017). Therefore, this aspect is vital for the success of value co-creation. Moreover, customers must adhere to directives from employees, such as being present when required, to ensure successful value co-creation (Yi and Gong, 2013). Responsible customer behavior is essential for the process to be effective (Khan and Hussainy, 2017). Finally, personal interaction, or interpersonal relations, between customers and employees is fundamental to successful value co-creation. This interaction, which includes respect, friendliness, and courtesy, significantly enhances the co-creation process (Yi and Gong, 2013). Customers often engage in mutual resource sharing and offer assistance or advice, fostering additional interactions and a temporary senseof camaraderie among them (Rihova et al., 2018).

2.5 Customer citizenship

Customer citizenship behavior refers to voluntary actions or extra-role behaviors that go beyond the expected responsibilities of a customer. These actions involve engaging positively with other customers, employees, or the company itself (Assiouras et al., 2019). Recent research suggests that customer value creation behavior can be

considered a form of customer citizenship behavior, emphasizing extra-role activities that significantly contribute value to the firm (Yi and Gong, 2013; Arıca and Kozak, 2019; Assiouras et al., 2019). This behavior includes a range of activities such as providing feedback, advocating for the firm, recommending the firm to others through positive word of mouth, assisting fellow customers, and displaying tolerance and patience when services or products do not meet expectations (AbdelAziz et al., 2023). Yi and Gong (2013) emphasize the importance of customer citizenship behavior in enhancing the co-creation experience and informing strategies for value co-creation. This behavior can provide firms with a competitive advantage by facilitating value co-creation and informing additional strategies. Customer citizenship behavior encompasses four distinct aspects: feedback, advocacy, helping, and tolerance.

According to Kim, Tang, and Bosselman (2019), feedback is a discretionary action rather than a requirement for successful service delivery. While feedback is beneficial, its absence does not necessarily impede the overall success of the service process. Advocacy involves recommending the business or its employees to others, such as friends or family, which can significantly benefit the firm by promoting products, enhancing its image, and expanding its customer base (Yi and Gong, 2013; Khan and Hussainy, 2017). Helping behavior refers to customers' willingness to assist and support other customers, contributing to the collaborative value creation process (Yacob et al., 2020). Finally, tolerance is defined as the customer's willingness to remain patient when service delivery does not meet their expectations, such as in cases of delays or shortages (Yi and Gong, 2013). The extra-role behaviors associated with customer citizenship contribute to the smooth operation of a company's social system.

2.6 Length of membership

Length of membership is defined as the number of years a member has been actively involved in a cooperative organization, from the date of joining to the present time (Rahman, Hossain, and Uddin 2018). Hence, length of membership in consumer cooperative context refers to the number of months or years a member is involved in a cooperative. For members who are still active, this value remains unknown or is considered "right censored." Conversely, "membership length" denotes the total time an individual has been a member at a specific point in time (Fang et al., 2021). Additionally, Debaere, Devriendt, Brunneder, Verbeke, De Ruyck, and Coussement (2019) define membership length as the number of days a member has actively participated in the community. Amsale (2019) further suggests that membership duration in a cooperative is influenced by factors such as the member's knowledge of cooperation, their involvement in cooperative management, and the extent of their utilization of cooperative services.

The duration of membership within cooperatives is pivotal in assessing the impact of cooperative societies on the economic well-being of their members (Demeke, 2020). Without considering this factor, it is challenging to fully understand the role of cooperatives, including their strengths and weaknesses, in effectively meeting their objectives for members (Demeke, 2020). Recently, cooperatives have garnered significant attention as a potential tool for addressing various developmental challenges (Slade Shan tz, Kistruck, Pacheco and Webb, 2020).

A study by Prentice, Han, Hua, and Hu (2019) demonstrates a significant moderating effect of membership duration on the relationship between social identification and customer attitudinal engagement. The results reveal that individuals who are new to a group are more likely to be influenced by the community's values and perceived similarities with the group, which drives their intention to actively engage. Conversely, long - standing members tend to focus more on the shared interactions and commonalities with other members (Prentice et al., 2019).

Furthermore, a study by Lee and Park (2019) indicates that membership duration does not moderate the relationship between social capital and content capital concerning attachment to the current community. This finding highlights inconsistencies with previous studies regarding the moderating effect of membership length across different contexts. Consequently, this study aims to contribute to the literature by exploring length of membership as a moderating factor specifically within the context of the consumer cooperative sector.

2.7 Loyalty

Cossio-Silva et al. (2016) propose that value co-creation behavior impacts both attitudinal and behavioral dimensions of loyalty. Loyalty is multifaceted and can be defined in various ways: behavioral loyalty refers to repeat purchasing actions, while attitudinal loyalty involves personal attitudes and emotions that foster customer loyalty towards a product or service (Cossio-Silva et al., 2016). Cultivating and sustaining customer loyalty is often viewed as a primary objective in business endeavors (Singh, Iglesias, and Batista -Foguet, 2012). Previous research has identified several antecedents of customer loyalty, with customer trust and customer affective commitment being among the most frequently examined factors (Leonidou, Kvasova, Leonidou, and Chari, 2013; Markovic et al., 2018; Singh et al., 2012). Although rational variables, such as customer trust, and emotional variables, such as customer affective commitment, have been extensively

linked to customer loyalty, there has been relatively limited exploration of interactional variables, such as co - creation, as potential antecedents of customer loyalty.

Members' loyalty is essential for advancing the goals of a cooperative, particularly by enhancing cooperation and reducing conflicts among members (Tjosvold and Sun, 2002; Yacob et al., 2016). Research indicates that understanding the cooperative's ideology and its unique business model significantly influences member loyalty. When members appreciate the cooperative's principles and recognize the distinct nature of the cooperative model, they are more likely to demonstrate loyalty to the cooperative (Fulton , 1999; Hayati, Asha'ari, Ahmad Faizal, and Norbiha, 2008; Ngadi, 2010). Additionally, Chu, Lee, and Chao (2012) propose that customer satisfaction has a direct impact on loyalty. When customers are satisfied and confident with the products and services they receive, their loyalty and trust in the firm are likely to increase (Osman, Mohamad, and Mohamad, 2016). The implementation of various loyalty programs is also believed to positively affect customer loyalty (Hafeez and Muhammad, 2012; Stathopoulou and Balabanis, 2016).

Loyalty within cooperatives depends on their ability to function effectively, which can be challenging due to the need to balance economic performance with the interests of members (Klafke, Pinto and Picinin, 2022). Cooperative members generally expect lower input prices and higher selling prices for their products, requiring the cooperative to operate competitively, achieve optimal economic performance, and meet member needs (Klafke et al., 2022). This study reflects a global trend identified by Bolton (20 20), highlighting the importance of balancing the interests and objectives of various stakeholders, including the cooperative, its members and the market.

2.8 Conceptual Framework and Hypotheses

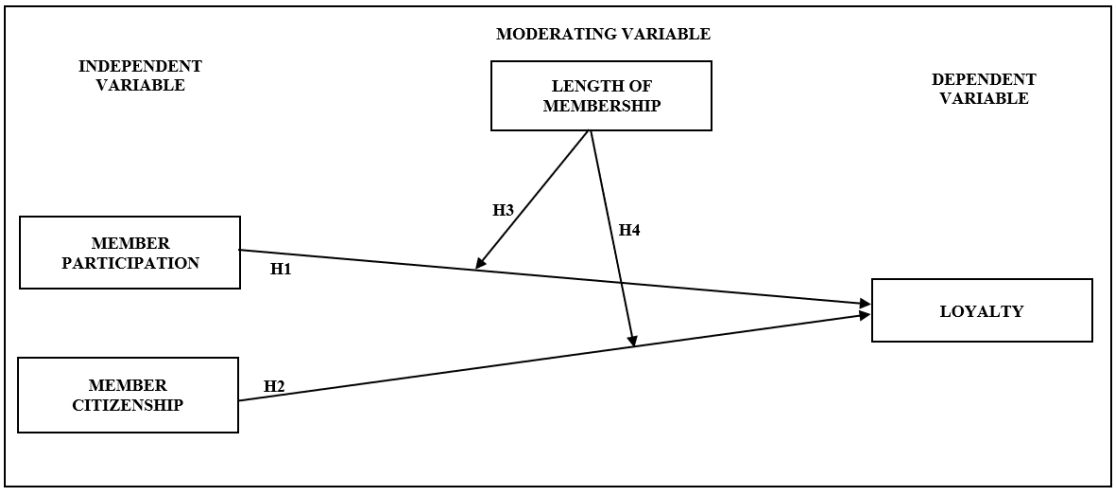

Figure 1: Conceptual framework adapted by Yi and Gong (2013) and Kolb (2015)

Due to the mixed findings from various studies, the following hypotheses are developed:

H1: There is a positive relationship between Member Participation and Loyalty.

H2: There is a positive relationship between Member Citizenship and Loyalty.

H3: Length of membership moderates the relationship between Member Participation and Loyalty.

H4: Length of membership moderates the relationship between Member Citizenship and Loyalty.

3. Methodology

The target respondents for this study are members of consumer cooperatives in Sarawak. The participantswere drawn from cooperatives across various major divisions in the state, including Bintulu, Kinawot, Kapit, Kuching, Lawas, Limbang, Marudi, Meradong, Miri, Mukah, Samarahan, Saratok, Sarikei, Serian, Sibu, Simunjan, and Sri Aman. The research employed purposive sampling, as the researcher established specific criteria for selecting respondents. The criteria include membership in the cooperative sector and active subscription to the products or services offered by the consumer cooperative. Examples of such products include food, beverages, apparel, and other related items. The rationale behind choosing Sarawak lies to its diverse ethnic composition and the sparse distribution of cooperatives, which highlights the importance of cultural differences among cooperative members. Additionally, Sarawak's economy is the third largest contributor to Malaysia's GDP (Lee and Voon, 2022) and

also the cooperative movement in Sarawak was established later than in other Malaysian states, adding another layer of relevance to this research. Consumer cooperatives rank as the fourth highest contributors to the nation's economy in terms of turnover, following banking, credit, and services cooperatives (Zakaria et al., 2022). In this study, completed questionnaires will be collected at the same time as their distribution. This study will be using physical and online questionnaire distribution. This is possible because the same enumerators will be responsible for both the distri bution and collection processes. Approximately 500 respondents will be assessed to ensure reliable information and to provide a backup in case any errors occur while filling out the questionnaire. As indicated by G Power 4.0.9.6 calculation, the minimum sample for this study is 129 respondents (f2 = 0.15, number of predictors = 4). IBM measurement SPSS Statistics Version 29 and Smart PLS 4.0.9.6 are tools that will be used to obtain the results.

4. Conclusion

This study has significant practical implications for the cooperative movement in Malaysia, highlighting the essential role of value co-creation behavior in the success of cooperatives. The research contributes to the development of a conceptual framework for value co-creation within consumer cooperative firms, providing both theoretical and practical insights into the value co-creation behavior model and its applications. The proposed framework, which describes the relationship between co-creation behavior and member loyalty, offers valuable guidance for practitioners, assisting them in refining their marketing strategies and practices. Furthermore, these research findings will deepen the understanding of the roles and length of membership related to loyalty, emphasizing their importance as critical components of relationship quality within the cooperative sector. The study also emphasizes the significance of members' active participation and citizenship as dimensions of value co-creation in consumer cooperatives. This insight will aid in recognizing how member engagement and citizenship contribute to enhancing loyalty towards consumer cooperatives.

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POLITEKNIK KOTA KINABALU

Assessing Tourism Potential and The Intention of Community Participation In Kampung Pahu Pinawantai, Ranau, Sabah, Malaysia

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Abstract

This study employs the Tourism Rapid Assessment (TRA) approach to evaluate the tourism potential and community participation intentions in Kampung Pahu Pinawantai, Ranau, Sabah. Through the identification of key natural and cultural resources and the involvement of the local community via surveys and interviews, the study aims to provide a comprehensive overview of the village's readiness for tourism development. The findings indicate that Kampung Pahu Pinawantai possesses significant tourism resources, particularly unique agrotourism opportunities centered around metal farming. Metal farming, which involves the cultivation of hyperaccumulators plants, presents innovative opportunities for sustainable agriculture and unique tourism experiences. The metal farm plot in Kampung Pahu Pinawantai is the world's first of its kind, further enhancing the village's appeal as a pioneering destination. The community demonstrates a positive attitude towards tourism, driven by employment prospects, economic benefits, and environmental conservation. However, challenges such as limited infrastructure and the need for capacity-building have also been identified. This study concludes with practical recommendations to enhance tourism potential and foster sustainable community participation, emphasizing the significance of stakeholder engagement and sustainable development practices.

Keywords: Tourism Potential; Community Participation Intention; Agrotourism

1. Introduction

Ranau is a renowned district in Sabah, Malaysia that attracts a multitude of visitors due to its prominent landmarks, including Kinabalu Park, the pleasant climate of Kundasang, Poring Hot Spring, and the iconic Desa Dairy Farm - the most visited attraction in Sabah. According to Yusoh et al. (2022), the variety of products and attractions in Ranau has led to an increase in both domestic and international tou rists visiting Ranau and the state of Sabah. While existing attractions are reaping the benefits of tourism, potential tourist destinations are being identified and developed, such as Kampung Pahu Pinawantai (Figure 1). Kampung Pahu Pinawantai is a remote village in Ranau, Sabah primarily relies on agriculture for its livelihood. The community is encompassed by breathtaking natural beauty, including abundant agricultural resources and picturesque landscapes. Despite its charm, Kampung Pahu Pinawantai faces challenges such as the absence of a clear community development plan and the lack of specific strategies for implementing tourism initiatives. Nevertheless, there is hope for the development of tourism in this village, particularly considering its unique distinction as the first location in Malaysia, where the nickel absorption method through the hyperaccumulators plants was successfully implemented (Dol, 2023). This method is known as metal farming. One of the most promising species globally for metal farming is the Phyllanthus species, also called the metal- blooded tree (Dol, 2023; Bouman et al. 2018) is available in Kampung Pahu Pinawantai. In the wave of rural tourism development, especially in Sabah, Kampung Pahu Pinawantai aspires to become as one of Sabah's prominent rural tourist destinations. The pleasant village of Pahu Pinawantai possesses tourism resources that can be developed for the tourism sector. However, these resources have not been fully identified and evaluated. Furthermore, the community's interest in tourism also remains uncertain. Therefore, the true tourism potential of the village remains unknown. This research aims to explore the tourism potential of Kampung Pahu Pinawantai and gauge the local community's interest in participating in tourism-related activities. Therefore, the objectives of this study are a) to identify tourism resources, b) To gauge local community participation intention in tourism, and c) to identify tourism development issues and challenges.

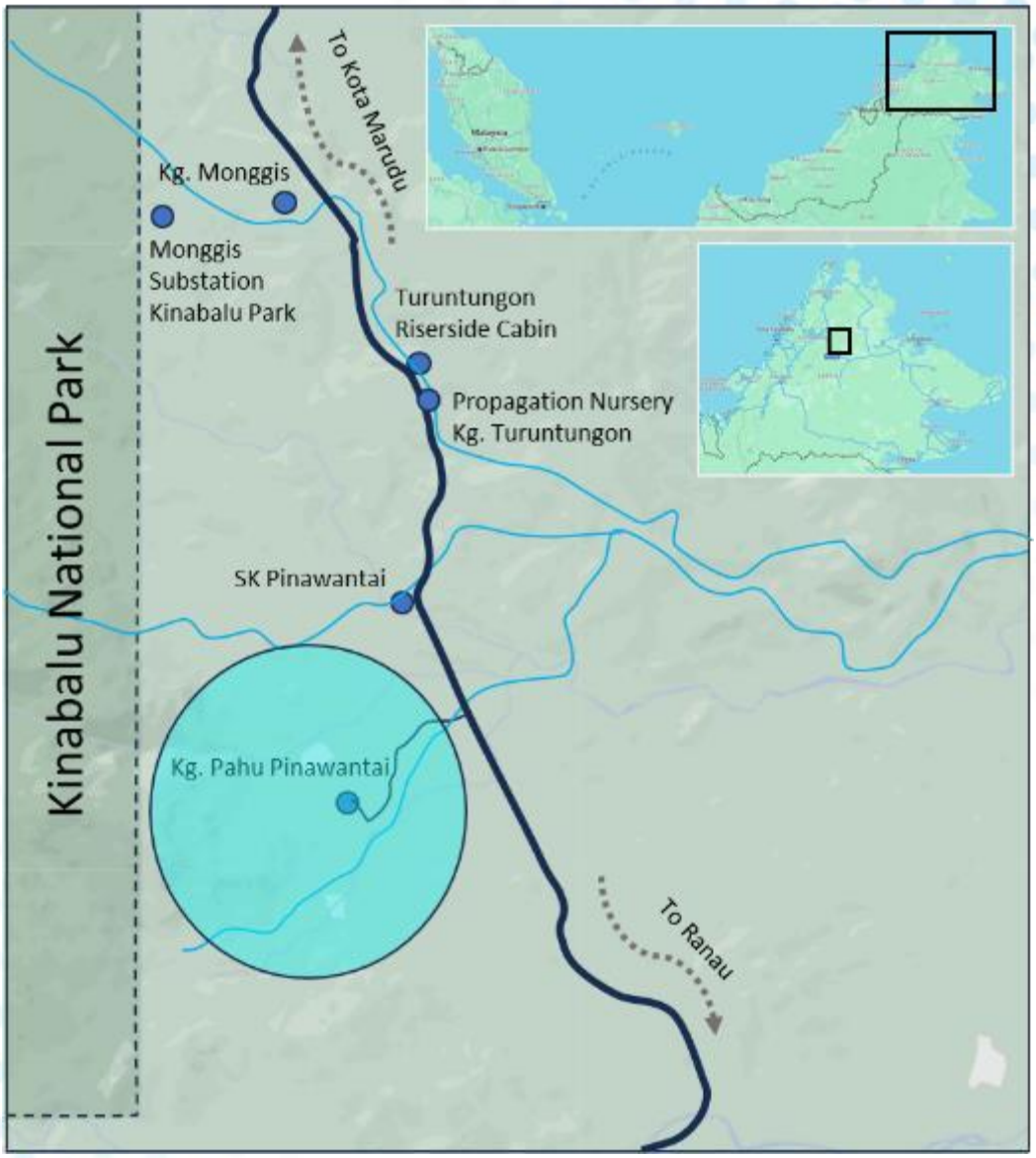

Fig. 1. Kampung Pahu Pinawantai, Ranau
Source: Google Map

2. Background of The Study Area

Kampung Pahu Pinawantai (Figure 1 & 2.) is surrounded by scenic hills and farmland. Its western boundary is Kinabalu National Park, where Mount Kinabalu is visible. The word "Pahu" in Dusun refers to a type of mango (fruit tree) that grows well in the village and is valued for its sweetness. Despite its rural location, the village has 82 homes that serve over 100 families and over 500 residents. The primary livelihood of the villagers is agriculture, with ginger production accounting for 90% of their output, while the remaining 6% and 4% are contributed by oil palm and rubber cultivation, respectively. In addition, the village has 500 acres of grazing reserve, with sections set aside for animal husbandry and water catchment (Limun Ambak, personal communication, January 25, 2024).

The metal farming initiative in Kampung Pahu Pinawantai began in 2015. This village was chosen for the metal farming project because of its unique natural environment, including ultramafic soil ideal for certain plants, one of which is the Phyllanthus species. The effort to rehabilitate the ultramafic soil for agricultural uses began in 2016 in collaboration with the community. This ongoing effort displays the communities' support for the metal farming initiative and the use of local resources for potential economic growth (Limun Ambak, personal communication, January 25, 2024)

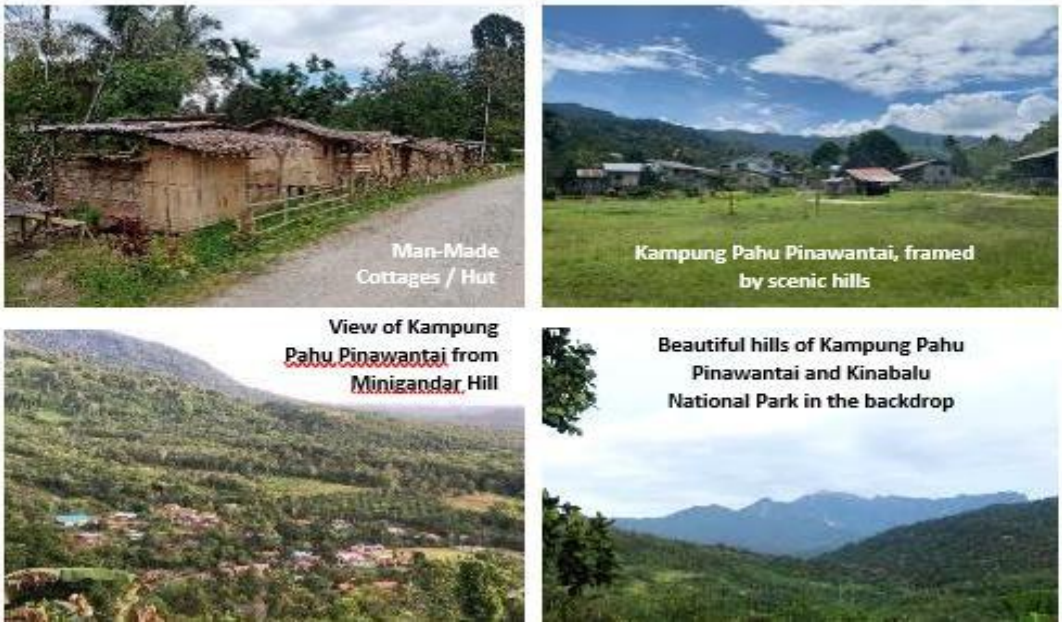

Figure. 2. Kampung Pahu Pinawantai

3. Literature Review

3.1 Agrotourism

Agrotourism, which is closely connected to agriculture, has gained global recognition. It is a growing form of tourism that is becoming increasingly popular worldwide (Pérez et al. 2021) and has become an important sector in the tourism industry since it emerged in the last century (Ana, 2017). In addition, Paul and Patil (2022) noted that there has been a rise in agrotourism focused on organic farming environments in both domestic and international tourism sectors. Agrotourism was first introduced to Malaysia in 1991 (Jaunis et al. 2022; Mazlan & Shukor, 2014; Mansor et al. 2015). The idea of agrotourism is gaining popularity in Malaysia due to the country's enormous agricultural resources. The symbiotic relationship between agriculture and agrotourism is also evident in Sabah, given that a significant portion of the population derives their livelihoods from agricultural practices and fishing, as documented by Wong et al. (2009). Agrotourism allows visitors to experience agricultural methods in a natural setting (Mansor et al. 2015), with activities such as farm visits, petting zoos, animal husbandry, and fishing. It also includes the display and sale of agricultural products, both consumable (fruits and processed foods) and non-consumable (crafts, souvenirs, seedlings, saplings, and agricultural equipment).

The terms "agri-tourism," "agritourism," "farm-based tourism," "agricultural tourism," "rural tourism," or "agritainment" are often used interchangeably with agrotourism. Agrotourism is a global phenomenon with various definitions and practices. Agrotourism can be identified as a fragment of rural tourism, that offers farm experiences and agricultural education while promoting sustainability and preserving local culture. Activities include farm visits, participation in farming practices, and learning tradit ional cultivation and harvesting methods. It serves as a platform for environmental awareness and supports local communities by advocating farming lifestyles and creating avenues for farmers to sell their produce (Phillip et al. 2010).

3.2 Tourism Potential

Tourism potential refers to a destination’s ability to attract visitors by utilizing its available resources, including natural, cultural, and infrastructural assets (Mogindol et al. 2024). Research by Sadykov et al. (2023) and Achmad et al. (2023) indicates that the success and sustainability of tourism development depend on effectively leveraging these potentials. Thus, assessing the potential of a specific destination is crucial. A thriving destination should meet several key criteria where the destination must have at least one unique attraction, sufficient basic infrastructure, good accessibility, comprehensive facilities and services, adequate accommodations, and support from stakeholders (Imikan et al. 2022; Fuente-Robles et al. 2020). Attractions can be categorized as natural, cultural, or man-made, each offering different tourist experiences. Natural attractions allow visitors to engage with nature through landscapes, natural phenomena, and wildlife. Cultural attractions

enable tourists to immerse themselves in local culture, heritage, and traditions. Man-made attractions include structures or features created by humans, such as theme parks and museums, which offer architectural, historical, or entertainment value (Leask, 2022; Mogindol et al. 2024). In addition, reliable access to essential infrastructure, such as communication networks, utilities, and transportation, benefits both tourists and service providers. All stakeholders, including local communities, NGOs (nongovernmental organization), and public and private sectors, play a key role in advancing the tourism industry. Therefore, identifying the tourism potential of specific destinations is crucial for stakeholders to strategically plan, develop, and implement the necessary infrastructure, services, and activities (Mogindol et al. 2024; Chan et al. 2021).

3.3 Community-Based Tourism

Community-based tourism (CBT) has recently gained recognition as a catalyst for sustainable tourism in rural areas of the developing world (Setokoe, 2020). CBT can therefore be defined as tourism owned and/or managed by communities and intended to deliver wider community benefit (Goodwin et al. 2009). According to Giampiccoli et al. (2018), CBT is a concept that encompasses social justice, empowerment, equitable distribution of benefits, ownership of the tourism sector, redistributive measures, and holistic community development. Factors contributing to successful CBT development include active community involvement, local knowledge and skills in tourism trends and development, community participation in decision -making, job creation for locals, economic linkages, appropriate infrastructure, and technical support (Habiba & Lina, 2023). Additionally, Kumar Bhatta and Ohe (2019) explain that when agricultural activities are integrated into CBT, it becomes Community-Based Agrotourism (CBAT). This adaptation expands community-based tourism to include agricultural experiences and practices, providing a more comprehensive and diverse approach to sustainable tourism development. In CBAT, the community actively engages in agricultural initiatives, enhancing the tourism experience through agro-related activities, agricultural education, and the promotion of local farming practices.

3.4 Community Participation in CBT

Community participation is critical to the effectiveness and long-term viability of CBT efforts. It is widely recognized that community engagement is critical to the success of tourist development efforts (Giampiccoli et al. 2018), as CBT projects are likely to fail over time without active community participation (Mohamad, 2016). Researchers have stated that community participation in tourism is crucial for achieving sustainable development (Srithong et al. 2019). The development of agrotourism in combination with CBT is significant as it encourages communities to utilize their farming knowledge and resources to generate additional income (Srithong et al. 2019). However, limited skills and knowledge in tourism can result in unrealistic expectations regarding its benefits and a lack of preparedness for the associated changes, thereby limiting opportunities. When implementing CBT or CBAT with community participation, it is crucial to consider both internal and external factors. External factors are influenced by stakeholders who are not part of the community, including governments, NGOs, private sector businesses, and educational institutions. On the other hand, internal factors refer to aspects that the community can directly control, although they may not be easily influenced or changed (Zielinski et al. 2018). As mentioned by Mohamad (2016), CBT often depends on external project initiators, such as NGOs or local agencies, for financial support, technical assistance, and capacity building. Hamzah (2011) stated that community participation is one of the domains of community capacity building. This participatory approach ensures that tourism activities align with the community's values and needs, while also creating opportunities for economic empowerment and social cohesion within the village.

3.5 Community Participation Intention in Tourism

Community participation intention refers to the local community's willingness and motivation to engage in activities that can contribute to local development, especially decision-making processes, initiatives, and tourism-related activities. Community participation is crucial because, with their support, any project can be done successfully, as they have full access to the resources (Salam et al. 2023). According to Seapudin et al. (2022), the local community can gain many benefits by participating in tourism-related activities and one of the most notable benefits are related to economic gains. In the context of tourism, local engagement promotes job creation and infrastructure development. However, several challenges hinder participation, such as changes in mindset, inequality of opportunity, and lack of knowledge. In Malaysia, the government has made several initiatives to encourage the community to participate in tourism, especially in the agrotourism industry. One of the initiatives is the first "Pasar Tani Agropelancongan" in Langkawi. The main aim of this project is to gather and encourage farmers from all over Langkawi to participate in agrotourism (Jaunis et al. 2022). Additionally, studies by Sithole et al. (2021), Bhatta and Ohe (2019), and Nguyen et al. (2018) highlight that community participation in tourism is strongly influenced by factors such as local attitudes, financial investment capacity, local economic benefits, preservation of culture, knowledge empowerment and infrastructure development. By addressing these key elements, stakeholders can implement targeted strategies to enhance the community's quality of life and drive sustainable tourism growth.

4. Methodology

This cross-sectional study employed a combined approach to collect data. First, a tourism rapid assessment (TRA) was conducted to ascertain the tourism resources in the study area. The TRA is an invaluable tool in facilitating tourism development planning as it enables swift data collection on-site while identifying potential areas for site development. The TRA entails field observation, and interviewing local community leaders to gather both quantitative and qualitative information about the site's attributes (Department of Tourism, 2019). Next, a survey of the local community was performed to gather their perspectives on their interest in participating in CBAT activities and to obtain their feedback on tourism resources, issues, and recommendations in the study area. The survey sample consisted of adults residing in Kampung Pahu Pinawantai who attended a discussion about CBAT at Kampung Pahu Community Hall, and a convenience sampling approach was used. All adult participants were given a self-administered questionnaire, and a total of 50 responses were collected and deemed usable for analysis. The survey data was analyzed using descriptive analysis in the Statistical Package for Social Sciences (SPSS) software. The data collections were conducted in January 2024.

5. Results

5.1 Tourism Resources and Potential Activities

Kampung Pahu Pinawantai offers a wide variety of tourism resources and activities, as shown in Table 1 and Figure 3. The TRA inventory categorizes these tourism resources into three main types: natural, cultural, and special. Natural resources include hills such as Minigandar, Nipis, and Lompoyou, which can serve as trekking trails. Stingless bees and the Sasapan River, which is home to tagal traditions are also considered as natural resources. Cultural attractions include traditional activities like knife making, weaving, traditional food preparation, and folklore stories. Special tourism resources include metal farming. This diverse inventory provides a range of experiences for tourism development planning. Furthermore, these resources and activities can be developed as CBAT products that can benefit the community, visitors, and other tourism stakeholders.

Table 1. Tourism Resources and Activities

Nature	Cultural	Special Types
1) Minigandar Hill	6) Traditional Food	10) Metal Farming
2) Nipis Hill	7) Traditional Knife Making	
3) Lompoyou Hill	8) Weaving i.e. Raffia Skirt Weaving	
4) Sasapan River (Tagal)	9) Folklore Stories	
5) Stingless bee		

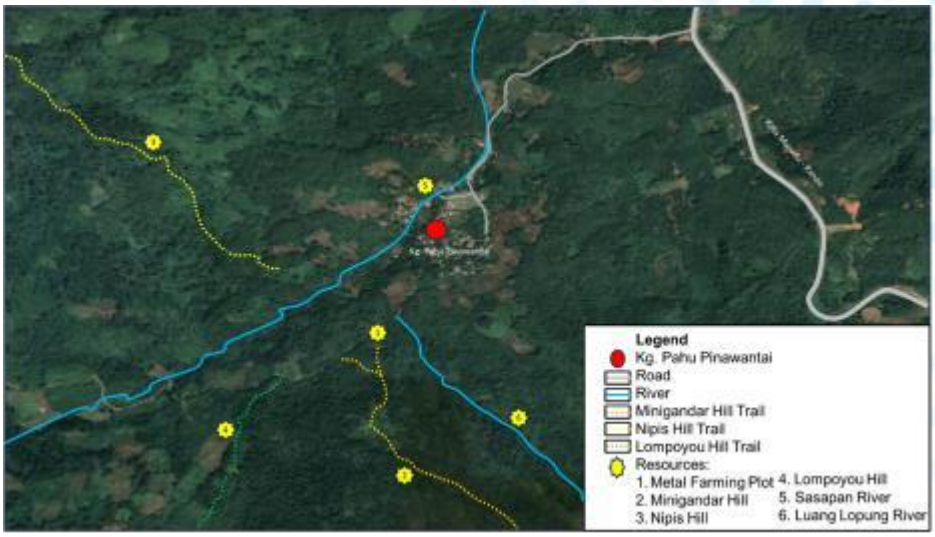

Fig. 3. Tourism Resources at Kampung Pahu Pinawantai
Source: Google Map

5.2 Notable Tourism Resource – Metal Farming

Metal farming, also known as agromining, involves growing hyperaccumulator plants specifically to harvest valuable metals like nickel (Ni) (Van der Ent et al. 2015). Hyperaccumulator plants have a natural ability to accumulate high levels of nickel in their leaves, sometimes reaching up to 3% nickel content. Among the most promising species for metal farming worldwide is *Phyllanthus Rufuschaneyi* (Figure 4), commonly known as the metal-blooded tree (Dol, 2023; Bouman et al. 2018). Cultivating hyperaccumulator plants not only helps in remediating metal-contaminated soils but also presents an opportunity for sustainable metal extraction. This process is particularly relevant in areas with metal-rich soils, such as post-mining sites and areas with serpentine or infertile ultramafic soil. In Kampung Pahu Pinawantai, where there is an abundance of infertile ultramafic soil and the presence of hyperaccumulator plants, metal farming could bring multiple benefits, including agricultural diversification, economic opportunities, and the potential for unique agrotourism experiences. The first trial plot for metal farm in Kampung Pahu Pinawantai could make this area a flashpoint for educational tourism.

Fig. 4. Close-up of *Phyllanthus Rufuschaneyi* (left) and Field Trial Plot of Nickel Farm at Kampung Pahu Pinawantai (right)

5.3 Accessibility, Facilities and Services

Kampung Pahu Pinawantai can be easily accessed from the main towns in Sabah via a well-maintained road and clear signage. The journey from Ranau town to Kampung Pahu Pinawantai typically takes around 46 minutes. However, there is no public transportation service available between Kampung Pahu Pinawantai and Ranau town.

In terms of facilities and services, the majority of households in Kampung Pahu Pinawantai have access to electricity, while approximately 20% rely on solar power as an alternative energy source. As for water supply, the villagers depend on a gravity-fed water system. The Rotary Club of Kota Kinabalu, in partnership with the Rotary Water and Sanitation Project, has provided essential infrastructure such as piping to ensure that all residents have access to clean and safe water. Recently, telecommunication services have become available in

the area, although the coverage is limited. Kampung Pahu Pinawantai also offers community facilities such as a community hall, a badminton court, a football field, and a takraw court for recreational activities. Additionally, there is a preschool nursery in the village. However, for primary school education, parents usually send their children to SK Pinawantai, which is located approximately 3.5 kilometers away. As for secondary school education, students must travel a bit further to Sekolah Menengah Kebangsaan Timbua, located about 10 kilometers from Kampung Pahu Pinawantai.

The residents of Kampung Pahu Pinawantai have access to healthcare services through three nearby clinics: Klinik Perancangan, Klinik Pinawantai, and Klinik Timbua. However, these clinics primarily offer maternal and child health services. In case of emergencies or more complicated medical issues, villagers are required to travel to Ranau Hospital. Furthermore, Kampung Pahu Pinawantai has two grocery stores within its vicinity. In addition, there are nearby accommodations such as Tinukadan Camping Ground and Turuntungon Riverside Cabin, which offer convenient lodging options near Kampung Pahu Pinawantai. These accommodations provide picturesque river views, allowing guests to enjoy activities like swimming in serene waters during their stay.

On the other hand, this village has a recreation association and a cultural association. These associations handle recreational and cultural activities in their area. Despite being a small village, this organized setup could facilitate effective community engagement and collaboration in various developmental and cultural initiatives, ultimately enhancing the village's overall well-being and vibrancy.

5.4 Community Survey

5.4.1 Respondent Profile

Table 2 presents the demographic composition of respondents from Kampung Pahu Pinawantai. The gender distribution reveals that 30% were male, while 70% were female. In terms of age groups, 2% were below 20 years old, 8% were aged 21-25, 10% were 26-30, 14% were 31-35, 18% were 36-40, 10% were 41- 45, 12% were 46-50, and the majority, 26%, were 51 years old and above. It is worth noting that all respondents were residents of the community.

Table 2. Respondent's Demographic Profile (n=50)

Item		**Number**	**%**
Gender	Male	15	30
	Female	35	70
Age	Under 20	1	2
	21-25	4	8
	26-30	5	10
	31-35	7	14
	36-40	9	18
	41-45	5	10
	46-50	6	12
	51 and older	13	26
A resident of the community	Yes	50	100
	No	0	0

5.5 Tourism Potential and Community Participation Intention

Table 3 shows that respondents have identified hand-made crafts (98%) and agricultural products (86%) as the primary items that can be promoted to visitors in Kampung Pahu Pinawantai. Moreover, cultural events such as the Kaamatan festival, traditional dances (*mongigol* and *sumazau*), gong performances, and marriage ceremonies are also recognized as potential attractions, with 78% of respondents in agreement. Additionally, 88% of respondents believe that their unique local cuisines, such as *linapot, sup polod, winulu, tonsom, bosou, wutod,* and *bambangan*, hold the potential to attract visitors. Most respondents (82%) view a significant opportunity to develop tourism products centered around the concept of "metal farming" in Kampung Pahu Pinawantai. Furthermore, 64% of respondents believe that historical or cultural resources can be developed into tourism products. The survey results also reveal an overwhelming support (94%) for the development of hiking trails to attract outdoor enthusiasts and visitors.

Table 3 also presents data on community participation intentions regarding tourism-related activities in Kampung Pahu Pinawantai. All respondents expressed interest in participating in tourism. Factors influencing the community's participation intention were also identified, with respondents highlighting employment opportunities (84%), economic benefits 80%), environmental conservation (80%), support from the community

(72%), and preservation of culture and heritage (54%) as key motivational factors for their involvement intention in tourism.

Table 3. Tourism Potential and Community Participation Intention in Tourism

Item		***f***	**%**
Local items that can be promoted as souvenirs for visitors.	Hand-made Crafts	49	98.0
	Traditional Textiles	11	22.0
	Local Artworks	11	22.0
	Agricultural Products	43	86.0
	Others: food, drinks, and *wakid* (bag)	3	6.0
Cultural events or festivals that can attract visitors.	No	1	2
	Not Sure	10	20
	Yes: Kaamatan festival, traditional dances *(mongigol and sumazau)*, gong performance, and marriage ceremony	39	78
Unique local cuisines or dishes that can attract food enthusiasts.	No	0	0
	Not Sure	6	12
	Yes: *linapot, polod soup, winulu, tonsom, bosou, wutod, and bambangan*	44	88
'Metal Farming' is a potential tourism product.	No, I do not see the potential of 'metal farming' as a basis for tourism products in Kampung Pahu.	0	0
	Not sure	9	18
	Yes, I see a great opportunity to develop tourism products based on the concept of 'metal farming'.	41	82
Historical or cultural resources as tourism products.	No	0	0
	Not sure	18	36
	Yes: *kipungit rock, snake hole, winokok pool, hail falls, mogondooi, kolid and tontolob, and salapa rock*	32	64
Hiking trails for outdoor enthusiasts and visitors.	No	0	0
	Not sure	3	6
	Yes: *Minigandar Hill, Nupis Hill, Lompoyou Hill, Sasapan River, and hike to Nikel Farm*	47	94
Interest in participating in tourism-related activities.	Yes	50	100
	No	0	0
	Maybe	0	0
Factors influencing participation in tourism-related activities.	Economic benefits	40	80.0
	Preservation of culture and heritage	27	54.0
	Opportunities for employment	42	84.0
	Environmental conservation	40	80.0
	Support from the community	36	72.0
	Other: *Experiences, and to promote Kampung Pahu Pinawantai at international level*	2	4.0

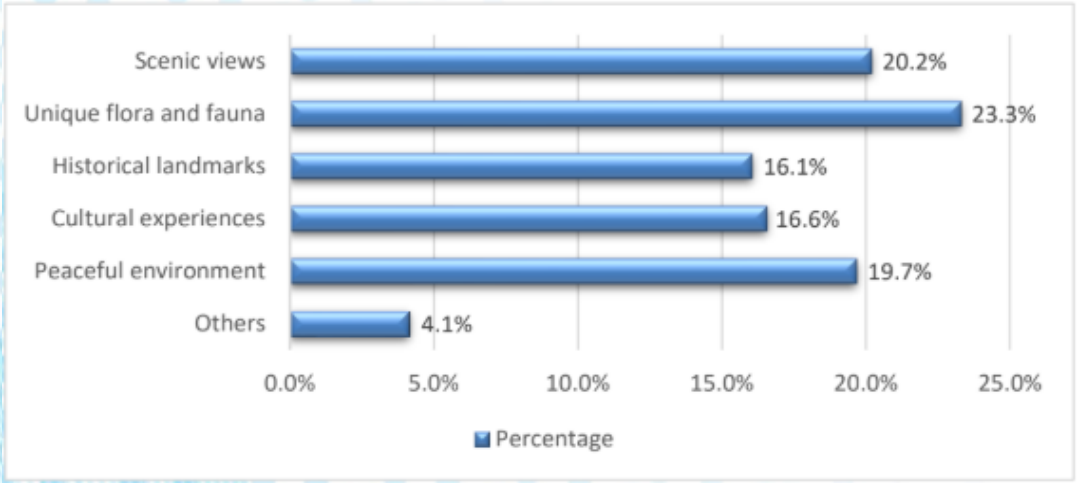

Fig. 5. Attractive Features of Kampung Pahu Pinawantai

Figure 5 presents the respondents' insights regarding the appealing attributes of Kampung Pahu Pinawantai to visitors. The findings show that unique flora and fauna (23.3%), scenic views (20.2%), serene environment (19.7%), cultural experiences (16.6%), and historical landmarks (16.1%) were identified as the most attractive features for visitors. Figure 5 lists "Others" as attractive features include hiking, crafts, *Tagal* (traditional fishing method), Kipungit (name of a stone) and homestays close to the river. In figure 6, the respondents' preferences towards different tourism activities or services are illustrated. It shows that 34.2% of the respondents indicated an interest in craft and souvenir production, 24.6% in providing accommodation, 19.3% in food services, 11.4% in conducting tours, and 8.8% in offering transportation services. “Others” in figure 6 includes farm cleaning and ticketing services.

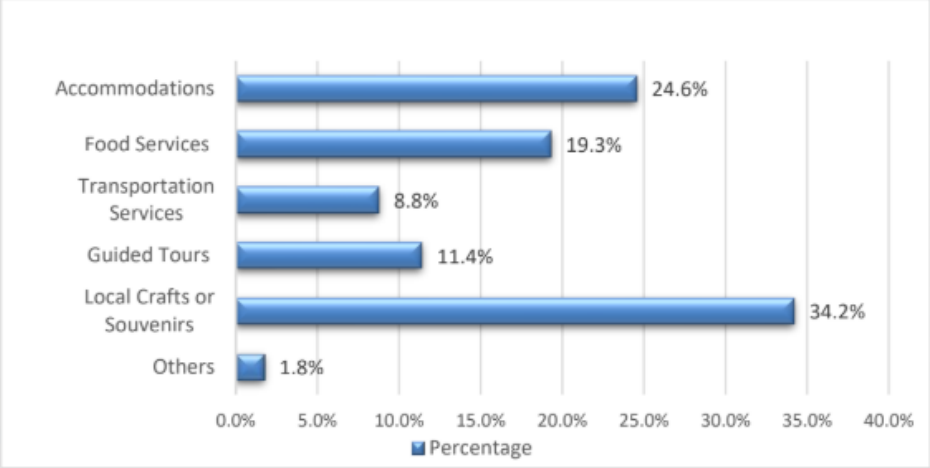

Fig. 6. Types of tourism services and activities that respondents would be willing to participate or contribute

5.5 Issues and Recommendations Related to Tourism

The data collection in Kampung Pahu Pinawantai identified two significant challenges: infrastructure shortcomings and a lack of experience in tourism development. The village faces challenges due to poor road and bridge conditions, which limit access to remote areas and hinder tourism activities. In addition, while the community possesses valuable tourism resources such as agrotourism, hiking trails, and interesting cultural resources, these assets remain underdeveloped due to a lack of knowledge and experience in developing and managing tourism.

Concerted efforts from stakeholders are necessary to improve the basic infrastructure in Kampung Pahu Pinawantai. This will allow seamless travel to visit the metal farming trial plot and other attractions. The next priority is to develop the village’s tourism products. Kampung Pahu Pinawantai has several potential attractions that can be enhanced for tourism, including metal farming activities, scenic hiking trails, and cultural experiences such as traditional practices and local crafts (Table 1). These unique assets can be developed into marketable tourism products that attract specific visitor segments, particularly educational visitors as metal farming could be their main attraction. In addition, homestay programs can be established to facilitate immersive cultural exchanges while generating sustainable income for local residents. To support the development of these tourism offerings, capacity building is essential. Consequently, training programs should be introduced to equip the community with skills in tourism product development and management, tour guiding, and hospitality services. This will enable community members to manage and promote their tourism resources effectively. Encouraging community involvement through cooperatives or local associations will empower residents to take ownership of tourism initiatives, thereby ensuring long-term sustainability.

6. Discussion

Identifying and assessing tourism resources is crucial for both new and established tourist destinations, as these resources can be developed into tourism products. As highlighted by Barbu (2014) and Dincu (2015), tourism resources, along with infrastructure, facilities, and services, play a significant role in attracting visitors to a destination. In the case of Kampung Pahu Pinawantai, these essential tourism components are present, albeit in very basic conditions. Of particular interest is the unique metal farming project in this village, which stands as the first of its kind in Malaysia and potentially the world, making it a truly distinctive tourism resource. As emphasized by Boniface et al. (2016), a single unique attraction can lead to a successful tourist destination. Moreover, visitors are typically drawn to exclusive and one-of-a-kind attractions.

Agrotourism is a form of tourism that offers visitors the opportunity to participate in recreational and cultural activities in rural areas, as well as establish business connections within the agricultural sector (Endah Djuwendah et al. 2021). Metal farming, a subset of agrotourism, is a unique attraction that is available year- round due to its non-edible and non-seasonal nature. Unlike other agrotourism sites that are dependent on specific seasons to attract many visitors, such as fruiting seasons, metal farming remains accessible throughout the year. Metal farming is a relatively new concept in Sabah and is closely associated with specific plants and the scientific process of extracting metal from these plants. As a result, these activities are particular ly suited for educational tourism. Initially, the demand for metal farming experiences is expected to come primarily from educational tourism visitors, including school children, undergraduate students, researchers, and individuals seeking knowledge. However, as metal farming gains popularity and the facilities as well as tourism services in Kampung Pahu Pinawantai improve, it is anticipated that more general visitors will be drawn to this unique agrotourism attraction.

Visitors to the agrotourism site can learn about innovative and environmentally friendly metal farming processes, experience the community's hospitality and culture, and explore the natural beauty of the surrounding area. Metal farming offers educational and eco-conscious experiences by combining agriculture, sustainable mining, and environmental conservation into a unique attraction. This approach is a relevant component for understanding metal farming and showcasing the cultivation of hyperaccumulating pl ants for metal extraction by the local communities. Demirezen (2020) emphasizes that effective management and evaluation of key elements such as farmers, villages, and agriculture are crucial for the successful development of agrotourism in a region, all of which are present in Kampung Pahu. These elements play a vital role in realizing the potential of agrotourism.

The demand for tourism in Sabah is significant, and Ranau is one of the most visited districts in Sabah. Desa Dairy Farm, Kinabalu National Park, and Poring Hot Spring are highly renowned tourist attractions in Ranau. For instance, Desa Dairy Farm receives an average of 800,000 visitors annually (Desa Dairy Farm, 2024), while Kinabalu Park (Head Quarters) welcomed 188,165 visitors in 2022 (Sabah Parks, 2023). Kundasang, a sub-district in Ranau, is currently facing issues related to overtourism. Overtourism refers to uncontrolled demand and excessive tourism activities in specific destinations that have negative impacts on the environment, local communities, and visitors (Capocchi et al. 2019). Consequently, during peak seasons, traffic congestion and overbooking are common occurrences in overtourism destinations. As a result, visitors often seek alternative tourism destinations and avoid overtourism hotspots. Given its proximity to Kundasang and other renowned attractions, such as Desa Dairy Farm and Kinabalu Park, Kampung Pahu Pinawantai presents a great opportunity to attract visitors in the future. These attractions are all within a 50km radius or about an hour's drive from Kampung Pahu Pinawantai. Meanwhile, closer to Kampung Pahu Pinawantai, Kinabalu Park's Poring Hot Spring and Monggis Sub-Station each welcomed 310,015 and 576 visitors respectively in 2022 (Sabah Parks, 2023).

Recognizing the potential of rural tourism, the Sabah state government has identified and supported several tourist destinations as rural CBT destinations, including Kadamaian in Kota Belud and Kiulu (Fong, 2023). Kampung Pahu Pinawantai can become a typical CBT destination by empowering local communities to participate in tourism development and the management of their tourism resources. Through collaboration with tourism stakeholders, Kampung Pahu Pinawantai can showcase its natural, cultural, and agricultural resources, offering visitors enriching experiences. For CBT initiatives to be successful and sustainable in any tourism destination, community involvement is crucial. According to Giampiccoli et al. (2018), it is commonly known that community engagement is essential to the success of tourism development initiatives. Based on the survey, it is evident that the residents of Kampung Pahu Pinawantai are interested in participating in tourism-related activities. Economic benefits and environmental conservation mainly drive their motivation to engage in tourism activities. Additionally, they are also interested in crafts and souvenir production, as well as providing accommodation and food services. This endeavor will contribute to the socio-economic well- being of the community while also preserving traditional practices and promoting sustainable tourism in the area.

Habiba and Lina (2023) have identified several factors that contribute to the successful development of CBT. These factors include active community involvement, local knowledge and skills in tourism services, community participation in decision-making, job creation for the community, economic linkages, appropriate infrastructure, and technical support. On the other hand, Zielinski et al. (2018) highlight the internal and external factors that support the success of CBT. In the case of Kampung Pahu, there is currently a lack of internal and external factors related to CBT. However, these factors can be planned, developed, and organized, just like in other CBTs in other destinations. The key here is the availability of tourism resources, specifically potential attractions, such as metal farming. Metal farming serves as the fundamental element for tourism development and the establishment of CBT. Therefore, it is crucial to make collaborative efforts in identifying, creating, and managing all the necessary factors for establishing CBT in Kampung Pahu Pinawantai.

7. Conclusion

The findings of this study highlight the vast potential for tourism development in Kampung Pahu Pinawantai, Sabah, Malaysia. The analysis of tourism resources, community participation intentions, and development challenges shows insights to inform strategic initiatives for sustainable tourism growth. In addition, the research's objectives have been met. Kampung Pahu Pinawantai presents an exceptional opportunity for the development of CBAT, mainly through the innovative practice of metal farming. Metal farming, a sustainable agricultural technique involving the cultivation of hyperaccumulator plants such as Phyllanthus species, holds promise as a unique attraction for visitors seeking immersive and educational experiences. By integrating metal farming into the agrotourism landscape, especially within educational and demonstrative farm settings, Kampung Pahu Pinawantai can showcase its pioneering efforts in sustainable agriculture while providing visitors with insightful and memorable experiences.

Furthermore, findings from this study denote that the village can leverage its supplementary tourism resources to enhance visitor engagement and satisfaction. These resources, ranging from cultural attractions like traditional food and knife making to natural wonders such as Minigandar Hill and Sasapan River, offer diverse opportunities for tourists to immerse themselves in the local culture and environment. The integration of these points of interest into tourism schedules has the potential to enrich the overall visitor experience and encourage longer stays in the locality through careful planning.

This study highlights the significance of strategic planning, cooperation, and sustainability in achieving the village's full tourism potential. It provides a basis for directing future efforts in Kampung Pahu Pinawantai tourism development. Kampung Pahu Pinawantai has the potential to become a leading example of a sustainable and prosperous rural tourism destination in Malaysia and beyond with coordinated efforts and a common goal.

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The Influence of Knowledge and Skills on the Readiness to Adopt Digital Marketing Strategies Among Micro-Entrepreneurs in Malacca, Malaysia

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Abstract

This study explores how knowledge and skills influence the adoption of digital marketing strategies among micro-entrepreneurs in Malacca. Despite the growing importance of digital marketing for business growth, many micro-entrepreneurs struggle with its implementation due to a lack of practical skills. A survey was conducted to assess their knowledge, skills, and current use of digital marketing tools. The results indicate a medium-high level of digital marketing knowledge among the respondents, but their skills and adoption levels are at a medium-low range. Correlation analysis shows a strong positive relationship ($r = 0.851$, $p < 0.01$) between knowledge, skills, and digital marketing adoption, suggesting that improving digital skills directly enhances the use of digital marketing in business practices. The study also identifies key areas of interest for future training, with Creative Content (76%), TikTok (70%), and Facebook Page (46%) being the most preferred courses. These findings highlight a clear need for targeted training programs to bridge the knowledge-skill gap, enabling micro-entrepreneurs to maximize the benefits of digital marketing. The study contributes to a deeper understanding of the factors affecting digital marketing adoption and provides actionable insights to support the digital transformation of micro-businesses in the region.

Keywords: Digital Marketing, Digital Adoption, Micro and Small Enterprise, Readiness

1. Introduction

In Malaysia, small and medium enterprises (SMEs) make up 98.5% of the 920,624 business establishments, positioning them as the backbone of the nation's economy. However, despite their crucial role, SMEs lag significantly behind larger enterprises in digital adoption, as highlighted by the World Bank (Azuar & Nehru, 2024). With the rapid advancement of technologies like artificial intelligence (AI) transforming industries, it is imperative for SMEs to embrace these changes to sustain economic growth and ensure positive revenue outcomes. In today's digital economy, the ability of businesses to adapt to and integrate digital marketing strategies is a critical determinant of their competitiveness and sustainability. Digital capabilities, including the use of social media, e-commerce platforms, and online advertising, have become essential for businesses to reach wider markets, enhance customer engagement, and drive growth (Denicolai et al., 2021). For micro, small, and medium enterprises (MSMEs), the transition to digital platforms is even more pressing, as their survival often depends on their ability to leverage cost-effective marketing solutions (Foroudi et al., 2018).

In Malacca, the adoption of digital marketing strategies among entrepreneurs is influenced by several factors, with knowledge and skills playing a pivotal role. Entrepreneurs with higher digital literacy and proficiency in using tools such as Facebook, Instagram, and WhatsApp for business are more likely to embrace digital marketing and achieve significant improvements in business performance (Moorthy & Sahid, 2021) . However, according to Lim et al., (2024), despite the rapid development of digital tools and platforms, many micro-enterprises in Malaysia still struggle with digital transformation due to limited digital skills. A study found that 50.3% of entrepreneurs were at a basic level of digital use, primarily relying on simple websites or emails, while 26% lacked any e-commerce capabilities (Yakob & Lokman, 2022). This indicates that a lack of technical expertise continues to be a barrier for micro and small businesses in adopting digital marketing (Tambunan, 2008).

The aim of this research is to evaluate the level of digital marketing transformation among entrepreneurs in Malacca and to assess how their knowledge and skills influence their readiness to adopt digital marketing strategies. By analyzing the extent of digital capabilities among these entrepreneurs, the study seeks to identify the key gaps and challenges they face in their digital transformation journey and provide recommendations to improve their digital literacy and adoption of digital marketing practices.

2. Literature Review

2.1 Digital Marketing Adoption

Digital marketing is essential for business growth, allowing SMEs to reach wider audiences and improve customer engagement through platforms like social media, e-commerce, and online advertising (Denicolai, Zucchella, & Magnani, 2021). Various forms of digital marketing contribute to a company's success. Websites are vital for showcasing professionalism, promoting consumer awareness, and serving as a platform for business transactions. Search Engine Marketing (SEM) and Search Engine Optimization (SEO) are key strategies to improve a company's visibility online. While SEO is a cost-effective approach that requires long- term effort, SEM uses paid strategies for faster results. Social media platforms, such as Facebook, Twitter, and Instagram, are also leveraged to build a company's image at minimal or no cost. Additionally, Online Advertising employs paid internet-based channels to promote products and services (Giantari et al., 2022). Tong and Gong (2020) outlined five key areas where digitalization can benefit businesses, regardless of size include Online marketing strategies that can efficiently reach a larger audience and are typically more cost - effective than traditional advertising. Platforms like Facebook, Instagram, and YouTube offer flexible pricing for digital ads. While eCommerce Platforms such as Lazada and Shopee allow businesses to expand beyond geographical limitations and lower the barriers to entry, enabling SMEs to compete with established companies. Thus, this study will investigate digital marketing adoption among microentrepreneurs in Malacca. This literature review lays a foundation for understanding the critical role digital marketing plays in busi ness growth, particularly for small and medium-sized enterprises (SMEs). Building upon this, the study will explore how the knowledge and skills of micro-entrepreneurs in Malacca influence their readiness to adopt digital marketing strategies. By focusing on the capabilities required to leverage platforms like social media, e-commerce, and online advertising, the research aims to assess the factors that determine successful digital marketing adoption among these micro-entrepreneurs.

2.2 Knowledge and Skills in Digital Marketing

A key barrier to digital marketing adoption is the lack of digital literacy among entrepreneurs. To effectively use tools like social media, SEO, and e-commerce platforms, entrepreneurs need strong digital skills (Moorthy & Sahid, 2021). Women entrepreneurs, for example, actively use the Internet for communication and marketing, even without formal training (Omar et al., 2019). Digital inclusion not only boosts creativity and innovation but also improves business management, such as inventory and financial control, leading to greater independence and success (Omar et al., 2019). Social media also plays a key role, helping businesses build trust, boost creativity, and improve satisfaction, especially among millennial entrepreneurs (Hamid et al., 2024). Despite its benefits, SMEs face challenges in adopting digital tools due to limited technical skills and resources. Many rural entrepreneurs, especially in areas like Sipitang, Sabah, experience "digital poverty," where they lack the necessary knowledge to fully utilize digital platforms (Rosman & Kee, 2022). This limits their ability to grow and compete in the increasingly digital marketplace.

In conclusion, while digital marketing offers significant growth opportunities for SMEs, a lack of knowledge and skills remains a major obstacle. Bridging these gaps is essential for helping SMEs fully embrace digital transformation and succeed in today's competitive business landscape. Existing studies have explored how digital tools can enhance creativity, innovation, and business management and have noted the positive impact of digital marketing on performance. However, there is still a gap in understand ing how the knowledge and skills of microentrepreneurs specifically influence their adoption of digital marketing strategies, particularly in a regional context like Malacca. The research gap points to a need to specifically investigate how the knowledge and skills of microentrepreneurs in Malacca relate to their adoption of digital marketing. Addressing this gap, the study proposes the hypothesis: *H1: There is a positive relationship between knowledge and skill towards adoption of digital marketing in business.*

This hypothesis builds upon the literature by addressing the specific influence of digital knowledge and skills on digital marketing adoption. By focusing on micro-entrepreneurs in Malacca, this study seeks to test whether higher levels of knowledge and skills in digital marketing positively correlate with the adoption and effective use of digital platforms, thus contributing to business growth and competitiveness in the region.

3. Methodology

A well-designed research study is crucial for researchers, as it allows them to effectively organize their investigation (Syed Arabi, 2002). This study employs a quantitative, descriptive (survey) method using a questionnaire as the research instrument. According to Marican (2006), survey research is necessary when

dealing with a large number of respondents, such as hundreds or thousands. In this paper, an attempt was made to study the relationship between knowledge and skill in digital marketing, and adoption of digital marketing in business within micro scale businesses around the state of Malacca, Malaysia. The population for this study consists of 95 registered micro and small enterprises in Malacca, as provided by the Ministry of Domestic Trade and Cost of Living in official website https://www.kpdn.gov.my/ . According to Krejcie and Morgan's (1970) table for determining sample size, the recommended sample size for a population of 95 is approximately 76. However, due to practical constraints, the study was able to secure 54 respondents, which still provides valuable insights into the population. The sampling method used was non-probability convenience sampling, allowing the researcher to gather responses from available and willing participants within the limited time and resources. While the sample size is smaller than the recommended size, it still represents a substantial portion of the population and provides a meaningful dataset for analysis.

The study is conducted on 54 business owners as respondents that run micro scale businesses around 3 nearest industrial area in Malacca which is Merlimau, Telok Mas and Malacca City, Malaysia. The samples were chosen based on the criteria for micro-enterprises across various sectors, specifically those with an annual sales turnover of less than RM300,000 or employing fewer than 5 full-time staff (smeinfo.com.my). The study uses primary data based on the results of distributing online questionnaires to 54 micro entrepreneurs who were selected by simple random sampling. The questionnaire was developed from past literature on entrepreneur's knowledge and skill towards adoption of digital marketing in business. Questions for digital marketing knowledge and skills in social media, website and ecommerce platforms were adapted from a study conducted by Ritz et al. (2019). Elements of adoption of digital marketing in business were based on a study by Mechman et al., (2022). The questionnaire is structured into two sections: Part A focuses on the respondent's profile, consisting of 5 items, including the business name, location, contact number, annual income, and the number of full-time employees. Part B addresses the key factors of the study, assessing components related to digital marketing knowledge, skills, and the adoption of digital marketing in business operations. An interval scale with a Likert scale method (as shown in Table 1) is utilized in Part B to capture respondents' answers. Part B is divided into three section; Section I and II, collect information related to dependent variable of the study, that is, knowledge and skill in digital marketing were measured with (20) items each. While Section III for independent variables was the adoption of digital marketing in business with
(20) items. The mean score interpretation is adapted from Norasmah (2002) as shown in Table 2.

For the data analysis, a regression analysis was conducted using SPSS version 21 to identify the relationship between the independent variables (knowledge and skill in digital marketing) and the dependent variable (adoption of digital marketing in business), providing insights into how each factor influences the overall outcome.

Table 1: 5-point Likert Scale

Scale	Rating
Strongly Disagree	1
Disagree	2
Moderate	3
Agree	4
Strongly Agree	5

Table 2: Mean score interpretation

Mean Score	Interpretation
1.00 - 2.00	Low
2.01 - 3.00	Medium Low
3.01 - 4.00	Medium High
4.01 - 5.00	High

Table 3 presents the results of the reliability analysis for the questionnaire items. The Cronbach's Alpha values are notably high for all constructs: knowledge in digital marketing (0.98), skill in digital marketing (0.98), and adoption of digital marketing in business (0.98). These high values indicate that the items are highly reliable, and as a result, no items were removed from the questionnaire.

Table 3: Cronbach' Alpha

Factors	Number of Items	Items Deleted	Total item	Cronbach's Alpha
Knowledge in digital marketing	20	0	20	0.978
Skill in digital marketing	20	0	20	0.984
Adoption of digital marketing in business	20	0	20	0.982

4. Findings and Analysis

4.1 Profile of Respondents

This section presented the description of participating respondents. As discussed previously, the population of this research was micro entrepreneurs in Malacca, Malaysia. The criteria of the businesses that participated were Micro entrepreneurs that earn sales turnover less than RM300,000 or less than 5 full-time employees. The study findings of the research participants' profile are summarized in Table. 4.

Table 4: Profile of Respondents

Variables	Category	Frequency	Percentage %	Total Sampling
Business's annual income	< RM100,000	39	72%	54
	RM100,000 – RM200,000	8	15%	
	RM200,001 – RM300,000	7	13%	
	>RM300,000	0	0%	
Number of full-time employees	1-2	28	52%	54
	3-5	26	48%	
	6-10	0	0	
	>10	0	0	

The study surveyed micro-entrepreneurs in Malacca, Malaysia, whose businesses have an annual sales turnover of less than RM300,000 or fewer than 5 full-time employees. The findings, summarized in Table 4, indicate the majority of respondents (72%) reported an annual income of less than RM100,000. About 15% earned between RM100,000 and RM200,000, while 13% fell in the RM200,001 to RM300,000 range. None of the businesses reported an income exceeding RM300,000. Over half of the respondents (52%) had 1 -2 full- time employees, while 48% employed 3-5 staff members. No businesses had more than 5 full-time employees. This data highlights that the surveyed micro-entrepreneurs primarily operate on a smaller scale, both in terms of income and workforce.

4.2 Descriptive Analysis of Construct

Table 5 shows the average mean score for all three variables; knowledge in digital marketing, skill in digital marketing and adoption of digital marketing in business are at a medium low to medium high level.

Table 5: Descriptive Statistics for knowledge in digital marketing, skill in digital marketing and adoption of digital marketing in business

Construct	Minimum	Maximum	Mean	Std.Deviation	Application Degree
Knowledge in digital marketing	2.30	3.72	3.18	0.928	Medium High
Skill in digital marketing	2.09	3.19	2.81	0.995	Medium Low
Adoption of digital marketing in business	2.19	3.44	2.83	1.133	Medium Low

Table 5 presents the average mean scores for the three key variables: knowledge in digital marketing, skill in digital marketing, and the adoption of digital marketing in business. The results indicate the mean score for knowledge is 3.18 with a standard deviation of 0.928, indicating that respondents have a medium -high level of knowledge in digital marketing. This suggests that, on average, micro-entrepreneurs in the study possess a reasonable understanding of digital marketing concepts and strategies, though there is some variation in their knowledge levels. While the mean score for skill is 2.81 with a standard deviation of 0.995**,** which falls into

the medium-low range. This indicates that while the entrepreneurs may have some knowledge, their practical skills in applying digital marketing techniques are relatively limited. As shown in the result, the lowest score mean for skills is 2.09, indicates that micro entrepreneurs in Malacca is lack the most in creating website for their business even website is very important platform in adopting digital business. The mean score for adoption is 2.83 with a standard deviation of 1.133**,** also categorized as medium-low. This suggests that the actual implementation of digital marketing strategies in their businesses is not widespread or highly developed, possibly due to the lower levels of practical skills. Overall, the results show that while micro - entrepreneurs in Malacca have a fair level of knowledge about digital marketing (medium-high), they face challenges in skillfully applying that knowledge (medium-low), which subsequently affects the adoption of digital marketing in their businesses (medium-low). This underscores the need for interventions aimed at improving both digital marketing skills and practical application to enhance adoption rates.

4.3 Relationship between knowledge and skill towards adoption of digital marketing in business

H1: There is a positive relationship between knowledge and skill towards adoption of digital marketing in business.

Table 6: Correlation analysis between knowledge and skill towards adoption of digital marketing in business

	Correlations			
			Knowledge and skill in digital marketing	Adoption of digital marketing in business
	Knowledge and skill in digital marketing	Pearson Correlation	1	.851**
		Sig. (2-tailed)		.000
		N	54	54
	Adoption of digital marketing in business	Pearson Correlation	.851**	1
		Sig. (2-tailed)	.000	
		N	54	54
	**. Correlation is significant at the 0.01 level (2 tailed).			

The correlation analysis in Table 6 examines the relationship between knowledge and skills in digital marketing and the adoption of digital marketing in business. The results show a strong positive correlation with a Pearson correlation coefficient (r) of 0.851, indicating a significant relationship between the two variables. This means that as the knowledge and skills in digital marketing among micro-entrepreneurs increase, their adoption of digital marketing in their business practices also tends to rise. The correlation is statistically significant at the 0.01 level (2-tailed), as indicated by the p-value of 0.000, which is well below the 0.01 threshold. This strong correlation supports the hypothesis (H1) that there is a positive relationship between knowledge and skill in digital marketing and its adoption in business. In other words, micro- entrepreneurs who possess a higher level of knowledge and skills in digital marketing are more likely to effectively adopt digital marketing strategies in their business operations. This finding underscores the importance of enhancing digital marketing knowledge and skills among micro-entrepreneurs to drive greater adoption and implementation of digital marketing in their businesses. It highlights a clear area for targeted interventions, such as training programs, to boost their digital marketing proficiency and, consequently, improve their business performance.

The findings of this study provide significant insights into the relationship between digital marketing knowledge, skills, and the adoption of digital marketing strategies among micro-entrepreneurs in Malacca. The results indicate that while micro-entrepreneurs possess a medium-high level of knowledge in digital marketing (mean = 3.18), their skills in effectively utilizing digital marketing tools are relatively lower (mean = 2.81). This gap between knowledge and skill is reflected in the adoption of digital marketing within their businesses, which also falls into the medium-low category (mean = 2.83). These findings are consistent with the literature, which emphasizes the critical role that digital skills play in the successful implementation of digital marketing strategies (Moorthy & Sahid, 2021; Omar et al., 2019). The strong positive correlation ($r = 0.851$, $p < 0.01$) between knowledge and skills in digital marketing and the adoption of digital marketing strategies in business supports the study's hypothesis (H1). This aligns with previous research that has shown how digital literacy is vital for effectively using digital marketing tools, such as social media, SEO, and e - commerce platforms (Moorthy & Sahid, 2021; Hamid et al., 2024). The correlation suggests that micro- entrepreneurs with greater digital marketing knowledge and skills are more likely to adopt these strategies in their business operations.

Despite the medium-high level of knowledge, the lower skill level indicates a gap between understanding digital marketing concepts and the ability to apply them in practice. This mirrors the findings of Omar et al. (2019), who noted that while women entrepreneurs actively use the internet for communication and marketing, many lack formal training in ICT, which limits their potential. Similarly, the study by Rosman and Kee (2022) on "digital poverty" in rural areas like Sipitang highlights how limited access to knowledge and technical skills hinders the full utilization of digital platforms. The situation in Malacca appears similar, where entrepreneurs possess basic knowledge but lack the advanced skills needed to effectively implement digital marketing. The adoption of digital marketing in this study is influenced not just by knowledge but also by the skills to implement digital strategies effectively. Tong and Gong (2020) emphasized that digital marketing tools, such as social media, websites, and e-commerce platforms, can significantly benefit businesses, regardless of size. However, for micro-entrepreneurs to leverage these tools, they need a combination of both knowledge and practical skills. A similar situation may exist in Malacca, where many micro -entrepreneurs possess the basic knowledge required for digital marketing but **lack the advanced skills** necessary to fully capitalize on it. This could explain why the adoption rate for digital marketing strategies among micro - entrepreneurs is in the medium-low category (mean = 2.83). The medium-low adoption rate found in this study suggests that while micro-entrepreneurs in Malacca are aware of digital marketing benefits, they struggle with the technical aspects of implementation. Furthermore, the literature underscores that enhancing digital skills can lead to better business outcomes, such as increased creativity, improved management practices, and customer satisfaction (Omar et al., 2019; Hamid et al., 2024). However, the findings in this study indicate that many micro-entrepreneurs in Malacca have yet to achieve these outcomes due to their limited skill levels. This reflects the need for targeted interventions and training programs aimed at building the digital capabilities of micro-entrepreneurs, focusing not only on theoretical knowledge but also on practical application.

In summary, the results of this study highlight the critical role that digital marketing knowledge and skills play in the successful adoption of digital marketing strategies among micro-entrepreneurs. While knowledge provides the foundation, practical skills are essential for translating this knowledge into effective business practices. Addressing the gap between knowledge and skill is crucial for enabling micro-entrepreneurs in Malacca to fully embrace digital marketing, thereby enhancing their competitiveness and growth in the increasingly digital marketplace.

5. Conclusion

This study examined the relationship between digital marketing knowledge, skills and their impact on the adoption of digital marketing strategies among micro-entrepreneurs in Malacca. The results reveal that while these entrepreneurs have a moderate level of knowledge in digital marketing, their skills in applying this knowledge are relatively low. This skill gap directly affects the level of digital marketing adoption in their businesses. The strong positive correlation found between knowledge, skill, and adoption indicates that improving digital marketing skills is crucial for entrepreneurs to fully utilize digital tools for business growth.

To address the gaps identified in this study, it is crucial to provide focused training programs that enhance both the knowledge and practical skills of micro-entrepreneurs in digital marketing. The survey results indicate a high interest in specific courses, with Creative Content (76%)**,** TikTok (70%)**,** and Facebook Page (46%) ranking as the top three. Therefore, training should first focus on developing creative content skills, teaching entrepreneurs how to craft engaging posts for websites, social media, and advertisements, along with practical tips for effective digital storytelling. A course on TikTok marketing would equip entrepreneurs with strategies to leverage this rapidly growing platform, allowing them to create dynamic content and reach a wider audience. Additionally, training in managing a Facebook Page would cover essential aspects such as optimizing posts, engaging with customers, and using Facebook Ads to target specific markets. By offering these tailored courses, micro-entrepreneurs can significantly improve their digital marketing skills, leading to more effective adoption and better business outcomes in the competitive digital marketplace. In conclusion, the findings of this study underscore the importance of targeted training programs in enhancing the digital marketing skills of micro-entrepreneurs. By leveraging the eUsahawan Hab initiative, partnering with Malaysia Digital Economy Corporation (MDEC), Politeknik Merlimau can provide the necessary support and education to empower these entrepreneurs, enabling them to effectively adopt digital marketing strategies and drive sustainable business growth in the competitive digital marketplace. Through this initiative, Politeknik Merlimau not only fulfills its educational mandate but also contributes to the overall economic development of the region by fostering a new generation of digitally literate entrepreneurs.

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Bridging Local Womenpreneurs' Knowledge and Application Toward SME Business Digitalisation

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Abstract

Business digitalisation is a transformative shift that leverages digital technologies to optimise processes, enhance productivity, and improve customer experiences with products or services. The COVID-19 pandemic accelerated the need for businesses to adopt digital practices, making digitalisation the new norm. However, a knowledge gap exists between male and female entrepreneurs when it comes to business digitalisation. This study aims to examine the knowledge and engagement of women entrepreneurs (womenpreneurs) in the digitalisation of SMEs. With a significant number of women involved in SMEs, their participation is crucial to supporting national initiatives such as the Malaysia Digital Economy Blueprint (MyDIGITAL). The study focuses on how local womenpreneurs are adopting digitalisation, particularly in the areas of product development, business processes, and communication strategies. There is a lack of research on the involvement of local womenpreneurs in business digitalisation, especially during the pandemic, which has highlighted the need for such studies. This study applied a quantitative research method to achieve the objectives. Questionnaires were conducted in data collection. The result of this study helps the relevant bodies such as the policymaker and local government authorities to strategize better plans and programs for small- medium enterprises (SMEs) in the future.

Keywords: *Womenpreneurs, digitalisation, knowledge gap, SME, pandemic, quantitative method.*

1.0 Introduction

Crisis, poverty, gender discrimination, and digital literacy are major barriers preventing women from fully participating in the increasingly digital global workforce (Taylor, 2018). The concept of the "digital divide" traditionally refers to the gap between those with access to computers and the internet and those without. However, experts suggest that women with limited digital skills will face the greatest challenges as technology advances. According to Nefesh-Clarke (cited in Taylor, 2018), women remain on the disadvantaged side of the digital skills gap because business digitalisation continues to be male-dominated. This is the scenario, particularly in developing countries, where the problem is more pronounced than in developed nations (Jayarathne, Surangi and Ranwala, 2023). In rural areas for example, men account for 75.6% of entrepreneurs involved in agro-technology, compared to just 24.4% of women, a disparity largely attributed to lower educational attainment among women (Yusof, 2021). The COVID-19 pandemic has further exacerbated this gap, deepening the challenges faced by women in accessing and leveraging digital tools.

According to Rosca, Agarwal and Brem (2020), women represent 40% of the global workforce and are recognized as a significant segment of entrepreneurs. That means encouraging women's entrepreneurship plays a critical role in driving socio-economic development. In developing countries, women's participation in entrepreneurial activities has had a positive impact on household welfare and consumption (Minniti and Naudé, 2010). Their unique roles within families create network effects that boost entrepreneurial endeavors (Datta and Gailey, 2012; Minniti, 2010). Beyond financial benefits, entrepreneurship provides women with economic security (Itani, Sidani and Baalbaki, 2011), a platform for self-expression and personal fulfilment (Eddleston and Powell, 2008), and a sense of empowerment. However, women entrepreneurs in developing regions often face significant challenges, including limited opportunities, resource constraints, and systemic obstacles.

The COVID-19 pandemic exacerbated these challenges, impacting all sectors, particularly small and medium enterprises (SMEs), which were at the epicentre of the crisis. According to the report by the International Trade Centre (2020), female entrepreneurs already grappling with limited access to business opportunities, networks, and resources, faced additional hurdles such as gender biases, lack of funding, and reliance on informal financing. Many women-led businesses, especially small and young firms, struggled to

survive (Chmura, 2020).

Digital entrepreneurship has emerged as a promising avenue for women, particularly in developing countries, allowing them to work from home, balance family responsibilities, and achieve financial independence while adhering to social norms (Orser, 2020; Ughetto, Rossi, Audretsch and Lehmann, 2020; Sharma, 2022). Social media platforms, such as Facebook, have become popular spaces for women to market handmade goods, recipes, clothing, and accessories (Williams and Nadin, 2012; Khajeheian, 2013). Many women engage in informal entrepreneurship through these platforms to avoid bureaucratic processes, high taxes, and low start-up funds (Brahem and Boussema, 2023). Digital business creation is particularly prevalent in Western countries due to their advanced information and communication technology (ICT) infrastructure and higher purchasing power (Linna, 2013; Gathege and Moraa, 2013; Ngoasong, 2018). Consequently, most studies on women digital entrepreneurs have focused on Western contexts or in developed countries, with limited research available on Southeast Asia. Thus, in this study, the researchers focus on local women entrepreneurs in Sabah.

This study seeks to explore the level of knowledge and application of SME digitalisation among local women entrepreneurs during the pandemic of COVID-19. The general research objective is to assess their understanding and usage of digital tools and strategies in managing their businesses during this period. While, the specific research question focuses on how women entrepreneurs apply their digitalisation knowledge to enhance their products, processes, and communication, ultimately transforming their business models in response to pandemic challenges. Accordingly, the specific research objective is to examine the extent to which digitalisation knowledge is applied across these key areas.

The rest of the paper is structured as follows. In the second section, the literature review will be presented. Then, the research framework and hypothesis development will be discussed. Before the analysis and findings presented in the fourth section, the paper will provide the research method in section three. This paper continues the discussions section, then followed by conclusion and recommendation.

2.0 Literature review

2.1 Womenpreneurs and Digital Entrepreneurship

Entrepreneurship has been referred to as "efforts to bring about new economic, social, institutional and cultural environments through the actions of an individual or a group of individuals" (Rindova, Barry and Ketchen, 2009, p. 477). This is a paradigm through which women can improve their social status, quality of life and the future of their families (Dheer, Li and Trevinl, 2019). Women entrepreneurship reflects the rate of women who proceed with self-employment (Nkoa and Song, 2023). In the context of this study, women entrepreneurs are referred to as womenpreneurs.

Over the past decade, womenpreneurs have noticeably gained currency in management and economics literature (Karim, Kwong, Shivastava and Tamvada, 2022; Sobhan and Hassan, 2023). This has appeared as part of the intensive investigation of the role women can play in the economic prosperity of countries (Althalathini and Tlaiss, 2023; Mousa and Abdelgaffar, 2023a; Atarah, Finotto, Nolan and Stel, 2023). However, the antecedents and consequences of the engagement of women in entrepreneurial activities vary across countries (Rashid and Ratten, 2020; Mousa and Abdelgaffar, 2023b; Poggesi, Mari and Schilleci, 2024).

Digital entrepreneurship is a subcategory of entrepreneurship in which an entrepreneur exercises its entrepreneurial activities virtually in an attempt to avoid the entry barriers accompanying traditional ventures (Dy, Marlow and Martin, 2017; Cenamor, Parida and Eltaief, 2019). According to Wearesocial (2022), at least 62% of the world's population has internet access and 58% are active on social media. Based on this data, the shift of traditional or conventional to digital entrepreneurship is happening and known with different terms. For example, Mckelvey (2001) refer digital entrepreneurs as internet entrepreneurship; Carrier, Raymond and Eltaief (2004) used the term cyber business and Hull, Hung, Hair, Perotti and Demartino (2007) are among the earliest researcher to use the term digital entrepreneurship. Nowadays, several prominent enterprises such as Meta, Google, Uber and Twitter are widely used and exercise digital entrepreneurship (Manjon, Aouni and Crutzen, 2022; Berman, Stuckler, Schallmo and Kraus, 2023).

2.2 Digitalisation

According to Gartner (2021), digitalisation is defined as the use of digital technologies to change a business model or concept and provide new revenue and value-producing opportunities. It is a transformation from manual to digital business. A creative idea is crucial together with an innovative product, process, and communication to enter into a gig economy (such as Grab and Food Panda), which is defined by Wilson in BBC News (2017) as a labour market characterised by the prevalence of short-term contracts or freelance

work, as opposed to permanent jobs. Furthermore, it is either a working environment that offers flexibility about employment hours, or it is a form of exploitation with very little workplace protection. Instead of the gig economy, people nowadays are talking and dealing with e-commerce platforms (such as Lazada and Shoppe) to market products globally. In addition, digitalisation is a transformative process that leverages technology to improve all aspects of a business, making it more agile, efficient, and competitive in the modern digital economy. It enables businesses to adapt to new opportunities, enhance their capabilities, and meet evolving customer expectations.

Malaysia is very much concerned about the digital economy. The digital economy is defined as economic and social activities that involve the production and use of digital technology by individuals, businesses, and the government (Economic Planning Unit, 2021). The government through its newly launching MyDIGITAL (The Malaysia Digital Economy Blueprint) spells out the efforts and initiatives to deliver the aspirations of MyDIGITAL. The Blueprint charts the trajectory of the digital economy's contribution to the Malaysian economy and builds the foundation to drive digitalisation across Malaysia including bridging the digital divide among men and women. Business entities among SMEs are seen to suffer from the coronavirus (COVID-19) attack. The COVID-19 pandemic amplifies the importance of the digital economy to ensure continuity in economic activities. The use of the internet and technological advancement contributes to the rapid growth of data, which is the future commodity. Nevertheless, countries risk creating a digital divide if the response to digitalisation is not managed well. The whole must embrace digitalisation, seize opportunities arising from this trend for the country's well-being, and to stay relevant and competitive.

2.2.1 Business Digitalisation

Digitalisation refers to the integration of digital technologies into all areas of a business, fundamentally changing how it operates and delivers value to customers. It involves the use of digital tools, processes, and data to improve efficiency, enhance customer experiences, streamline operations, and create new business models. Digitalisation goes beyond simply adopting new technology—it transforms how a business interacts with its stakeholders, manages its resources and innovates in response to changing market demands.

Business digitalisation refers to the integration of digital technologies into all aspects of an organization's operations, which transforming traditional business processes to enhance efficiency, innovation, and customer experience. This shift involves adopting tools such as cloud computing, artificial intelligence, data analytics, and e-commerce platforms, which enable companies to streamline workflows, automate repetitive tasks, and make data-driven decisions. Digitalisation not only improves internal processes but also fosters greater connectivity with customers, offering personalized services and real-time engagement. Moreover, it allows businesses to expand their reach, entering global markets with reduced overhead costs. In short, business digitalisation may also have purposes like:

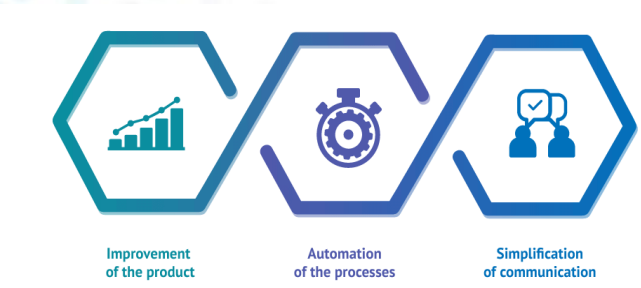
a. improvement of the product (or service): its quality, attractiveness, ease of use, delivery.

b. automation of production and other internal processes of the company.

c. simplification of internal and external communications.

According to Woxapp (2020), business digitalisation is very much concerned with the goals of digitalisation as shown in Figure 1:

Figure 1: Goals of Digitalisation



Digitalisation is in line with The Malaysia Digital Economy Blueprint (MyDigital) concepts. MyDigital is a critical phase for Malaysia to accelerate its economic progress as a technologically advanced economy globally. This will chart the path to strategically position Malaysia as a competitive force in this new era. MyDIGITAL acts as an enabler in realising the Twelfth Malaysia Plan (RMK-12) 2021-2025 as the plan also works towards *Wawasan Kemakmuran Bersama* 2030.

Digitalisation is a profound transformation of business, involving the use of digital technologies to

optimize business processes, enhance the company's productivity and improve the experience with customers. One of the key aspect is the satisfaction of consumer needs, which change along with the development of technologies, namely, the creation of a more comfortable and prompter interaction between the customers and the company. Beyond improving customer engagement, digitalisation serves several strategic purposes, including:

a. Improvement of the product (or service): its quality, attractiveness, ease of use, delivery.
b. Automation of production and other internal processes of the company.
c. Simplification of internal and external communications.

2.3 Product and SME Business Digitalisation

Lack of knowledge about technologies and scepticism prevent an enterprise from engaging in digital initiatives, especially SMEs. Digitalisation has a transformative impact on innovation in firms and markets. New business models based on digital technologies are disrupting traditional industries. Productization (product plus digitalisation), where a manufacturer is required to adopt solution-oriented business models in the evolving 'science economy', instead of sticking to product-oriented ones in the industrial economy (Motohashi, 2014). The value proposition should carry three essential points to support the SME business digitalisation i.e., unique centric, problem-solver, and opportunity creator. Servitization (service plus digitalisation), according to Motohashi and Rammer (2020), is referring to the phenomenon of increasing value added by services provision related to the product, which was pointed out even before the internet was started (Vandermerwe and Rada, 1988). However, recent IT technologies enable efficient implementation of product-related services (Rymaszewska et al., 2017). Cusumano et al. (2015) discuss the relationship between servitization and the competitive strategy of product firms. Product-related services are categorised into three:

a. Smoothing (such as technical service)
b. Adapting (such as customization service)
c. Substituting (such as cloud service of storage and computer power).

In the context of SME business digitalisation, p**roduct** refers to the goods or services offered by an SME that have been enhanced or transformed through the use of digital technologies. Digitalisation in product development can involve integrating digital tools and innovations to improve the design, production, marketing, and distribution of products or services. In addition, in SME business digitalisation, focusing on the product means leveraging digital tools to innovate, streamline, and improve the overall product offering, making it more adaptable, competitive, and aligned with customer expectations in a digital economy.

2.4 Process and SME Business Digitalisation

Numerous studies suggest SMEs have not yet initiated digital transformation. Thus, have not yet embarked on the process of digitizing their business operations. As many SMEs operate in global markets shaped by competition, this can yield significant risks for their long-term business success. Access to technology and automation platforms allows SMEs to decrease overall expenditure by optimizing productivity (Hess, Matt, Benlian, and Wiesböck, 2016; Saam, Viete, and Schiel, 2016). The study by Snapdeal found that SMEs can optimize productivity by 60% to 80% of the total cost. In India, as reported by the International Finance Corporation (IFC), the total financing demand gap is massive at 2.93 trillion in 2016 in India's SME sector. That means, SMEs in India are facing significant challenges of poor infrastructure and inadequate finance. Poor infrastructure raises the fear of optimizing the utilization of resources. On the other hand, data security is defined as the protection of data from unauthorized access, such as modification, destruction, or disclosure to others without permission. The biggest security issues arise from malware and cyber-attacks during operations (Singh, 2017).

In the context of SME business digitalisation, process refers to the transformation and optimization of business operations and workflows through the integration of digital technologies. This digitalisation of processes aims to increase efficiency, reduce costs, improve accuracy, and enable real-time decision-making by leveraging digital tools and systems. It is believed that by digitalizing business processes, SMEs can streamline operations, enhance productivity, and better respond to market demands. This shift allows for greater flexibility, improved customer experiences, and a more agile business model that can compete in the increasingly digital business landscape.

2.5 Communication and SME Business Digitalisation

Having only a physical presence limits an organization's market reach. Upgrading digital technology and having an online presence can provide significant opportunities for SMEs to grow and increase their top line.

This is a new line of communication under the customers' channel of distribution. Engagement through a company website or shifting to an e-commerce platform can increase sales by allowing SMEs to access new customers in local and overseas markets. It also allows flexibilities of time, geographical location, and delivery to conduct business. A study by Snapdeal (2015) states that an enterprise can potentially improve its revenues by about 51%, which means the growth of SMEs is driven by e-commerce. The study also states that 46% of the SMEs have witnessed significant growth by adopting an online sales channel. Diversified customers also help divide business risk across different locations. The fast-paced growth of the e-commerce industry has provided unmatched opportunities for the SME community. Increased digital engagements allow SMEs to explore new markets, enabling them to compete with the bigger giants in the industry. E-commerce has provided cost-effective solutions for companies in large cities and rural areas alike to connect and trade with customers around the world.

However, SMEs often lack the skills to enter international markets due to limited knowledge, language barriers, unfamiliarity with cultural differences and narrow business outlook (Singh, 2017). Offline SMEs are quickly recognizing missed growth opportunities due to a lack of online presence. Adoption of digital technology tools and integration of one's sales platform on a digital channel is important to survive in today's fast-growing local and global competitive market. Businesses with an ignorant approach towards online presence or sluggishness to adopt digital channels may have to face significant challenges to survive in the present data-driven ecosystem.

In the context of SME business digitalisation, communication refers to the use of digital tools and technologies to facilitate internal and external communication, both within the organization and with stakeholders. Digital communication enables SMEs to streamline their messaging, enhance collaboration, and improve engagement, leading to more effective interactions and a stronger market presence.

Additionally, in SME business digitalisation, communication encompasses all these digital methods and tools to improve how businesses interact internally and externally. Effective communication strategies enable SMEs to enhance customer experiences, foster collaboration, and build a more responsive, connected business environment, all of which are essential for staying competitive in a digital-first world.

3.0 Research Framework and Hypothesis Development

This paper will apply the Theory of Technology. One of the theories named Social Theories to be specific, Social Construction of Technology (SCOT). The Social Theory of SCOT argues that technology does not determine human action, but human action shapes technology.

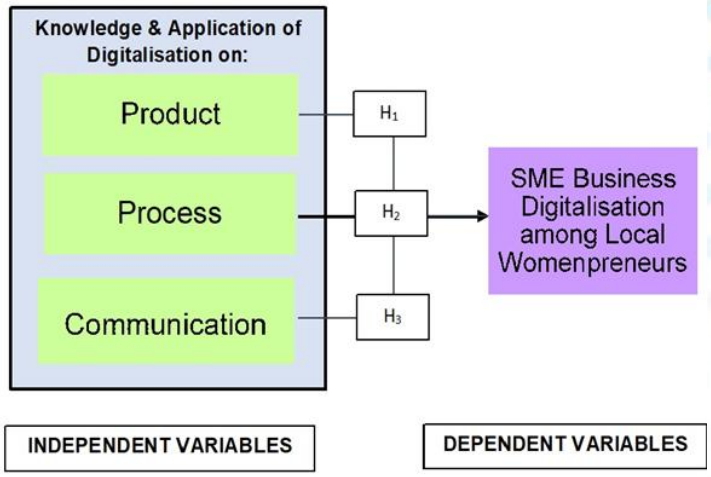
3.1 The Social Construction of Technology

Basically, Social Theories study how humans and technology affect each other. Some theories focus on how decisions are made between humans and technology: humans and technology are equal in their decisions, humans drive technology, and vice versa. The interactions used in most theories under Social Theories look at an individual human's interactions with technology, but there is a sub-group for the group of people interacting with technology.

SCOT can be effectively applied to business digitalisation by highlighting how social factors and stakeholder needs shape the adoption and development of digital solutions. In digitalisation, technologies are not implemented solely based on technical efficiency but are influenced by the diverse interpretations and priorities of relevant stakeholders. The digitalisation process stabilises once a consensus among stakeholders is achieved, ensuring that the adopted technologies align with business objectives and social expectations. Thus, SCOT emphasises that the success of digitalisation efforts depends not only on technological advancements but also on understanding and addressing the social dynamics within the organisation or environment.

Based on the above explanation, the research framework is presented in Figure 2 below.

Figure 2: Framework on Knowledge and Application of Digitalisation



As in Figure 2, it can be concluded that the study will find out the relationship between three main independent variables against a single dependent variable as detailed out in the following hypotheses:

a. *H_1 – There is a significant relationship between Knowledge & Application of Digitalisation on Product (IV1) and SME Business Digitalisation among Local Womenpreneurs (DV).*

b. *H_2 – There is a significant relationship between Knowledge & Application of Digitalisation on Process (IV2) and SME Business Digitalisation among Local Womenpreneurs (DV).*

c. *H_3 – There is a significant relationship between Knowledge & Application of Digitalisation on Communication (IV3) and SME Business Digitalisation among Local Womenpreneurs (DV).*

4.0 Research Method

The data collection for this study is based on primary data, which serves as the instrument for gathering information. A 5-point Likert Scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree), is used to select the most appropriate responses for the various constructs, including both independent and dependent variables, as illustrated in Figure 2. A structured questionnaire with close-ended questions has been developed to collect the necessary data. The questionnaire consists of four sections: Section A, which focuses on profiling/demographics; Section B1, which assesses the knowledge and application of digitalisation in relation to products (goods and services); Section B2, which examines the knowledge and application of digitalisation in business processes; Section B3, which explores the knowledge and application of digitalisation in communication; and Section C, which evaluates the state of SME business digitalisation among women entrepreneurs.

The respondents are womenpreneurs, which consist of local Sabahan womenpreneurs commencing their business in the past three years. They should possess licenses, with or without premises, Sabah residents, have no limit of age, be allocated in all districts of Sabah, various types of business, and be considered SMEs. A random convenient sampling technique was applied to pool the number of respondents in the Sabah region.

5.0 Analysis, Findings and Discussions

The SPSS version 21 was used to analyse all the data, in order to produce results in the forms of descriptive analysis (profiling), the relationship and regression between independent variables and dependent variables.

5.1 Descriptive Analysis

Based on findings of the descriptive analysis as in Table 1, it highlights the demographic and business characteristics of women entrepreneurs. The data shows that the majority of respondents are from the Bumiputra Sabah ethnic group (50.9%) and primarily practice Islam (74.5%), reflecting the cultural and regional demographics of the surveyed population. The largest age group of entrepreneurs is between 36-40 years (20.9%), suggesting that mid-career individuals are more likely to pursue entrepreneurship. Furthermore, the majority are married (70.9%), indicating that family responsibilities may play a role in their

entrepreneurial journeys. Educational qualifications reveal that most participants hold SPM/STPM certificates (54.5%), while only a small proportion have higher education degrees, potentially limiting access to advanced skills or business knowledge.

From a business perspective, food and beverage is the most dominant sector (44.5%), followed by trading (24.5%), indicating these industries' accessibility and lower barriers to entry. In contrast, sectors like handicrafts and services are underrepresented, each accounting for just 3.6% of businesses, suggesting opportunities for diversification into these areas. A significant portion of businesses are sole proprietorships (65.5%), which may reflect the tendency of women entrepreneurs to start and manage businesses independently. Additionally, the majority of businesses are relatively young, with 55.4% operating for five years or less, highlighting the need for targeted support to sustain and grow these ventures in their early stages.

The data also reveals gaps in digital adoption and training among these entrepreneurs. Notably, 59% have not attended digital courses, which could reduce their ability to leverage technology for business growth. Suburban areas are the most popular business location (46.4%), potentially offering a balance between affordability and market access. However, the under-utilisation of digital tools and platforms may limit opportunities to expand into larger markets or improve operational efficiency. These findings suggest a need for targeted interventions, such as digital literacy programs, financial assistance, and initiatives to encourage diversification, to empower women entrepreneurs and enhance their long-term success.

Table 1: Result of Descriptive Analysis

	Frequency	(%)
Race		
Malay	29	26.4
Cina	1	0.9
India	2	1.8
Bumiputra Sabah	56	50.9
Others	22	20
	110	
Religion		
Hindu	2	1.8
Islam	82	74.5
Cristian	26	23.6
	110	
Age		
Below 25 years	5	4.5
25-30 years	16	14.5
31-35 years	13	11.8
36-40 years	23	20.9
41-45 years	17	15.5
46-50 years	16	14.5
51 years and above	20	18.2
	110	
Marriage Status		
Single	21	19
Widow	3	2.7
Divorced	8	7.2
Married	78	70.9
	110	
Highest Educational Level		
SPM/ STPM and equivalent	60	54.5
Diploma	28	25.5
Bachelor Degree	15	13.6
Master	6	5.5
Others	1	0.9
	110	
Sector		
Trading	27	24.5
Food and Beverage	49	44.5
Handicraft/ Fashion	4	3.6
Tourism/ Homestay	6	5.5
Beauty Saloon	20	18.2
Services	4	3.6
	110	
Type of entity		
Sole proprietorship	72	65.5
Partnership	17	15.5
Company	21	19
	110	
Years of operating		
5 years and below	61	55.4
6 - 10 years	26	23.6
11 - 15 years	14	12.7
16 - 20 years	1	1
21 years and above	8	7.3
	110	
Attending digital course		
Yes	45	41
No	65	59
	110	
Business Location		
Rural	25	22.7
Sub-urban	51	46.4
Urban	34	30.9
	110	

5.2 Result of Correlation and Regression Analysis

The analysis of the four key variables as in Table 2, reveals a consistent performance level across all areas, with each scoring a medium rating based on their respective mean values. Digitalisation has a mean of 3.229, indicating a moderate level of technological integration or adoption. Similarly, the Product variable, with a mean of 3.512, suggests that product quality or performance meets average expectations. In the Process, a mean of 3.245, reflects standard operational efficiency. While the Communication score of 3.438, indicates moderately effective information sharing or interaction with customers via digital platforms. Overall, these results point to balanced but non-exceptional outcomes, highlighting opportunities for further improvement across all categories.

Table 2: Result of Mean

Variable	Mean	Level*
Digitalization	3.229	**Medium**
Product	3.512	**Medium**
Process	3.245	**Medium**
Communication	3.438	**Medium**
*Source: Jamil Ahmad (2002)		

The correlation matrix (as in Table 3) highlights the relationships among all the variables: Product, Process, Communication, and Digitalization. The results show strong positive correlations among Product (0.761), Process (0.778), and Communication (0.781). These strong correlations suggest that improvements in one area are closely associated with enhancements in the others, indicating a high level of interdependence between these factors. However, Digitalization shows weaker, yet statistically significant, correlations with Product (0.488), Process (0.378), and Communication (0.454). While digitalization appears to influence all three variables, the relatively lower correlation values suggest that other factors may also contribute to changes in these areas. Overall, the data underscores the strong interconnectedness of Product, Process, and Communication, with Digitalization playing a supportive but less dominant role in motivating their development.

Table 3: Result of Correlation Matrix

	Product	Process	Communication	Digitalization
Product	1			
Process	0.761	1		
Communication	0.778	0.781	1	
Digitalization	0.488	0.378	0.454	1

In Table 4, again-the correlation analysis results highlight the need to strengthen the integration of Digitalisation with Independent Variables: Product (0.488), Process (0.378), and Communication (0.454). The results reveal there is relatively weak relationship between Dependent and Independent variables. To address this, the local womenpreneurs should prioritize adopting digital tools and technologies that enhance product innovation, streamline processes, and improve communication efficiency.

Table 4: Result of Correlation Analysis

		Product	**Process**	**Communication**
Digitalization	Pearson Correlation	**0.488**	**0.378**	**0.454**
	Sig (2-tailed)	0.000	0.000	0.000
	N	110	110	110
Correlation Strength		**Weak**	**Weak**	**Weak**

In Table 5, the regression results indicate a moderately strong model, with an $r^2 = 54.8\%$ in the dependent variable explained by the model's independent variables. The model is statistically significant overall, as

shown by a low Significance F (0.00) and an F-statistic of 12.07. Among the predictors, *Product* emerged as a significant contributor, with a positive coefficient of 0.401 and a p-value of 0.011, indicating that knowledge and application of digitalisation in Product are associated with a significant increase in the dependent variable. However, Process and Communication did not show statistical significance, with p-values of 0.546 and 0.130, respectively, suggesting they have limited explanatory power in this context.

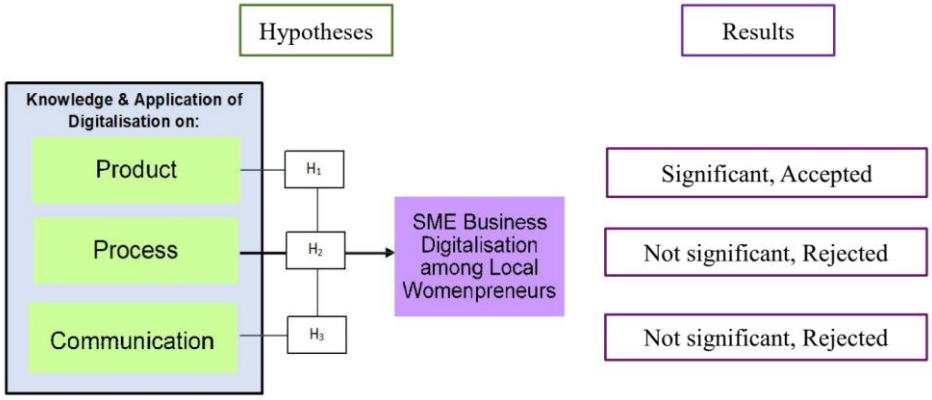
Table 5: Result of Regression Analysis

Model	***Coefficients***	***Std. Error***	***t***	***P-value***
Intercept	1.331	0.331	4.019	0.000
Product	**0.401**	0.154	2.600	**0.011**
Process	-0.081	0.133	-0.606	0.546
Communication	0.219	0.144	1.524	0.130
r^2=0.548; F=12.07; Sig=0.000				

Furthermore, the regression results showing that Product has the most significant positive impact on business outcomes, while Process and Communication are less impactful, reflect findings from other studies focusing on women entrepreneurs. It is widely reported that product innovation and differentiation are often seen as the most effective ways for women entrepreneurs to compete in crowded markets. However, many studies also highlight that women entrepreneurs frequently encounter barriers in optimizing processes and communication strategies due to limited resources, training, and sometimes, a lack of support networks. This could explain why Process had an insignificant negative effect and Communication showed a positive but not statistically significant relationship in this study.

Thus, derived from the results and findings above, this study concludes the result as shown in Figure 3.

Figure 3: Overall results



5.3 Discussions

The relationship between the knowledge and application of digitalisation in three independent variables: Product, Process, and Communication, as well as, the impact on SME business digitalisation among local womenpreneurs is depicted in Figure 3 above. There are 3 hypotheses: H_1, H_2, and H_3 being examined to explore whether the independent variables significantly influence the dependent variable, digitalisation.

The first hypothesis (H_1) tests whether knowledge and application of digitalisation in product development significantly affect SME digitalisation. The result indicates a **significant and accepted**, suggesting that product digitalisation plays a crucial role in advancing digital transformation. The local womenpreneurs know better their products and have adopted digital tools for product innovation and design. Additionally, product digitalisation may offer competitive advantages such as improved customer satisfaction, product customization, and market spread.

The second Hypothesis H_2, focused on the digitalisation of business processes, was **not significant and rejected.** This result indicates that while process digitalisation is essential for operational efficiency, it may not be an influencing variable in the digitalisation efforts of local womenpreneurs. That means the local womenpreneurs did not have enough knowledge and application of digitalisation in their business process. One possible explanation could be limited access (Mahat, Mahat and Mustafa, 2021) to advanced digital

infrastructure, high costs of implementing automated systems, or a focus on external-facing elements like product and customer communication rather than internal processes.

Similarly, the third Hypothesis H_3, which addresses the impact of digital communication, was also **not significant and rejected.** This result may suggest that while digital communication tools such as social media, email marketing, and online customer service are available and important (Ughetto et al., 2020), tools alone may not be sufficient to drive digital transformation. That is because the local womenpreneurs need to know "know-how" to apply the tools in their business operation, especially during the interaction with the customers or stakeholders. It's possible that effective communication strategies need to be paired with other variables, such as strategic planning and product innovation, to have a meaningful impact.

Derived from the result, this study highlights the importance of focusing on product digitalization as a key driver for digital transformation among local womenpreneurs. Efforts to support womenpreneurs might benefit from targeted interventions, such as training programs that enhance digital product development skills. Additionally, stakeholders could explore strategies to integrate process and communication digitalization more effectively, potentially addressing barriers and challenges faced by local womenpreneurs.

6.0 Conclusion and Recommendation

This study reveals a diverse demographic and business landscape, with potential opportunities for digital upskilling and support for small businesses in suburban and rural areas. This study found that the local womenpreneurs in Sabah are left behind, they only "know-how" to apply technological innovation to their product but they still struggle with the integration of digital technologies into their operations especially in process development and effective communication. Based on the findings, the related government agencies or non-government organisations (NGO) could arrange continuous training for local womenpreneurs, especially in suburban and rural areas. Focused training on upskilling the local womenpreneurs to increase their knowledge and application of business digitalisation. Future research should look into the barriers and challenges faced by local womenpreneurs in Sabah and the availability of resources and support for them to succeed in their business. In summary, while digitalizing products has a significant impact, the broader digital transformation strategy should consider addressing process and communication challenges to unlock the local womenpreneurs full potential.

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Faktor Kebergantungan Terhadap Kecerdasan Buatan *(Artificial Intelligence)* Dalam Kalangan Pelajar

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Abstrak

Sejak kebelakangan ini, kecerdasan buatan (AI) telah menjadi instrumen yang boleh dieksploitasi oleh pelajar untuk membantu mereka dalam pembelajaran. AI dilihat boleh mempercepatkan proses pembelajaran, penulisan dan penyelidikan, dan memberikan perspektif baharu untuk dunia akademik. Tahap kebergantungan pelajar terhadap AI seolah-olah tidak dapat dinafikan lagi, sehingga setiap aktiviti pembelajaran kendiri pun dilakukan dengan bantuan AI. Oleh yang demikian, berdasarkan kepada senario ini, objektif kajian ini dijalankan adalah untuk mengenal pasti faktor-faktor yang mempengaruhi kebergantungan pelajar terhadap AI. Sampel yang digunakan adalah pelajar Jabatan Kejuruteraan Elektrik di Politeknik Kota Kinabalu, Sabah. Kajian ini menggunakan soal selidik sebagai instrumen kajian yang diedarkan secara rawak dalam talian. Analisis yang digunakan adalah analisis deskriptif. Hasil kajian mendapati bahawa tiga faktor utama kebergantungan AI adalah (a) AI membantu mencari bahan pembelajaran, (b) menggunakan AI adalah percuma, dan (c) AI memberikan maklum balas yang cepat dalam pelbagai faktor. Dapatan ini menjelaskan bahawa AI merupakan instrumen yang berpotensi besar untuk memudahkan kerja akademik dan pengajaran mereka. ChatGPT adalah aplikasi AI yang menjadi pilihan dengan skor yang tertinggi. Dapatan ini juga menunjukkan bahawa AI berpotensi untuk menjadi alat pembelajaran yang berkesan tetapi ia juga mempunyai keupayaan untuk disalahgunakan untuk mengatasi kekangan moral. Justeru, kajian ini penting untuk meramalkan tingkah laku penggunaan AI dalam kalangan pelajar.

Kata kunci: Kebergantungan, kecerdasan buatan, pembelajaran

1. Pengenalan

Banyak kajian menunjukkan bahawa pelajar telah menggunakan kecerdasan buatan secara meluas dalam beberapa tahun kebelakangan ini (Elaiess, 2023). AI dilihat banyak membantu pelajar dalam banyak aspek pembelajaran dengan lebih berjaya dan berkesan. Sebagai contoh, dengan kemajuan terkini dalam AI, instrumen AI dapat membantu pelajar dalam mengesan dan membetulkan masalah tatabahasa dan ejaan, serta menyediakan petikan yang sesuai. Selain itu, pelajar dengan pantas mendapatkan dan membaca bahan -bahan yang luas dengan menggunakan AI untuk meringkaskannya, membolehkan pelajar dapat menjimatkan masa pembelajaran. AI juga boleh digunakan untuk meningkatkan kerjasama akademik. Memandangkan sudah ramai pengguna AI termasuklah dalam kalangan ahli akademik, justeru mereka boleh menggunakan AI untuk bekerjasama dalam projek akademik yang memudahkan mereka berkongsi idea, memantau kemajuan projek pelajar dan memberikan maklum balas dengan segera. Selain itu, AI juga boleh meningkatkan motivasi pembelajaran akademik, kerana pelajar AI boleh membantu pembelajaran kendiri termasuklah memberikan jawapan latihan dan boleh menjawab soalan-soalan yang sukar.

Namun begitu, terdapat juga kajian menjelaskan keburukan AI kepada pelajar. Lebih-lebih lagi sekiranya pelajar mempunyai tahap kebergantungan yang tinggi terhadap AI tersebut seperti terlalu bergantung kepada AI untuk mencari idea dan plagiarisme yang tinggi. Kemunculan AI telah pun menghampiri pelbagai bidang, termasuk pendidikan. Tidak dinafikan, AI membantu dalam sektor pendidikan terutamanya apabila diaplikasikan di institusi pengajian tinggi yang akan membantu mencari bahan pembelajaran (Lee & Koh, 2020). Namun begitu timbul persoalan, apakah yang menyebabkan kebergantungan pelajar menggunakan AI untuk tujuan pembelajaran? Untuk menjawab persoalan ini, kajian ini dijalankan untuk mengenal pasti faktor utama kebergantungan pelajar terhadap AI. Faktor-faktor ini penting untuk membantu institusi merangka satu strategi bagi memberi panduan pembelajaran yang betul menggunakan AI agar tidak disalah guna oleh pelajar.

2. Sorotan Kajian

Pendidikan kecerdasan buatan (AI) menjadi semakin penting di seluruh dunia (Suh & Ahn, 2022). Hari ini, teknologi kecerdasan buatan mengubah institusi pendidikan dan bilik kuliah dan menjadikan pekerjaan

guru menjadi semakin lebih mudah (Ikedinachi et al., 2019). Kecerdasan buatan boleh dibahagikan kepada beberapa bidang yang merangkumi sintesis teks dan pertuturan, robotik, pembelajaran mesin, pemprosesan bahasa semula jadi, penglihatan komputer, dan perancangan dan sistem pakar (Mukhamediev et al., 2022). Menurut Loeffler (2018), kecerdasan buatan kini sudah biasa dalam kehidupan seharian manusia sama ada orang awam mahupun pelajar. Ini kerana AI telah mengubah cara orang belajar, di samping teknologi kecerdasan buatan telah digunakan dalam memudahkan pekerjaan seperti menangkap imej dan sistem tempat letak kenderaan automatik.

Aplikasi kecerdasan buatan telah digunakan untuk pendidikan sejak sekian lama. Kecerdasan buatan digunakan dalam pendidikan seperti melakukan latihan berasaskan komputer dan arahan berbantukan komputer (Beck et al., 1996). Peningkatan bilangan pelajar dari pelbagai wilayah geografi yang mendaftar dalam kursus yang ditawarkan di IPT adalah salah satu sebab yang menarik untuk penggunaan kecerdasan buatan dalam pendidikan. Ini dilihat sebagai sesuatu yang positif kerana AI membantu institusi, tetapi ini mengakibatkan kurang tenaga pengajar dan penjimatan kos di kebanyakan universiti (Hollands & Tirthali, 2014; Popenici & Kerr, 2017). Oleh itu, terdapat keperluan yang semakin meningkat untuk penggunaan AI sama ada dari sudut pelajar untuk membantu pembelajaran kendiri, mahupun institusi untuk kursus dalam talian sebagai satu cara untuk membantu pembelajaran jarak jauh melalui teknologi. Namun begitu, menurut AlAfnan et al. (2023), kebergantungan pada kecerdasan buatan untuk menyelesaikan tugasan dan penyerahan pelajar membawa kepada ketidakcerdasan manusia, tidak belajar, dan kekurangan dalam pembangunan akademik dan profesional pelajar. Ini akhirnya akan mengurangkan minat mereka dalam kelas kerana mereka bergantung kepada kecerdasan buatan.

3. Metodologi Kajian

Kajian penyelidikan ini menggunakan kaedah kuantitatif yang telah dilakukan di Politeknik Kota Kinabalu, Sabah. Seramai 105 pelajar mengambil bahagian dengan menjawab soal selidik yang dijalankan secara dalam talian. Teknik pensampelan yang digunakan adalah secara rawak mudah kepada pelajar di Jabatan Kejuruteraan Elektrik (JKE). Item kajian dibina berdasarkan kajian lepas yang menunjukkan faktor - faktor penggunaan AI dalam kalangan pelajar. Item kajian telah melalui analisis kebolehpercayaan menggunakan Cronbach alpha dan menghasilkan melebihi 0.7. Data yang telah dikumpulkan akan dianalisis secara statistik menggunakan analisis deskriptif untuk mendapatkan nilai skor min. Nilai min akan diterjemahkan kepada berikut seperti yang digunakan dalam kajian Ngadiman et al. (2019): 1.00– 1.99 (Lemah); 2.00– 2.99 (Rendah); 3.00– 3.99 (Sederhana); 4.00– 5.00 (Tinggi).

4. Hasil Kajian

a) Latar Belakang Responden

Jadual 1: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	84	80.0
	Perempuan	21	20.0
Semester	1	21	20.0
	2	7	6.7
	3	29	27.6
	4	34	32.4
	5	9	8.6
	6	5	4.8
Jabatan	Diploma Kejuruteraan Elektrik & Elektronik	66	62.9
	Diploma Kejuruteraan Elektronik (Komputer)	29	27.6
	Diploma Kejuruteraan Elektronik (Komunikasi)	10	9.5

HPNM	1.00 - 2.00	1	1.0
	2.00 - 2.99	24	22.9
	3.00 - 3.33	30	28.6
	3.43 - 3.67	19	18.1
	3.68 - 4.00	10	9.5
	Semester 1 (Tiada HPNM)	21	20.0
Kerap menggunakan teknologi *Artificial Intelligence* (A.I)?	Jarang	23	21.9
	Kadang-kadang	44	41.9
	Sangat kerap	9	8.6
	Sentiasa	21	20.0
	Tidak pernah	8	7.6

Responden kajian ini adalah daripada jabatan Kejuruteraan Elektrik dan Elektronik. Majoriti pelajar adalah lelaki (80%) berbanding wanita (20%). Majoriti pelajar adalah daripada semester ketiga (27.6%) dan keempat (32.4%). Dari segi program, majoriti pelajar (62.9%) mengambil bahagian dalam program Diploma Kejuruteraan Elektrik & Elektronik. Pencapaian akademik (HPNM) menunjukkan majoriti pelajar memperoleh purata mata gred (GPA) antara 2.00 - 2.99 (22.9%) dan 3.00 - 3.33 (28.6%). Dari segi penggunaan teknologi AI, 41.9% pelajar menggunakannya kadangkala, manakala 20% menggunakannya secara berterusan dan 21.9% jarang menggunakannya. Hanya sebilangan kecil (7.6%) yang tidak pernah menggunakan teknologi AI.

b) Analisis Faktor Kebergantungan Kecerdasan Buatan (AI)

Jadual 2: Faktor Kebergantungan Kecerdasan Buatan (AI)

Item	Min	S.P	Tahap
1. AI membantu pembelajaran kendiri	4.000	1.010	Tinggi
2. AI membantu mencari bahan pembelajaran	4.143[1]	0.945	Tinggi
3. AI menjawab soalan dengan serta-merta	3.981	1.019	Sederhana
4. AI dapat menjawab soalan-soalan yang ditanya	3.971	0.945	Sederhana
5. AI memberikan saya maklum balas yang cepat	4.086[3]	0.982	Tinggi
6. Pembelajaran dengan AI seperti VR dan AR membolehkan belajar dengan *gamifikasi*	3.657	1.099	Sederhana
7. AI memberikan persekitaran pembelajaran menarik	3.819	1.072	Sederhana
8. AI boleh meningkatkan motivasi belajar	3.848	1.036	Sederhana
9. Menggunakan AI untuk membantu menjana idea baru	4.067[4]	0.963	Tinggi
10. AI menjana bahan pembelajaran yang kreatif	4.029[5]	0.965	Tinggi
11. AI sebagai sumber pembelajaran tambahan	3.943	1.008	Sederhana
12. AI membantu menganalisis data	4.067[4]	0.943	Tinggi
13. Menggunakan AI adalah percuma	4.124[2]	0.997	Tinggi
14. AI jarang memberikan maklumat yang salah	3.552	1.126	Sederhana
15. Pembelajaran dengan AI dapat menjimatkan masa pembelajaran	4.010	0.985	Tinggi
16. Menggunakan AI mengurangkan kos pembelajaran	4.000	1.000	Tinggi
17. AI meningkatkan kualiti pembelajaran	3.876	1.089	Sederhana

18. Platform AI menyediakan pembelajaran 24 jam	4.000	1.047	Tinggi
19. AI boleh menggantikan pensyarah	3.048	1.490	Sederhana
20. AI membantu memahami subjek yang sukar	3.819	1.099	Sederhana
Purata	*3.902*	*1.041*	*Sederhana*

Nota: [1]Min tertinggi; [2]Min kedua tertinggi; [3]Min ketiga tertinggi, [4]Min keempat tertinggi, [5]Min kelima tertinggi

Kajian mengenai penggunaan teknologi Artificial Intelligence (AI) dalam kalangan pelajar menunjukkan bahawa AI sangat membantu dalam proses pembelajaran mereka. Tiga faktor utama kebergantungan penggunaan AI adalah seperti yang ditunjukkan dalam Jadual 2. Faktor pertama menunjukkan dapatan purata skor 4.143 iaitu peranan AI dalam membantu mencari bahan pembelajaran, menunjukkan bahawa AI sangat berkesan dalam menyediakan sumber yang diperlukan. Faktor kedua min 4.124, menunjukkan AI juga menyediakan kemudahan penggunaan secara percuma, menunjukkan akses yang mudah dan tanpa kos menjadi faktor penting. Manakala faktor ketiga min 4.086, AI memberikan maklum balas yang cepat, menegaskan kepentingan AI dalam mempercepatkan proses pembelajaran dan memberikan respon segera kepada pelajar.

Selain daripada tiga faktor utama terdapat tiga lagi faktor lain yang menduduki lima tempat teratas jawapan pelajar boleh dipertimbangkan atau diambil kira sebagai antara faktor yang menyumbang kebergantungan pelajar terhadap kecerdasan buatan atau AI. Faktor-faktor tersebut adalah menggunakan AI untuk membantu menjana idea baru mendapat 4.607 skor berkongsi dengan faktor AI membantu menganalisis data. Pelajar menyedari bahawa aplikasi AI dapat membantu mereka untuk menjana idea-idea baru dalam menyiapkan tugasan mereka. Mereka juga merasakan bahawa AI dapat membantu mereka untuk menganalisis data. Ini sudah tentunya amat memudahkan para pelajar dan dapat menjimatkan masa mereka untuk menyelesaikan tugasan yang melibatkan analisis data. Penggunaan AI sebagai alat bantu yang dapat menjana bahan pembelajaran yang kreatif adalah min kelima tertinggi dengan skor 4.029. Seperti yang kita tahu terdapat pelbagai jenis aplikasi AI yang begitu mudah didapati secara online. Aplikasi-aplikasi AI ini sudah tentunya dapat merangsang daya pemikiran dan motivasi pelajar didalam pembelajaran mereka.

Pembelajaran dengan AI dapat menjimatkan masa pembelajaran adalah faktor keenam yang menjadi pilihan pelajar sebagai faktor yang menyebabkan kebergantungan mereka terhadap AI. Faktor ini mendapat skor sebanyak 4.010. Aplikasi AI contohnya ChatGPT sememangnya dapat memberi respon dalam masa yang sangat singkat, ini semestinya dapat menjimatkan masa kepada pelajar. Malahan respon atau jawapan yang diberikan oleh aplikasi AI ini melebihi ekspektasi yang mungkin difikirkan oleh pengguna.

5. Perbincangan dan Kesimpulan

Pada era digital ini, seperti yang semua sedia maklum penggunaan AI dalam kehidupan seharian menjadi sesuatu yang tidak dapat dielakkan. Teknologi ini pada masa kini semakin hebat diperkatakan di mana -mana. Terdapat pihak yang mungkin kerana tidak mengetahui ataupun mungkin tidak memahami tanpa sedar juga menggunakan perkhidmatan AI. Kajian ini menjuruskan kepada penggunaan AI oleh para pelajar di Jabatan Kejuruteraan Elektrik. Seperti yang telah dibincangkan sebahagiannya di bahagian pengenalan dan sorota n kajian mengatakan bahawa walaupun AI ini adalah sesuatu yang baik namun jika tidak terkawal juga memberi kesan yang kurang baik kepada pengguna ataupun mungkin juga kepada sesuatu sistem. Kebergantungan yang berlebihan terhadap AI ini boleh mengurangkan kreativiti dan penaakulan kepada pengguna. Bagi kajian ini terdapat 20 soalan yang telah digubal untuk menentukan faktor-faktor yang menyebabkan pelajar-pelajar di Jabatan Kejuruteraan Elektrik terdorong untuk menggunakan perkhidmatan AI.

Kajian ini secara umumnya berdasarkan kepada objektif yang telah ditetapkan menunjukan hasil yang signifikan dengan senario semasa. Melihat kepada gaya pembelajaran pelajar dan ketika menyiapkan tugasan-tugasan yang diberikan dapat dilihat hasil kerja yang lebih baik dan terdapat idea-idea baru yang jelas dari sumber-sumber seperti AI. Hasil daripada kajian membuktikan kecenderungan pelajar untuk menggunakan AI adalah tinggi. Mereka mengetahui bahawa AI sangat berkesan dalam membantu mereka menyediakan sumber-sumber yang diperlukan. Oleh kerana sangat mudah untuk mengakses aplikasi AI di samping kos yang hampir tiada kecuali talian internet maka ia menjadi pilihan utama kepada pelajar sebagai platform dalam pembelajaran mereka.

Hasil kajian mendapati bahawa hanya 20% daripada 105 sampel pelajar Jabatan Kejuruteraan Elektrik yang menggunakan AI secara berterusan, manakala 49.1% pelajar menggunakan secara kadang-kala. Ini menunjukkan bahawa tahap kebergantungan pelajar terhadap AI berada pada tahap yang terkawal. Para pelajar tidak terlalu bergantung kepada aplikasi AI. Walau bagaimanapun kajian ini menunjukkan bahawa tahap

kesedaran dan pengetahuan pelajar terhadap AI masih berada pada tahap perlu ditingkatkan. Kesedaran pelajar terhadapp aplikasi-aplikasi AI yang terdapat di dalam talian masih agak rendah. Ini di dapat diketahui apabila melihat kecenderungan pelajar yang majoriti hanya mengetahui dan menggunakan hanya beberapa aplikasi AI seperti ChatGPT, QuillBot, WriteLab dan beberapa yang lain. Hasil kajian menunjukkan tiga faktor utama yang menyumbang kepada kebergantungan penggunaan aplikasi AI adalah seperti yang dibincangkan di bahagian analisis hasil kajian. Walaupun didapati bahawa tiga faktor itu sangat mempengaruhi kebergantungan pelajar namun tahap adalah masih terkawal dan tidak memberikan implikasi yang tidak baik malahan meningkatkan motivasi pelajar dan dapat mempelbagaikan gaya pembelajaran mereka.

Pelaksanaan kajian adalah sesuatu yang wajar untuk dilaksanakan agar pihak-pihak yang terlibat dapat melihat bagaimana perlunya untuk meningkatkan akses pelajar kepada talian internet di samping melihat keperluan meningkatkan kemudahan ICT agar tiada pelajar yang tercicir daripada menikmati teknologi- teknologi baru seperti AI. Tidak dapat dinafikan dalam era serba moden ini dengan pepatah dunia dihujung jari masih ada insan-insan yang tidak mengetahui tentang AI. Hasil kajian ini telah membuktikan masih terdapat walau sebilangan kecil yang tidak pernah menggunakan teknologi ataupun aplikasi AI.

Kajian seperti ini perlu di perbanyakkan lagi dengan memperluaskan sampel kepada jabatan-jabatan yang lain agar dapat mengetahui dengan lebih baik tentang tahap kebergantungan pelajar terhadap kecerdasan buatan. Kajian terhadap faktor-faktor yang menyebabkan pelajar tidak menggunakan teknologi kecergasan buatan juga boleh dilakukan, memandangkan pihak kerajaan juga sangat menggalakkan penggunaan teknologi kecerdasan buatan di samping kebanyakan teknologi baru telah mengadaptasikan penggunaan teknologi AI dalam sistem mahupun peralatan.

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POLITEKNIK KOTA KINABALU

Kesan Keterlibatan Atlet Sepaktakraw Terhadap Prestasi Akademik - Varsity Sepak Takraw League 2024 Sirkit 2

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Abstrak

Tujuan kajian ini adalah untuk melihat kesan penglibatan pelajar dalam sukan sepak takraw di peringkat institusi pengajian tinggi di Malaysia menerusi Kejohanan Varsity Sepaktakraw League 2024 Sirkit 2 terhadap prestasi akademik mereka. Kertas kerja ini bertujuan untuk menentukan sama ada penyertaan dalam sukan sepaktakraw memberi manfaat kepada seseorang pelajar atau jika kelemahannya lebih besar daripada kelebihannya. Walaupun beberapa kajian telah menunjukkan bahawa pelajar yang mengambil bahagian dalam aktiviti sukan menunjukkan prestasi yang lebih baik di pusat pengajian berbanding mereka yang tidak, tidak jelas sama ada dapatan tersebut adalah hasil prestasi akademik yang positif, atau disebabkan oleh pengaruh yang tidak dapat diperhatikan. Dalam kajian ini, lebih daripada 50 atlet yang terdiri daripada pelajar mewakili IPT yang berbeza telah melengkapkan tinjauan pada Mei 2024 untuk menentukan kesan penglibatan mereka dalam sukan sepaktakraw terhadap prestasi akademik. Kajian ini mendapati bahawa penyertaan dalam sukan sepaktakraw tidak memberikan kesan negative terhadap prestasi akademik atlet. Malahan didapati bahawa atlet-atlet ini menunjukkan prestasi yang lebih baik di dalam bilik darjah, menguruskan kemahiran pengurusan masa yang baik, berasa bermotivasi untuk menyelesaikannya pengajian mereka, bermotivasi untuk menghadiri kelas, dan mengalami peralihan yang lebih lancar dalam gaya hidup sebagai pelajar. Keputusan kami hanya memberikan bukti terhad bahawa penyertaan pelajar dalam sukan sepaktakraw membawa kepada peningkatan prestasi akademik.

Keywords: sepak takraw, akademik, atlet.

1. Pendahuluan

Terdapat 100 atlet yang bersaing dalam Kejohanan Varsity Sepaktakraw League 2024 Sirkit 2 di Universiti Malaysia Pahang, Pekan. Tujuan kajian ini adalah untuk mengkaji kesan penglibatan dalam sukan sepaktakraw di peringkat Institusi Pengajian Tinggi. Kertas kerja ini bertujuan untuk menentukan sama ada penyertaan dalam sukan sepaktakraw bermanfaat kepada seseorang atau jika kelemahannya melebihi kelebihannya. Tujuh puluh tujuh (77) atlet pelajar menyelesaikan tinjauan pada bulan Mei 2024 untuk menentukan kesan penglibatan dalam sukan sepaktakraw di IPT. Kajian ini mendapati bahawa penyertaan dalam sukan sepaktakraw sangat bermanfaat. Atlet ini menunjukkan prestasi yang lebih baik di dalam bilik darjah, membangunkan kemahiran pengurusan masa yang mengagumkan, berasa bermotivasi untuk menamatkan pengajian mereka, bermotivasi untuk menghadiri kelas, dan mengalami peralihan yang lebih lancar ke dalam gaya hidup kolej mahupun di universiti.

Seorang pelajar yang berstatus atlet mesti memenuhi dua tanggungjawab sebagai pelajar dan sebagai atlet (Gomez et al., 2018). Akibatnya, mereka mempunyai masa lapang yang kurang kerana mereka perlu menghadiri kelas, sesi latihan dan pertandingan. Ini memerlukan tenaga dan keazaman untuk berjaya. Oleh itu, pada satu ketika mereka juga dipanggil sebagai atlet sarjana untuk mentakrifkan pelajar yang ingin membangunkan pendekatan pendidikan yang luas dan holistik dan komited untuk berjaya prestasi sukan peringkat tinggi (Cross & Fouke, 2019). Sebaliknya, kelebihan menjadi pelajar dan atlet yang bersaing di peringkat kebangsaan atau antarabangsa, mereka menerima sokongan kewangan dan perkhidmatan daripada institusi pengajian tinggi (Gomez et al., 2018). Oleh itu, dalam konteks kajian ini, atlet yang terdiri dalam kalangan pelajar boleh ditakrifkan sebagai pelajar berdaftar sepenuh masa yang merupakan wakil di mana - mana institusi pengajian tinggi di Malaysia.

Oleh kerana dua tanggungjawab sebagai atlet dan pelajar, situasi ini boleh mencabar mereka untuk mengimbangi masa mereka antara bilik darjah dan sesi latihan. Umum mengetahui bahawa tujuan pengajian tinggi adalah untuk kecemerlangan akademik dan menyediakan generasi akan datang serta menggalakkan pelajar membina sahsiah untuk menjadi pemimpin masa depan negara. Berdasarkan Teori Penentuan Diri (TPD) oleh Rayn dan Deci (2000), motivasi dan personaliti menyerlahkan bahagian penting manusia untuk berjaya. TPD biasanya dikaitkan dengan pencapaian dan bantuan kejayaan untuk individu. Oleh itu, motivasi dan personaliti atlet yang juga pelajar perlu meningkatkan kejayaan penyertaan akademik dan sukan.

Satu kajian terdahulu oleh Pascarella, Bohr, Nora, dan Terenzini (1995) mendapati bahawa atlet kolej

sememangnya menderita di dalam bilik darjah dan dalam pengetahuan kognitif berbanding rakan sebaya mereka. Sebaliknya, kajian mengiktiraf positif penglibatan olahraga, seperti peningkatan pengurusan masa, kepuasan dengan sekolah, dan pengakuan bahawa hasil positif mungkin melebihi hasil negatif (Maloney & McCormick, 1993; Byrd & Ross, 1991; Pascarella, Truckenmiller & Terenzini, 1999). Tujuan kajian ini adalah untuk mengkaji kesan penglibatan dalam olahraga di peringkat kolej di South Dakota State University.

2. Kajian Literature

Penyelidikan terdahulu tidak bersetuju bahawa mengambil bahagian dalam sukan akan meninggalkan kesan negatif terhadap prestasi akademik (Routon & Walker, 2015; Muñoz-Bullon et al., 2017; Schultz, 2017; Guo et al., 2019). Seperti yang dinyatakan oleh Robst & Keil (2000), penglibatan dalam sukan menghalang kebolehan pelajar untuk berprestasi baik di dalam bilik darjah kerana komitmen latihan dan perjalanan yang memakan masa dan tenaga. Oleh itu, penyelidik mula terlibat dalam perdebatan mengenai kesan penglibatan atlet pelajar dalam sukan terhadap kejayaan akademik mereka (Guo et al., 2019; Yarkwah & Agyei, 2020).

Masa latihan dan persediaan untuk menyertai kejohanan sudah pasti membuatkan pelajar meninggalkan seketika pelajaran mereka. Maloney dan McCormick (1993) menjalankan kajian di Universiti Clemson terhadap 595 atlet pelajar dalam penentuan mencari kesan olahraga terhadap kejayaan akademik. Mereka mendapati bahawa dari segi akademik, atlet melakukan tiga persepuluh mata gred lebih buruk daripada pelajar biasa dalam tiga daripada 10 kelas. Mereka juga mendapati atlet dalam sukan ketinggalan di belakang rakan sebaya mereka. Atlet dalam bola sepak dan bola keranjang melakukan satu persepuluh daripada mata gred lebih buruk daripada atlet pelajar mereka (Maloney & McCormick, 1993). Kebimbangan terhadap pelajar yang bergiat aktif dalam sukan adalah tinggi dengan cadangan bahawa sukan utama ini tidak memberi masa untuk atlet mereka menjadi pelajar. Sesetengah orang juga menyuarakan pendapat mereka bahawa atlet ini adalah pekerja jabatan olahraga (Feezell, 2001).

Sebaliknya, ramai orang percaya bahawa penyertaan dalam sukan positif melebihi negatif. Kajian telah menunjukkan bahawa penyertaan mempunyai kesan positif terhadap pembelajaran dan pembangunan (Bonfiglio, 2011). Bersaing di peringkat kolej mengakibatkan kehilangan masa kelas yang besar, tetapi apabila mereka tidak keluar beraktiviti, atlet menghadiri kelas untuk akhirnya kekal meneruskan aktiviti sukan yang mereka gemari. Penglibatan sukan menggalakkan penggunaan masa yang lebih cekap dan motivasi yang lebih tinggi untuk cemerlang dalam usaha pendidikan yang berbeza (Byrd & Ross, 1991). Kemahiran pengurusan masa adalah penting untuk pekerjaan dan usaha masa depan. Walaupun sesetengah atlet terkandas dalam akademik, ibu bapa masih terus melihat sukan sebagai penglibatan positif untuk anak-anak mereka. Byrd dan Ross (1991) menjalankan tinjauan kedua terhadap ibu bapa, pengetua, guru dan jurulatih 379 atlet pelajar Tennessee dan apa yang mereka percaya sebagai pengaruh penyertaan dalam sukan. Kajian mendapati bahawa lima faktor teratas mengapa ibu bapa memilih untuk mendaftarkan anak-anak mereka dalam sukan ialah: meningkatkan identiti sekolah, menarik sokongan masyarakat, mengurangkan prasangka kaum, menggalakkan kecergasan fizikal dan penyertaan yang sihat, dan meningkatkan pendapatan. Melalui penglibatan sukan, atlet ini dapat bertemu orang baharu daripada latar belakang yang berbeza, terlibat dengan komuniti mereka, mewujudkan rasa bangga untuk sekolah mereka, dan menjalani gaya hidup yang boleh diterima secara fizikal (Byrd & Ross, 1991).

Menurut Allen, (1997), bergiat aktif dalam sukan berpasukan merupakan salah satu faktor yang mempengaruhi pencapaian akademik atlet universiti, selain daripada faktor seperti tingkah laku ibu bapa dan ahli fakulti akademik. Allen (1997) juga mencadangkan sub budaya sesebuah pasukan dipengaruhi oleh tingkah laku jurulatih dan rakan sepasukan dan ini memberi kesan kepada pencapaian akademik sepanjang pendidikan universiti mereka, atlet universiti akan didedahkan kepada pelbagai budaya dan gaya hidup di kampus yang boleh menjejaskan pencapaian akademik mereka. Budaya mereka akan berkembang apabila mereka bersosial dengan rakan sebaya, jurulatih, pensyarah, kakitangan universiti dan ahli fakulti, serta kaunselor akademik dan dengan orang lain dalam komuniti universiti dari tahun pertama mereka sehingga mereka menamatkan pengajian dari universiti.

3. Metedologi

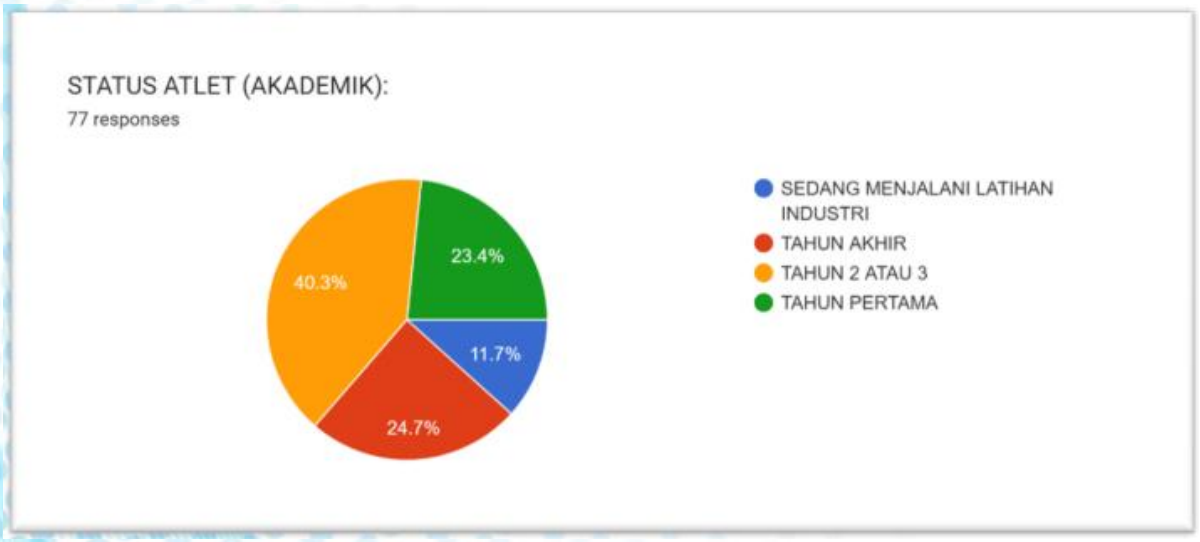
Usaha untuk menggalakan sukan dalam kalangan atlet Institusi Pendidikan Tinggi (IPT) telah menimbulkan persoalan sama ada atlet IPT boleh mencapai tahap akademik yang sama seperti pelajar universiti luar negara. Kebanyakan penyelidikan mendapati bahawa atlet universiti memperoleh gred yang lebih rendah berbanding bukan atlet (Sack, 1987-88; Adler & Adler, 1985). Walau bagaimanapun, terdapat penyelidik lain (Henschen & Fry, 1884; Shapiro, 1984) yang telah memperolehi penemuan sebaliknya, yang mana menunjukkan bahawa atlet IPT mencapai keputusan akademik yang lebih baik berbanding bukan atlet, manakala kumpulan ketiga penyelidik (Hanks & Eckland, 1976; Stuart, 1985) mendapati tiada perbezaan

dalam gred purata dalam kalangan atlet universiti dan bukan atlet. Perbezaan penemuan terdahulu perlu dikaji lebih lanjut bagi menganalisis isu pencapaian akademik atlet universiti. Penyelidikan ini dijalankan untuk menentukan kesan keterlibatan atlet sepaktakraw terhadap prestasi akademik terhadap pelajar yang mennyartai Varsity Sepaktakraw League 2024.

Dalam konteks atlet pelajar yang menyertai VSL Sirkit 2 Tahun 2024 di UMP Pekan Pahang ini, tahap penyertaan sukan dalam sepaktakraw ini terdiri daripada pertandingan Seoaktakraw secara liga yang dilaksanakan secara tiga sirkit dan satu Grand Final. Setiap peringkat penyertaan memerlukan permintaan yang berbeza untuk masa dan tenaga dalam latihan dan pertandingan. Bagi atlet ini latihan sangat penting kerana mereka dikehendaki mengikut jadual latihan. Permintaan untuk latihan di kalangan atlet pelajar di peringkat negeri, universiti, kelab dan kolej secara relatifnya lebih rendah berbanding atlet pelajar peringkat kebangsaan (Schultz, 2017). Atlet-atlet ini hanya perlu menghadiri latihan berpusat apabila terdapat pertandingan. Selalunya, mereka tidak mempunyai sebarang latihan dan pertandingan tetap sepanjang tahun. Walau bagaimanapun, setiap atlet pelajar tanpa mengira tahap penyertaan sukan telah terlibat dalam sukan semasa perjalanan akademik mereka. Oleh itu, kajian ini berpendapat bahawa tidak ada perbezaan dalam kejayaan akademik tanpa mengira tahap penglibatan sukan. Selain itu, objektif kajian ini adalah untuk mengkaji pengaruh tahap penyertaan atlet sepaktakraw di IPT terhadap kejayaan akademik di kalangan atlet yang berstatus pelajar.

Penyelidikan dijalankan melalui tinjauan 16 soalan dan 77 daripada 108 orang atlet yang meyertai Varsity Sepaktakraw League Sirkit 2 ,2024 telah menjawab melalui *link google form* yang dikongsikan menerusi pengurus setiap pasukan IPT yang menyertai. Semua peserta sangat memberi kerjasama. Kadar respon tinjauan itu adalah 71% Dua soalan pertama tinjauan itu ialah soalan umum dan demografi yang digunakan untuk mengenal pasti ciri-ciri kumpulan secara keseluruhan. Kedua-dua soalan demografi ini adalah pertanyaan tentang jantina dan status pendidikan. 14 soalan yang diikuti berkaitan secara langsung dengan soalan kajian tentang kesan penyertaan dalam sukan sepaktakraw dan semuanya menggunakan beberapa jenis skala Likert untuk menentukan kadar maklumbalas. Soalan pertama menetapkan sama ada kemahiran pengurusan masa telah terjejas oleh penglibatan peserta dalam sukan sepaktakraw. Dua soalan berikut wujud untuk membandingkan jumlah masa yang ditumpukan oleh atlet untuk komitmen sukan sepaktakraw dan akademik. Dua soalan seterusnya bertujuan untuk menentukan kepercayaan atlet tentang gred mereka. Kedua- dua soalan ini bertujuan untuk menentukan kedudukan gred mereka tanpa penglibatan dalam sepaktakraw dan jika mereka akan terus mengambil bahagian dalam sepaktakraw jika penyertaan ini mengakibatkan gred yang lebih teruk daripada pelajar biasa. Tiga soalan berikut berkaitan dengan sokongan akademik

4. Dapatan dan Analisa Kajian



Rajah 1: Status pengajian atlet

Hasil dari borang soal selidik yang diedar melalui Google Form, seperti di Rajah 1, didapati kira-kira 40.3% atau 31 orang atlet sepaktakraw yang menyertai Varsity Sepaktakraw League Sirkit 2 ini adalah merupakan pelajar tahun 2 atau tahun 3 di institusi pegajian tinggi masing-masing. Manakala 24% iaitu 19 orang merupakan pelajar tahun akhir dan 23.4% atau 18 orang merupakan pelajar tahun pertama. Seramai 9 orang atau 11.7% merupakan pelajar yang sedang menjalani latihan industri.

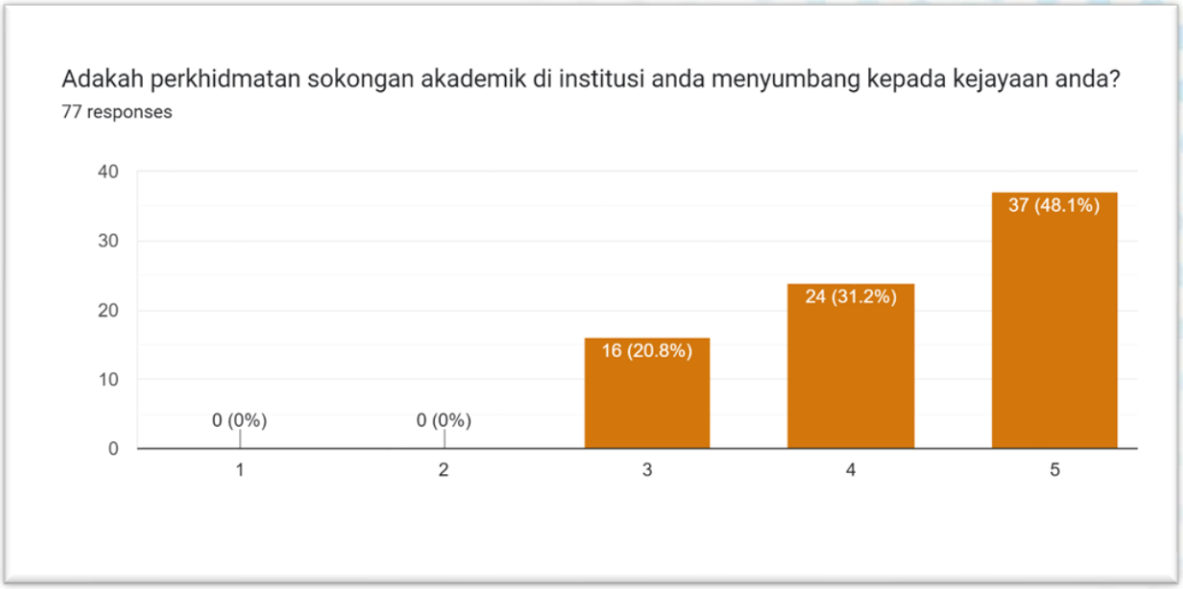
Rajah 2: Kesanggupan melibatkan diri dalam sukan sepaktakraw

Berdasarkan dapatan kajian ini melalui soal selidik yang dijalankan seperti yang ditunjukan pada Rajah 2, hampir 28 orang (36.4%) pemain sepaktakraw yang mewakili institusi pengajian masing-masing menyatakan keinginan untuk meneruskan penglibatan mereka dalam sukan ini walaupun sekiranya dapatan kajian ini dapat membuktikan keterlibatan mereka dalam sukan sepaktakraw akan memberi kesan negatif kepada prestasi akademik mereka. Ini menggambarkan bahawa pada pandangan mereka, impak negatif terhadap prestasi akademik hasil daripada keaktifan mereka terhadap sukan sepaktakraw tidak memberi kesan terhadap penglibatan golongan ini terhadap sukan sepaktakraw.

Rajah 3: Pengurusan masa yang baik

Bagi persoalan dengan penglibatan pelajar-pelajar ini terhadap sukan sepaktakraw telah membantu mereka

mengembangkan kemahiran pengurusan masa yang lebih baik, Berdasarkan Rajah 3, 51 orang daripada 77 responden (66.2%) menyatakan mereka sangat setuju bahawa penglibatan mereka dengan sukan sepaktakraw ini membantu mereka mengembangkan lagi kemahiran pengurusan masa yang lebih baik.



Rajah 4 : Sumbangan perkhidmatan sokongan akademik

Rajah 4 menunjukan seramai 61 orang atlet sepaktakraw daripada 77 orang responden iaitu hampir 80% , menyatakan setuju dan sangat setuju bahawa perkhidmatan sokongan akademik di institusi menyumbang kepada kejayaan mereka sama ada dalam bidang akademik mahupun sukan sepaktakraw yang mereka ceburi.

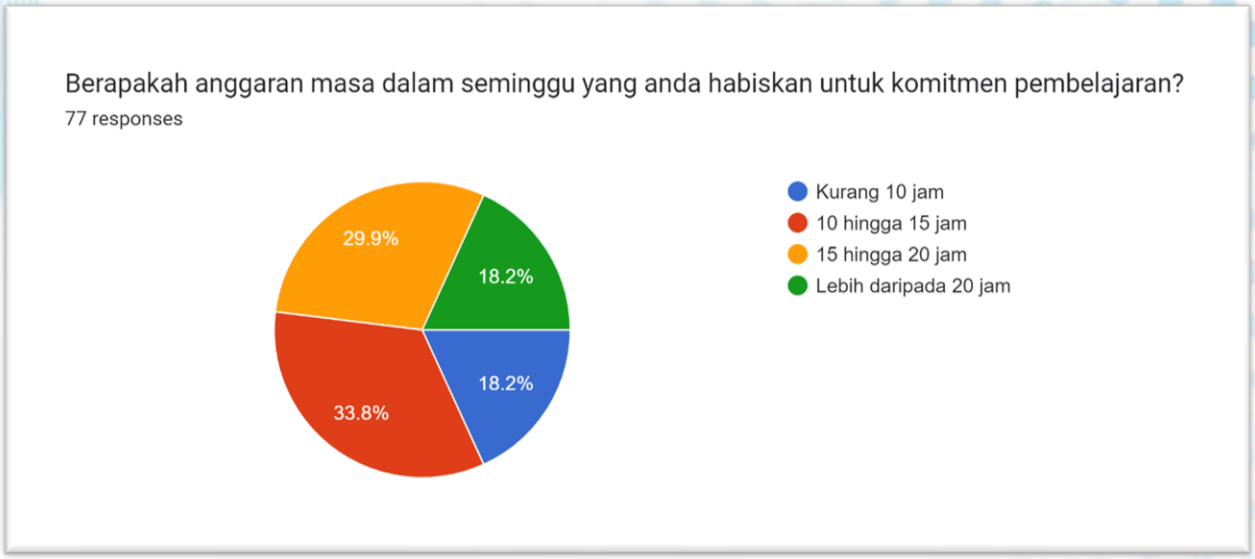
Rajah 5: Motivasi kehadiran ke kelas

Rajah 5 menunjukan bahawa 50 orang pelajar (59%) menyatakan setuju dan sangat setuju bahawa penglibatan mereka dalam sukan mempengaruhi motivasi mereka untuk hadir ke kelas. Manakala hanya 7 orang yang menyatakan sangat tidak setuju sukan memberikan motivasi kepada mereka untuk hadir ke kelas. Manakala Rajah 6 menunjukan 61 orang responden menyatakan penglibatan dalam sukan ini menjadikan kehidupan mereka sebagai pelajar lebih mudah.

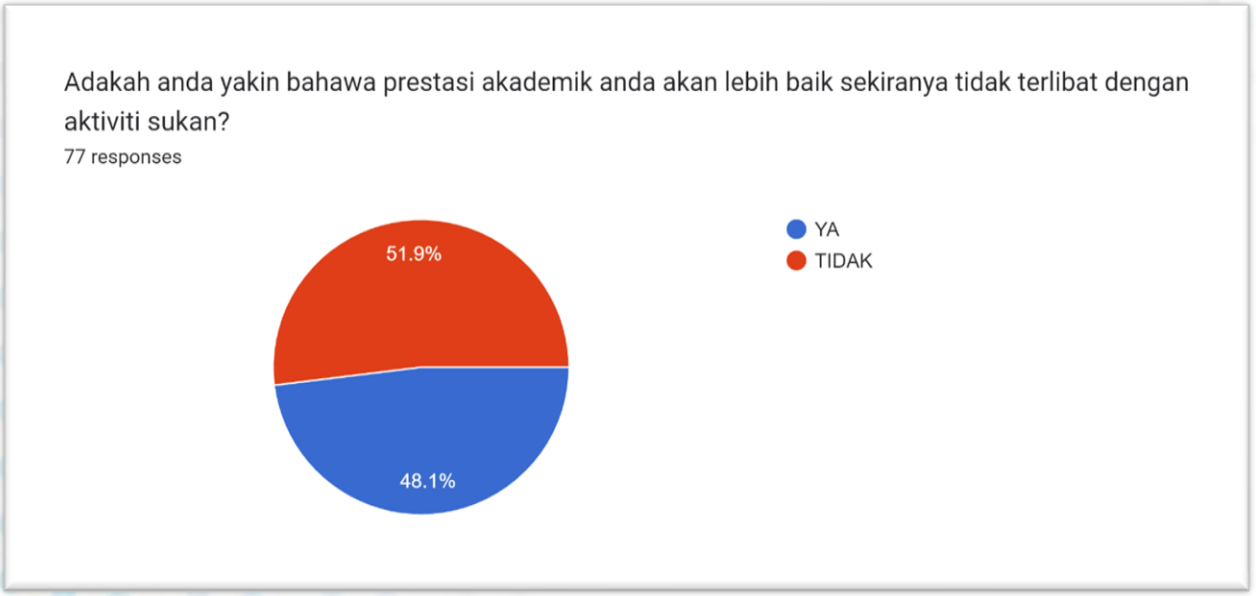
Rajah 6 : Penglibatan Sukan menjadikan kehidupan pelajar lebih mudah

Rajah 7 : Masa untuk sukan dalam seminggu

Rata-rata pelajar menghabiskan masa bawah 15 jam dalam seminggu untuk aktiviti Latihan dalam sukan mereka. Ini dibuktikan daripada hasil soal selidik yang dijalankan, dalam Rajah 6 menunjukan bahawa 80.1 % atau 61 orang pelajar memperuntukan maksimum 15 jam masa untuk Latihan dalam sukan manakala hanya 9.1% responden memperuntukan masa melebihi 20 jam dalam seminggu untuk altiviti sukan mereka. Ini berbeza dengan komitmen atau masa yang diluangkan untuk pelajaran seperti yang ditunjukan dalam Rajah 8. Sebanyak 63.7% atau hampir 50 orang memperuntukan masa untuk pembelajaran mereka lebih 10 jam dan maksimum 20 jam. Manakala 18.2% menggunakan lebih 20 jam masa mereka untuk pelajaran.



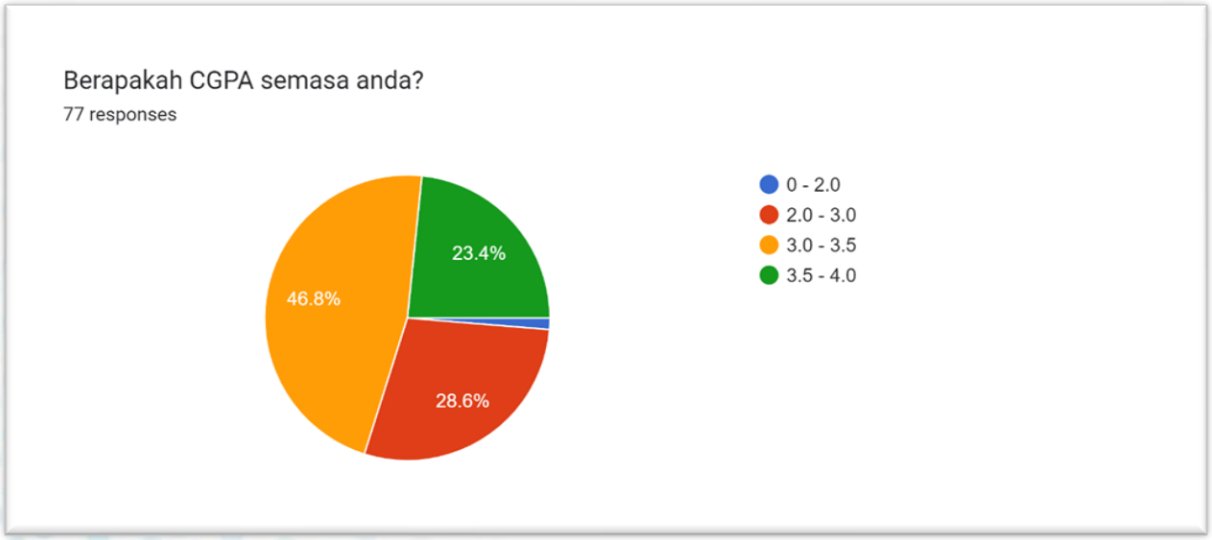
Rajah 8: Masa untuk komitmen pembelajaran



Rajah 9: Prestasi akademik dengan penglibatan sukan

Rajah 9 menunjukan bahawa 48.1% responden bersutuju bahawa prestasi akademik mereka akan lebih baik sekiranya tidak terlibat dengan sukan sepaktakraw , manakala 51.9% atau hampir 40 orang tidak bersetuju penglibatan mereka dalam sukan sepaktakraw ini memberi kesan yang tidak baik terhadap prestasi akademik mereka.

Rajah 10: Pilihan responden terhadap pelajaran atau sukan



Rajah 11: CGPA responden

Berdasarkan dapatan kajian ini, hampir 77.9% iaitu 60 orang pelajar akan memilih pelajaran atau akademik mereka berbanding sukan sekiranya kedua-duanya berlaku pada masa yang sama. Hal ini dapat dibuktikan lagi pada Rajah 11, walaupun mereka terlibat aktif dalam sukan 46.8% atlet sepaktakraw menvatatkan CGPA atas 3.0 dan 23.4% atas 3.5.

5. Kesimpulan

Berdasarkan dapatan kajian ini, penglibatan atlet sepaktakraw yang menyertai VSL Sirkit 2, 2024, tidak memberi kesan yang negatif terhadap pencapaian akademik mereka , malahan penglibatan dalam sukan dapat meningkat minat mereka untuk terus belajar. Keputusan dijalankan dalam usaha untuk menentukan positif dan negatif penglibatan dalam sukan sepaktakraw dari pandangan atlet pelajar. Untuk sebahagian besar, keputusan daripada atlet pelajar yang terlibat dgn VSL 2024 bersetuju dengan penyelidikan ilmiah ini bahawa penglibatan mereka dalam sukan ini tidak memberi kesan negatif terhadap pencapaian akademik mereka. Satu pendapat yang bercanggah melibatkan penyelidikan Maloney dan McCormick. Mereka mendapati bahawa atlet melakukan tiga persepuluh daripada mata gred lebih buruk daripada pelajar biasa setiap semester (Maloney, 1993). Di South Dakota State University, tinjauan ini mendapati bahawa atlet berprestasi lebih baik di sekolah daripada rakan sebaya mereka. Dapatan kajian menunjukkan bahawa terdapat gambaran yang

positif antara kepuasan dengan perkhidmatan sokongan akademik dan keyakinan dalam hala tuju kerjaya dan pengenalpastian kemahiran hidup (Burns et al, 2013). Keputusan ini konsisten dengan penyelidikan yang dijalankan oleh Byrd dan Ross dan menunjukkan beberapa positif yang terhasil daripada penglibatan dalam olahraga (Byrd & Ross, 1991). Pascarella et al (1999) mendapati korelasi positif mengenai penglibatan dalam olahraga dan kepuasan dengan keseluruhan pengalaman kolej, motivasi untuk menamatkan ijazah, t amat ijazah sarjana muda, dan kegigihan di kolej. Bukti juga ditemui daripada Pascarella et al untuk mencadangkan bahawa penyertaan dalam olahraga mempengaruhi pulangan yang positif semasa tahun pertama atlet pelajar di kolej.

7. Penghargaan

Kami ingin mengucapkan terima kasih kepada pihak penganjur Kejohanan Varsity Sepaktakraw League 2024 dan sokongan dari pengurus pasukan sepanjang proses kajian ini. Kami tidak akan mampu menyelesaikan kertas kajian ini, tanpa bantuan dan Kerjasama mereka. Kami juga ingin mengucapkan terima kasih kepada semua atlet yang meluangkan masa untuk membantu kami menjalankan kajian ini.

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POLITEKNIK KOTA KINABALU

Kesan Media Sosial Dalam Mempengaruhi Etika Komunikasi Pelajar

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Abstrak

Penggunaan media sosial yang meluas di kalangan pelajar membawa kepada pelbagai isu yang mempengaruhi etika komunikasi mereka. Antara isu utama adalah penurunan kualiti komunikasi secara bersemuka, di mana pelajar menjadi kurang mahir dalam membaca ekspresi wajah dan bahasa tubuh. Kajian ini bertujuan untuk mengenal pasti kesan media sosial terhadap etika pelajar dalam berkomunikasi. Responden kajian ini adalah terdiri daripada pelajar Politeknik Kota Kinabalu yang dipilih menggunakan teknik pensampelan rawak. Instrumen kajian yang digunakan adalah borang soal selidik berdasarkan skala jenis Likert 5-poin. Analisis data dijalankan menggunakan analisis deskriptif untuk memahami kesan penggunaan media sosial terhadap etika komunikasi pelajar. Secara keseluruhannya, hasil kajian menunjukkan bahawa media sosial memberikan kesan negatif terhadap etika komunikasi pelajar, namun pada tahap yang rendah. Dapatan ini menjelaskan bahawa majoriti pelajar masih memahami dan menunjukkan etika yang baik semasa berkomunikasi di media sosial. Kajian ini juga mendapati terdapat segelintir pelajar tidak mengetahui etika berkomunikasi di media sosial, ingin belajar memperbaiki etika komunikasi mereka, dan kadang-kala mereka menghantar pesanan yang saya hantar tidak difahami oleh orang lain. Kajian ini penting kepada institusi mahupun pensyarah untuk merangka pelan pembangunan modal insan dan program-program kerohanian yang bertujuan menerapkan nilai-nilai murni dalam kalangan pelajar bagi memastikan pelajar menggunakan media sosial secara bijak dan bertanggungjawab.

Kata kunci : media sosial, penggunaan, etika komunikasi, pelajar

1. Pengenalan

Teknologi hari ini telah banyak membantu kehidupan manusia termasuklah dalam aspek komunikasi. Teknologi meningkatkan proses komunikasi. Kemajuan dalam teknologi telah membawa kepada kemunculan banyak kaedah baru komunikasi elektronik, seperti laman web rangkaian sosial dan persidangan video. Peningkatan komunikasi elektronik telah membantu menghapuskan masa dan jarak sebagai halangan kepada komunikasi. Komunikasi pada masa kini menjadi cepat disebabkan munculnya teknologi. Platform media sosial Twitter, WhatsApp, Facebook, Instagram, Snapchat, dan lain-lain., adalah contoh bagaimana komunikasi telah berubah. Ia membolehkan orang ramai berhubung dengan sesiapa sahaja di seluruh dunia.

Namun begitu, selalunya berlaku, etika diabaikan semasa komunikasi melalui media sosial. Kes yang paling biasa muncul ialah banyak perkataan kesat semasa perbualan melalui rangkaian sosial, baik secara sengaja mahupun tidak sengaja. Keadaan ini dilihat sudah menjadi lumrah dan sebati dalam kehidupan hari ini untuk berkomunikasi di Internet menggunakan perkataan yang sopan dan betul. Fenomena semasa menunjukkan terdapat penurunan kesantunan komunikasi dalam kalangan pelajar (Julia et al., 2018). Ini didakwa disebabkan kehadiran dan penggunaan media komunikasi dalam bentuk media sosial, etika komunikasi tidak dijaga baik dengan rakan sebaya mahupun dengan pensyarah. Oleh itu, objektif kajian ini dijalankan adalah untuk mengenal pasti kesan media sosial terhadap etika pelajar dalam berkomunikasi. Kajian ini penting untuk merangka pelan pembangunan modal insan dan program-program kerohanian untuk penerapan nilai-nilai murni dalam kalangan pelajar. Sebagai institusi pengajian tinggi, bukan sahaja bertindak sebagai platform untuk mengeluarkan graduan untuk bekerja, tetapi juga melahirkan insan yang penuh dengan akhlah dan etika.

2. Objektif kajian

Kajian ini dijalankan adalah untuk mengenal pasti kesan media sosial terhadap etika dalam berkomunikasi dalam kalangan pelajar Politeknik Kota Kinabalu.

3. Sorotan kajian

Penggunaan media sosial dalam kalangan pelajar merupakan fenomena yang semakin berkembang dalam masyarakat kontemporari. Platform media sosial menawarkan mereka cara mudah untuk mengakses dan membangunkan rangkaian rakan, keluarga dan profesional yang berkaitan. Disamping itu, komuniti dalam talian yang diminati boleh didapati sesuai dengan minat hampir semua orang (Adenekan & Lala, 2022). Media sosial muncul melalui "bentuk komunikasi elektronik di mana pengguna mencipta komuniti dalam talian

untuk berkongsi maklumat, idea, mesej peribadi dan kandungan lain" (Amalia, 2020). Contoh media sosial termasuk blog, Twitter, LinkedIn, Wikipedia, YouTube, podcast, forum dalam talian dan Facebook serta WhatsApp, Instagram, LinkedIn, Imo, skype dan semua yang lain (Zawawi & Judi, 2022; Desiriyanti, 2019). Namun begitu, kehadiran media sosial dalam kehidupan seharian memberi kesan positif dan negatif kepada adab komunikasi (Kalaisilven & Sukimi, 2019). Kesan ini juga berlaku di persekitaran sekolah mahupun di dalam kampus (Julia et al., 2018). Kesan negatif kni kerana pelajar kebanyakan pelajar terikat rapat dengan media sosial, di mana media sosial menjadi rutin harian bagi kebanyakan pelajar sekolah menengah dan mahasiswa (Jingjing Gu, 2022). Kebanyakan mereka menggunakan media sosial adalah untuk hiburan dan bersantai (Destiana et al, 2013), kemudian adalah kerana sembang dan komunikasi (Yusof, 2018). Kajian oleh Turnip & Siahaan (2021), ramai mahasiswa hilang etika ketika berkomunikasi di media digital.

Media sosial telah menjadi platform utama komunikasi dalam kalangan pelajar, dan penggunaannya yang meluas memberikan kesan yang signifikan terhadap etika komunikasi mereka. Dalam kajian yang dilakukan oleh Hamid dan Rashid (2020), didapati bahawa media sosial seperti Facebook, Twitter, dan Instagram mempercepatkan proses penyebaran maklumat, namun pada masa yang sama mengurangkan tahap ketepatan dan etika dalam berkomunikasi. Mereka berpendapat bahawa sifat interaktif dan pantas media sosial menyebabkan pelajar sering terdedah kepada kesalahan komunikasi seperti penyebaran maklumat palsu dan bahasa yang tidak sesuai. Selain itu, kajian yang dijalankan oleh Ibrahim et al. (2021) menunjukkan bahawa wujudnya hubungan antara penggunaan media sosial yang kerap dengan penurunan tahap etika komunikasi dalam kalangan pelajar. Penyelidik mendapati bahawa pelajar yang sering berkomunikasi secara dalam talian cenderung untuk menggunakan bahasa yang kurang formal, tidak menitikberatkan aspek kesopanan, dan mudah terjebak dalam perdebatan yang negatif. Fenomena ini disokong oleh kajian yang dilakukan oleh Noor dan Aziz (2022), yang mendapati bahawa komunikasi di media sosial sering kali kurang dipandu oleh norma- norma tradisional, seperti rasa hormat dan kesantunan, disebabkan oleh anonimitas dan jarak sosial yang wujud dalam platform-platform tersebut.

Namun, tidak semua kesan media sosial terhadap etika komunikasi pelajar adalah negatif. Menurut kajian oleh Syed et al. (2023), media sosial juga membuka peluang untuk meningkatkan kesedaran pelajar terhadap isu-isu global dan meningkatkan kemahiran mereka dalam menyampaikan pandangan secara kritis dan beretika. Kajian ini menunjukkan bahawa platform seperti LinkedIn dan blog peribadi memberi ruang kepada pelajar untuk mengasah kemampuan komunikasi profesional mereka. Kesimpulan ini seiring dengan pandangan oleh Ghani dan Hashim (2019) yang menekankan bahawa etika komunikasi yang baik masih dapat diterapkan melalui bimbingan dan pendidikan yang berterusan mengenai penggunaan media sosial dengan bijak. Secara keseluruhannya, kajian-kajian ini mengesahkan bahawa media sosial mempunyai kesan dualisme terhadap etika komunikasi pelajar. Di satu sisi, ia menggalakkan komunikasi yang lebih terbuka dan luas, tetapi di sisi lain, ia memperkenalkan risiko terhadap kemerosotan etika, terutamanya apabila tiada kawalan atau pendidikan yang mencukupi. Maka, adalah penting untuk menerapkan pendekatan yang seimbang dalam penggunaan media sosial, dengan penekanan pada tanggungjawab etika dalam komunikasi pelajar masa kini.

4. Metodologi kajian

Kajian ini menggunakan kaedah tinjauan dengan pendekatan kualitatif. Bilangan sampel yang digunakan terdiri daripada 80 pelajar daripada Politeknik Kota Kinabalu yang sedang mengikuti pengajian peringkat Diploma. Kaedah tinjauan dengan pendekatan kualitatif sangat sesuai untuk kajian ini kerana ia menyediakan data yang mendalam tentang etika komunikasi pelajar dalam konteks penggunaan media sosial. Mereka terdiri daripada 40 wanita dan 40 lelaki. Sampel kajian terdiri daripada pelajar berusia 18 -20 tahun yang merupakan pengguna aktif media sosial, menjadikan mereka kumpulan sasaran yang relevan. Tinjauan telah dijalankan melalui Google Docs menggunakan skala Likert dan Gutman, dan soalan terbuka. Penggunaan skala Likert dan Gutman membantu mengukur persepsi responden dengan tepat, manakala soalan terbuka memberikan pandangan yang lebih terperinci. Dokumen Google ialah alat ciptaan tinjauan yang mudah digunakan dan tersedia secara percuma dengan pelbagai jenis soalan yang harus memenuhi keperluan kebanyakan pencipta tinjauan (Travis, 2010). Selain itu, penggunaan Google Docs memudahkan pengumpulan data dalam talian, manakala analisis deskriptif terhadap skor min membantu memahami tahap etika komunikasi pelajar. Item kajian adalah adaptasi dari kajian Zammit (2016). Data responden akan dianalisis secara deskriptif untuk mendapatkan nilai skor min. Penentuan tahap berdasarkan skor min seperti yang ditunjukkan dalam Jadual 1. Penentuan ini dipetik dalam kajian Ngadiman et al. (2019).

Jadual 1: Tafsiran Skor Min

Skor min	Tafsiran
1.00– 1.99	Lemah
2.00– 2.99	Rendah
3.00– 3.99	Sederhana
4.00– 5.00	Tinggi

5. Hasil kajian

5.1 Latar belakang responden

Jadual 2 merupakan maklumat responden daripada kalangan pelajar Politeknik Kota Kinabalu, Sabah. Responden terdiri daripada 50% pelajar lelaki dan 50% pelajar perempuan. Majoriti pelajar terdiri dari Jabatan Perdagangan (JP) (35.0%), diikuti oleh JKA (18.8%), JKM dan JPH (masing-masing 17.5%), dan JKE (11.3%). Sebahagian besar pelajar berada di semester 3 (31.3%), diikuti oleh semester 2 (22.5%), dan semester 1 (17.5%), dengan sedikit yang berada di semester 6 (3.8%). Dari sudut pencapaian akademik, kebanya kan pelajar memiliki HPNM antara 3.43 - 3.67 (27.5%), diikuti oleh mereka yang memperoleh HPNM antara 3.68 - 4.00 (22.5%), dan HPNM antara 3.00 - 3.33 (17.5%).

Jadual 2: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	40	50.0
	Perempuan	40	50.0
Jabatan	JKA	15	18.8
	JKE	9	11.3
	JKM	14	17.5
	JP	28	35.0
	JPH	14	17.5
Semester	1.00	14	17.5
	2.00	18	22.5
	3.00	25	31.3
	4.00	11	13.8
	5.00	9	11.3
	6.00	3	3.8
HPNM	2.00 - 2.99	12	15.0
	3.00 - 3.33	14	17.5
	3.43 - 3.67	22	27.5
	3.68 - 4.00	18	22.5
	Semester 1 (Tiada HPNM)	14	17.5

5.2 Hasil analisis

Hasil analisis dalam Jadual 3 menunjukkan tahap kekerapan pelajar mengikuti perbincangan dalam media sosial. Secara keseluruhannya adalah pada tahap sederhana. Aktiviti yang paling kerap dilakukan adalah responden kerap menonton video di media sosial (skor min tertinggi iaitu 3.950), diikuti oleh aktiviti melihat gambar di media sosial (min 3.900) dan kerap mengakses maklumat di media sosial (min 3.900). Semua item (aktiviti) ini menunjukkan bahawa pelajar sering terlibat dalam aktiviti media sosial, secara rutin dan harian.

Jadual 3: Analisis Kajian

Bil	Item kajian	Sisihan piawai	Skor Min	Tahap
	Kerap Anda Mengikuti Perbincangan Dalam Media Sosial			
1	Kerap berkomunikasi dengan rakan di media sosial	1.161	3.763	Sederhana
2	Kerap melihat gambar di media sosial	0.976	3.900[2]	Sederhana
3	Kerap mengakses maklumat di media sosial	1.165	3.900[3]	Sederhana
4	Kerap melihat status orang lain di media sosial	1.065	3.825	Sederhana
5	Kerap berkongsi sesuatu di media sosial	1.277	2.875	Rendah
6	Kerap bermain permainan online di media sosial	1.191	3.513	Sederhana
7	Kerap menonton video di media sosial	0.992	3.950[1]	Sederhana
8	Kerap membaca komen-komen di ruangan perbincangan di media sosial	0.986	3.875	Sederhana
	Purata		*3.700*	*Sederhana*
	Kesan Negatif Media Sosial Terhadap Komunikasi			
1	Saya rasa saya jarang bercakap dengan santun	1.067	2.338	Rendah
2	Saya rasa gunakan bahasa yang kurang sopan ketika berkomunikasi	0.995	2.150	Rendah
3	Saya rasa saya jarang menelefon atau menghantar mesej terlebih dahulu untuk menyatakan hasrat untuk berbincang	0.934	2.163	Rendah
4	Ketika berkomunikasi dalam talian, saya selalu tidak menghidupkan kamera	1.097	3.388[2]	Sederhana
5	Ketika perbincangan dalam talian, saya selalu terlupa menutup microfon apabila tidak bercakap	1.081	1.913	Lemah
6	Saya kerap menyampuk ketika orang lain sedang bercakap	1.018	1.950	Lemah
7	Saya kerap mencelah tanpa meminta izin untuk menyampaikan pendapat.	0.896	1.863	Lemah
8	Saya kerap meninggikan suara ketika bercakap	0.877	1.875	Lemah
9	Saya rasa saya kurang beretika ketika bercakap dengan pensyarah saya	0.887	1.813	Lemah
10	Saya rasa saya kurang beretika ketika bercakap dengan orang yang lebih tua dari saya	1.028	1.863	Lemah
11	Saya rasa saya perlu belajar beretika ketika berkomunikasi	1.146	3.450[1]	Sederhana

12	Kadang-kadang pesanan yang saya hantar tidak difahami oleh orang lain	1.175	3.013[3]	Sederhana
13	Saya kerap meninggikan suara apabila orang lain tidak menghiraukan saya bercakap	0.941	2.000	Rendah
14	Saya rasa saya selalu gunakan kata-kata kesat apabila berkomunikasi	1.018	2.025	Rendah
15	Saya rasa saya selalu gunakan kata-kata kotor atau lucah ketika berkomunikasi	0.951	1.738	Lemah
16	Saya jarang memulakan dengan ucapan salam ketika berkomunikasi di media sosial	1.025	2.250	Rendah
17	Saya jarang membalas pertanyaan orang lain di media sosial (seperti di whatsApps dll)	1.053	2.325	Rendah
18	Saya marah apabila orang tidak merespon pertanyaan saya di media sosial	1.097	2.613	Rendah
19	Saya kerap menukar topik pebualan yang sedang dibincangkan	1.019	2.113	Rendah
20	Saya kerap menulis singkatan perkataan yang sukar difahami	1.070	2.363	Rendah
21	Saya rasa saya pernah membuli di media sosial	1.034	1.913	Lemah
	Purata		*2.243*	*Rendah*

Nota: [1]Min tertinggi; [2]Min kedua tertinggi; [3]Min ketiga tertinggi

Sementara itu, hasil analisis mengenai kesan negatif media sosial terhadap komunikasi menunjukkan bahawa terdapat beberapa aspek yang memerlukan perhatian. Item pertama, iaitu "Saya rasa saya perlu belajar beretika ketika berkomunikasi," (skor min tertinggi iaitu 3.450), menunjukkan bahawa pelajar secara umumnya tidak mengetahui etika berkomunikasi di media sosial, justeru mereka ingin belajar memperbaiki etika mereka. Kemungkinan juga etika di media sosial tidak dipelajari secara formal di institusi. Item kedua, iaitu "Ketika berkomunikasi dalam talian, saya selalu tidak menghidupkan kamera," (skor min 3.388), menggambarkan kecenderungan untuk tidak menggunakan kamera semasa berkomunikasi yang mungkin digunakan semasa kelas dalam talian atau mengikuti mana-mana pembelajaran dalam talian. Manakala item ketiga iaitu "Kadang-kadang pesanan yang saya hantar tidak difahami oleh orang lain," (skor min 3.013), menandakan responden menghadapi kesulitan dalam penyampaian pesan di media secara jelas. Secara keseluruhan, kesan negatif atau masalah yang timbul akibat penggunaan media sosial dalam komunikasi adalah pada tahap sederhana dan rendah.

6. Kesimpulan

Secara kesimpulannya, hasil analisis mendapati media sosial memberikan kesan negatif terhadap etika komunikasi pelajar, tetapi pada tahap yang rendah. Ini kesan daripada kekerapan pelajar yang sering menggunakan media sosial untuk menonton video, melihat gambar dan mengakses maklumat. Oleh yang demikian, terdapat beberapa aspek yang perlu diperbaiki seperti elakkan penggunaan bahasa yang kurang sopan dan pastikan menyampaikan pesan dengan jelas. Dapatan kajian ini adalah penting untuk institusi pendidikan dan pensyarah dalam merangka pelan pembangunan modal insan serta program pembangunan diri untuk menerapkan nilai-nilai murni dan memastikan penggunaan media sosial yang bijak dan bertanggungjawab dalam kalangan pelajar.

Rentetan daripada hasil kajian yang diperolehi, terdapat beberapa cadangan penambahbaikan yang dapat membantu meningkatkan penggunaan media sosial dengan baik dalam komunikasi pelajar. Pertama, institusi pendidikan perlu menawarkan kursus atau bengkel khusus mengenai etika berkomunikasi di media sosial. Kedua, program pembangunan diri yang menekankan kepentingan komunikasi beretika perlu diperkenalkan. Ketiga, pensyarah dan pihak institusi perlu memainkan peranan aktif dalam membimbing pelajar untuk menggunakan media sosial secra positif dan sopan. Secara keseluruhannya, kajian ini menegaskan pentingnya kesedaran dan pendidikan tentang etika komunikasi dalam era digital, di mana media sosial menjadi platform utama interaksi di kalangan pelajar.

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POLITEKNIK KOTA KINABALU

Kecenderungan Pelajar Untuk Menghasilkan Aplikasi Berunsurkan Islam Dalam Projek Akhir Pelajar

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Abstrak

Penggunaan Internet sebagai medium menyebar dan menambahbaik ajaran dan amalan Islam semakin berleluasa sejak beberapa tahun kebelakangan ini umpamanya peranti mudahalih seperti telefon pintar, tablet dan lain-lain telahpun menjadi medium yang amat diperlukan dalam aktiviti harian setiap individu. Perkembangan kecanggihan serta penyebaran telefon pintar telah mewujudkan peluang baharu untuk pembangun aplikasi agama untuk membangunkan aplikasi yang akan menyediakan utiliti dan akses mudah kepada maklumat agama, namun di peringkat awal ia hanya melibatkan penilaian aplikasi Islam yang tersedia di *Google Play Store* serta tidak konsisten dan tidak mempunyai kategori agama. Oleh itu, ketiadaan kategori menyukarkan pengguna dan penyelidik untuk mencari aplikasi Islam yang mereka inginkan. Keadaan ini menunjukkan bahawa terdapat ruang yang besar untuk membina aplikasi yang sistematik dan lebih struktur. Oleh yang demikian, pembinaan aplikasi Islamik dilihat lebih sesuai dilaksanakan di projek akhir pelajar dengan objektif kajian dijalankan adalah untuk menilai tahap kecenderungan pelajar untuk menghasilkan aplikasi atau inovasi berunsurkan Islamik dalam projek akhir pelajar. Sampel kajian yang dipilih adalah pelajar Politenik Kota Kinabalu, Sabah dengan kajian kecenderungan ini penting untuk mengumpulkan data-data pelajar yang mempunyai minat terhadap inovasi bercirikan Islamik supaya mereka dapat dibimbing mengenai aplikasi tertentu yang perlu dihasilkan agar aplikasi tersebut selari dengan keperluan Muslim. Kajian ini dijalankan menggunakan pendekatan kuantitatif dengan instrumen kajian adalah soal selidik berstruktur digunakan untuk mengumpul data. Kajian ini dilaksanakan menggunakan pendekatan kuantitatif dengan instrumen kajian adalah soal selidik berstruktur digunakan iaitu semua item dalam soal selidik kecuali data demografi dinilai menggunakan skala Likert 5 mata (5 = sangat setuju – 1 = sangat tidak setuju) dengan sampel kajian adalah dari semua semester termasuklah dari program bukan teknikal seperti Jabatan Perdagangan dan Jabatan Perlancongan dan Hospitaliti. Secara keseluruhan, dapatan telah menunjukkan minat dan komitmen yang kuat di kalangan pelajar untuk mengintegrasikan nilai-nilai Islam dalam projek akhir mereka melalui pembangunan aplikasi.

Kata kunci : aplikasi Islamik, penggunaan, minat, komitmen, pelajar

1. Pengenalan

Penggunaan Internet sebagai medium menyebar dan menambah baik ajaran dan amalan Islam semakin berleluasa sejak beberapa tahun kebelakangan ini (Mansur et al., 2013). Pada masa ini, banyak laman web mahupun aplikasi berunsurkan Islam telah wujud dan kebanyakannya ditujukan untuk menyebarkan syiar Islam dan memperbaiki cara hidup Islam melalui pelbagai aktiviti. Berikutan itu, beberapa aplikasi Islam telah dikemukakan oleh ahli akademik dan profesional dalam bidang berkaitan yang dicipta untuk dan ditumpukan kepada perkhidmatan agama Islam dan cara hidup Islam. Antara aplikasi yang yang biasanya digunakan pada masa kini dan boleh dimuat turun adalah Azan, Al-Quran digital, doa dan zikir dan banyak lagi. Walaupun begitu masih banyak lagi aplikasi ataupun software yang boleh diteroka dan dihasilkan bagi manfaat orang Islam. Keperluan untuk menghasilkan aplikasi Islamik ini akan diperoleh apabila dilakukan tinjaun dan sangat sesuai dijalankan oleh pelajar dalam subjek projek pelajar. Dengan memanfaatkan teknologi secara bijak, umat Islam dapat terus memperkaya pengetahuan dan praktikal amalan yang dituntut, sekaligus menjaga nilai - nilai Islam dalam setiap aspek kehidupan mereka (Suherman, 2023).Pembangunan aplikasi Islamik mempunyai impak yang signifikan dalam kehidupan umat Islam, terutamanya dalam memudahkan akses kepada ilmu dan amalan agama. Aplikasi seperti Al-Quran digital, waktu solat, arah kiblat, dan panduan ibadah harian membantu umat Islam dalam menunaikan kewajipan agama dengan lebih mudah dan tepat. Dalam konteks semasa, keperluan aplikasi ini semakin meningkat seiring dengan perkembangan teknologi dan gaya hidup moden yang memerlukan penyelesaian segera dan mudah diakses. Selain itu, aplikasi Islamik turut memainkan peranan penting dalam menyebarkan dakwah dan pengetahuan agama secara lebih meluas, terutama kepada generasi muda yang lebih cenderung menggunakan peranti digital dalam kehidupan harian mereka.

Disamping itu, Dalam situasi semasa, penggunaan teknologi memainkan peranan penting dalam memperkasakan amalan Islam di kalangan umat Islam. Aplikasi Islamik seperti platform pembelajaran atas

talian, ceramah digital, dan kelas pengajian Al-Quran secara maya membolehkan umat Islam untuk terus mendalami ilmu agama walaupun dalam kesibukan harian atau ketika menghadapi cabaran seperti pandemik. Teknologi juga memudahkan penyebaran maklumat agama yang sahih melalui media sosial dan aplikasi, sekaligus mengurangkan kebergantungan kepada sumber yang tidak dipercayai. Hal ini selari dengan kajian oleh Salih et al., yang menunjukkan bahawa penggunaan teknologi informasi dalam dakwah telah meningkatkan keberkesanan penyebaran ilmu pengetahuan (Salih et al., 2019). Dengan adanya aplikasi mudah alih untuk doa, zikir, dan panduan ibadah, umat Islam kini lebih mudah untuk konsisten dalam amalan harian, menjadikan teknologi sebagai medium penting dalam memperkukuhkan hubungan spiritual dalam dunia moden.

Oleh yang demikian, objektif kajian ini dijalankan adalah untuk menilai tahap kecenderungan pelajar untuk menghasilkan aplikasi atau inovasi berunsurkan Islamik dalam projek akhir pelajar. Sampel kajian yag dipilih adalah pelajar Politenik Kota Kinabalu, sabah. Kajian kecenderungan ini penting untuk mengumpulkan data- data pelajar yang mempunyai minat terhadap inovasi bercirikan Islamik supaya mereka dapat dibimbing mengenai aplikasi tertentu yang perlu dihasilkan, agar aplikasi tersebut selari dengan keperluan Muslim. Selain itu juga kajian ini akan membantu dalam menilai kelemahan-kelemahan yang perlu diperbaiki seperti peranan dakwah untuk mewujudkan kecenderungan pelajar Islam membina aplikasi Islamik. Aplikasi Islamik buka sahaja terhad kepada aplikasi harian tetapi boleh dikembangkan kepada industri perbankan Islam dan sebagainya.

2. Objektif Kajian

Kajian ini dijalankan adalah untuk menilai tahap kecenderungan pelajar untuk menghasilkan aplikasi atau inovasi berunsurkan Islamik dalam projek akhir pelajar.

3. Sorotan Kajian

Peranti mudah alih seperti Telefon Pintar, tablet dan PDA telah menjadi bahagian yang amat diperlukan dalam aktiviti harian setiap orang. Pertumbuhan dan penyebaran telefon pintar telah mewujudkan peluang baharu untuk pembangun aplikasi agama untuk membangunkan aplikasi yang akan menyediakan utiliti dan akses mudah kepada maklumat agama (Hameed et al., 2019). Pertumbuhan aplikasi Islam yang berkembang pesat telah menimbulkan pengaruh media sosial untuk mengikuti kemajuan teknologi (Fauzi et al., 2022). Ini termasuk ciri-ciri interaktif seperti bacaan al-Quran, qiblat, hadis, waktu solat, zakat dan doa yang berjaya menarik minat umat Islam khususnya di kalangan belia untuk memuat turun aplikasi Muslim (Al-Qaysi et al, 2020). Penggunaan peranti digital seperti internet, komputer, tablet, telefon pintar dan jam tangan pintar telah meningkatkan permintaan untuk aplikasi Islam yang inovatif yang sesuai dengan gaya hidup umat Islam semasa (Hameed et al. 2019). Pada peringkat awal melibatkan penilaian aplikasi Islam yang tersedia di *Google Play Store*; Namun ianya tidak konsisten dan tidak mempunyai kategori Agama. Oleh itu, ketiadaan kategori menyukarkan pengguna dan penyelidik untuk mencari aplikasi Islam yang mereka inginkan (Olmstead et al., 2015). Keadaan ini menunjukkan bahawa terdapat ruang yang besar untuk membina aplikasi yang sistematik dan lebih struktur. Oleh yang demikian, pembinaan aplikasi Islamik dilihat lebih sesuai dilaksanakan di projek akhir pelajar. Projek tahun akhir ialah satu bentuk pembelajaran berasaskan projek yang biasa dilaksanakan dalam program diploma atau sarjana muda untuk pelajar memanifestasikan pengetahuan, kemahiran dan pengalaman pembelajaran yang terkumpul melalui pengajian akademik mereka (Saari & Tan, 2022). Pelajar boleh memilih sebarang projek yang akan dijalankan secara bebas atau mengikut tema yang diberikan. Justeru sekiranya ramai cenderung untuk membina aplikasi Islamik, akan membantu pensyarah membuka ruang tambahan tema projek akhir.

4. Metodologi

Kajian ini dijalankan menggunakan pendekatan kuantitatif. Instrumen kajian adalah soal selidik berstruktur digunakan untuk mengumpul. Semua item dalam soal selidik kecuali data demografi dinilai menggunakan skala Likert 5 mata (5 = sangat setuju – 1 = sangat tidak setuju). Sampel kajian dsipilih secara rawak. Sampel kajian adalah pelajar Politeknik Kota Kinabalu, Sabah dari semua semester termasuklah dari program bukan teknikal seperti Jabatan Perdagangan. Ini kerana mereka juga terlibat dengan projek semes ter akhir. Analisis desriptif digunakan untuk mendapatkan tahap kecenderungan berdasarkan nilai skor min. Penentuan tahap berdasarkan skor min seperti yang ditunjukkan dalam Jadual 1. Penentuan ini dipetik dalam kajian Ngadiman et al. (2019). Instrumen kajian yang ditunjukkan dalam Jadual 3 dibina sendiri selari yang mencerminkan minat untuk menghasilkan aplikasi berunsurkan Islam dalam projek akhir pelajar.

Jadual 1: Tafsiran Skor Min

Skor min	Tafsiran

1.00– 1.99	Lemah
2.00– 2.99	Rendah
3.00– 3.99	Sederhana
4.00– 5.00	Tinggi

5. Hasil Kajian

5.1 Latar Belakang Responden

Jadual 2: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	26	48.1
	Perempuan	28	51.9
Jabatan	JKA	22	40.7
	JKE	8	14.8
	JKM	8	14.8
	JP	3	5.6
	JPH	13	24.1
Semester	1.00	2	3.7
	2.00	11	20.4
	3.00	8	14.8
	4.00	13	24.1
	5.00	7	13.0
	6.00	13	24.1
HPNM	1.00 - 2.00	1	1.9
	2.00 - 2.99	4	7.4
	3.00 - 3.33	24	44.4
	3.43 - 3.67	17	31.5
	3.68 - 4.00	6	11.1
	Semester 1 (Tiada HPNM)	2	3.7

Responden kajian dalam Jadual 2 adalah seramai 54 pelajar Politeknik Kota Kinabalu yang terdiri dari pelajar perempuan (51.9%) berbanding lelaki (48.1%). Majoriti responden berasal dari Jabatan Kejuruteraan Awam (JKA) sebanyak 40.7%, diikuti oleh Jabatan Perhotelan dan Pelancongan (JPH) dengan 24.1%, serta Jabatan Kejuruteraan Elektrik (JKE) dan Jabatan Kejuruteraan Mekanikal (JKM) masing-masing sebanyak 14.8%, dan Jabatan Perdagangan (JP) sebanyak 5.6%. Dari segi semester, majoriti responden dari semester 4 dan 6, masing-masing 24.1%, diikuti oleh semester 2 sebanyak 20.4%, semester 3 sebanyak 14.8%, semester 5 sebanyak 13.0%, dan semester 1 sebanyak 3.7%. Dalam kategori HPNM, majoriti responden mempunyai nilai purata antara 3.00 - 3.33 sebanyak 44.4%, diikuti oleh pelajar yang mempunyai HPNM 3.43 - 3.67 sebanyak 31.5%, HPNM 3.68 - 4.00 sebanyak 11.1%, HPNM 2.00 - 2.99 sebanyak 7.4%, dan HPNM 1.00 - 2.00 sebanyak 1.9%.

5.2 Hasil Analisis Data

Jadual 3: Analisis Kecenderungan Minat Pelajar Untuk Menghasilkan Aplikasi Berunsurkan Islam Dalam Projek Akhir

Bil	Item Kajian	Sisihan Piawai	Skor Min	Tahap
1	Saya minat terhadap aplikasi berunsurkan Islam	0.71	4.20[3]	Tinggi
2	Saya mempunyai cita-cita untuk membina satu aplikasi berunsurkan Islam di projek akhir saya	0.80	4.00	Tinggi
3	Saya minat menghasilkan aplikasi berunsurkan Islam dalam projek akhir saya	0.81	4.02	Tinggi
4	Saya akan menyatakan hasrat saya kepada penyelia projek untuk membina aplikasi berunsurkan Islam	0.84	3.93	Sederhana
5	Saya sedang mencari-cari idea projek berunsurkan Islam untuk dihasilkan pada projek akhir pelajar	0.79	4.02	Tinggi
6	Saya sedang mencari ahli kumpulan yang berminat untuk menghasilkan aplikasi berunsurkan Islam	0.94	3.98	Sederhana
7	Saya minat menyumbangkan sesuatu kepada Islam seperti sumbangan membina aplikasi	0.74	4.22[2]	Tinggi
8	Saya sedang menyediakan persiapan untuk membina aplikasi berunsurkan Islam dalam projek akhir pelajar	1.02	3.94	Sederhana
9	Saya mempunyai kemahiran untuk membina aplikasi berunsurkan Islam dalam projek akhir pelajar.	1.08	3.87	Sederhana
10	Saya akan kecewa sekiranya idea saya untuk menghasilkan aplikasi berunsurkan Islam dalam projek akhir pelajar tidak mendapat sokongan.	1.01	4.31[1]	Tinggi
	Purata		*4.05*	*Tinggi*

Nota: [1]Peratusan tertinggi; [2]Peratusan kedua tertinggi; [3]Peratusan ketiga tertinggi

Jadual 3 menunjukkan tahap minat pelajar dalam menghasilkan aplikasi berunsurkan Islam dalam projek akhir mereka. Secara keseluruhan minat pelajar adalah pada tahap tinggi. Sekiranya dilihat dari perincian setiap item, item yang mendapat skor min tertinggi (4.31) adalah pernyataan "Saya akan kecewa sekiranya idea saya untuk menghasilkan aplikasi berunsurkan Islam dalam projek akhir pelajar tidak mendapat sokongan". Ini menunjukkan bahawa pelajar sangat berkeinginan dan merasa penting untuk mendapat sokongan dalam merealisasikan idea mereka. Item kedua tertinggi (skor min 4.22) adalah "Saya minat menyumbangkan sesuatu kepada Islam seperti sumbangan membina aplikasi" yang menunjukkan kesediaan pelajar untuk memberikan sumbangan kepada komuniti Islam melalui pembangunan aplikasi. Manakala item ketiga (skor min 4.20), "Saya minat terhadap aplikasi berunsurkan Islam," menunjukkan minat umum pelajar terhadap konsep aplikasi berunsurkan Islam. Secara keseluruhan, data ini menunjukkan minat dan komitmen yang kuat di kalangan pelajar untuk mengintegrasikan nilai-nilai Islam dalam projek akhir mereka melalui pembangunan aplikasi.

Dalam konteks pengembangan aplikasi berunsurkan Islam, terdapat beberapa aspek penting yang perlu dipertimbangkan. Pertama, minat terhadap aplikasi berunsurkan Islam menunjukkan keperluan untuk mengintegrasikan nilai-nilai agama dalam teknologi. Menurut Salsabila et al., penggunaan teknologi pendidikan berasaskan blended learning dalam pembelajaran pendidikan agama Islam dapat meningkatkan kualiti dan jangkauan pendidikan, serta memiliki implikasi positif bagi kesejahteraan ekonomi (Salsabila et al., 2022). Ini menunjukkan bahawa pengembangan aplikasi yang berunsurkan Islam dapat memberikan manfaat yang signifikan dalam konteks pendidikan dan pengamalan agama. Kedua, cita -cita untuk membina aplikasi berunsurkan Islam dalam projek akhir menunjukkan kesedaran pelajar terhadap pentingnya teknologi dalam menyebarkan ilmu agama. Dalam kajian oleh Maritsa et al., dinyatakan bahawa teknologi memainkan peranan penting dalam dunia pendidikan, di mana alat dan media digunakan untuk mempermudah proses pembelajaran (Maritsa et al., 2021). Ini menunjukkan bahawa pelajar yang ingin membina aplikasi berunsurkan Islam dapat memanfaatkan teknologi untuk mencapai tujuan pendidikan yang lebih baik. Seterusnya adalah hasrat untuk menyatakan idea kepada penyelia projek dan mencari ahli kumpulan yang berminat menunjukkan kolaborasi dalam pengembangan aplikasi. Menurut Ahmad dan Rokhibi, amalan budaya yang berkait dengan sunnah dapat dianalisis untuk memahami bagaimana teknologi dapat digunakan dalam konteks pemakanan dan pengubatan Islam (Ahmad & Rokhibi, 2021). Ini menunjukkan bahawa aplikasi yang dibangunkan tidak hanya terhad kepada pendidikan, tetapi juga boleh merangkumi aspek lain dalam kehidupan beragama.

Selain itu, minat untuk menyumbang sesuatu kepada Islam melalui aplikasi menunjukkan kesedaran sosial dan tanggungjawab dalam kalangan pelajar. Kajian oleh Alnashr et al. menekankan kepentingan penghayatan nilai-nilai pendidikan Islam melalui pembiasaan dan budaya madrasah, yang boleh diterapkan dalam konteks aplikasi yang dibangunkan (Alnashr et al., 2022). Ini menunjukkan bahawa penerapan yang berunsurkan Islam boleh menjadi medium untuk menyebarkan nilai-nilai positif dalam masyarakat. Akhir sekali, persediaan membina aplikasi berunsur Islam dan kemahiran yang dimiliki pelajar menunjukkan kesediaan mereka untuk menghadapi cabaran dalam perkembangan teknologi. Dalam kajian Hasriadi, pemanfaatan teknologi dalam membuat media pembelajaran pendidikan agama Islam dibincangkan, menekankan kepentingan penggunaan media yang betul dalam proses pembelajaran (Hasriadi, 2022). Ini menunjukkan pelajar yang mempunyai kemahiran dalam teknologi dapat menghasilkan aplikasi yang berkualiti dan berguna.. Secara keseluruhan, minat dan usaha untuk membina aplikasi berunsurkan Islam dalam projek akhir pelajar mencerminkan kesedaran akan pentingnya teknologi dalam memperkukuhkan amalan agama dan menyebarkan nilai -nilai Islam dalam masyarakat.

6. Kesimpulan

Penciptaan teknologi masa kini memberikan banyak kemudahan untuk membantu dan memudahkan manusia melaksanakan apa sahaja tugasan. Teknologi juga banyak memberi manfaat kepada Muslim seperti pembangunan aplikasi dalam telefon pintar turut memudahkan umat Islam beribadah. Walaupun terdapat banyak aplikasi yang telah dibangunkan dan boleh digunakan secara percuma, namun masih terdapat ruang dan peluang untuk membina bermacam-macam lagi bentuk aplikasi yang berunsurkan Islamik. Oleh yang demikian, kajian ini dilaksanakan adalah bertujuan menilai tahap kecenderungan pelajar untuk menghasilkan aplikasi atau inovasi berunsurkan Islamik dalam projek akhir pelajar. Dapatan menunjukkan bahawa majoriti pelajar berminat untuk membangunkan aplikasi Islamik khusus untuk kegunaan orang-orang Islam. Dapatan ini menunjukkan kecenderungan pelajar untuk memberi sumbangan kepada agama selari dengan tuntutan Syariah agar umatnya menghasilkan sesuatu bermanfaat kepada manusia.

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Program 'Exit Survey' Terhadap pelajar lepasan Diploma Pemasaran di Politeknik Kota Kinabalu bagi Sesi II 2022/2023

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Abstrak

Penilaian program 'exit survey, merupakan kajian untuk mendapatkan maklumbalas berkenaan keberkesanan program dalam menentukan pencapaian hasil pembelajaran di Politeknik Kota Kinabalu. Selain itu, kajian ini dibuat untuk memastikan penambahbaikan secara berkala dapat dilaksanakan bagi memastikan keperluan program seiring keperluan dan kehendak industri dalam pasaran alam pekerjaan semasa. Kajian ini dilaksanakan bertujuan untuk menilai hasil pembelajaran program yang ditawarkan di Politeknik Kota Kinabalu Sabah bagi Program Diploma Pemasaran (DPR) bagi ambilan Jun 2020 untuk satu kohort sahaja dimana pelajar adalah mereka yang telah tamat pengajian pada sesi II: 2022/ 2023. Seramai 24 orang responden mengambil bahagian dalam kajian ini. Data dikumpul melalui borang soal selidik yang diedarkan kepada pelajar melalui platform *google form* dan dianalisis menggunakan kaedah deskriptif. Soalan kajian meliputi elemen utama iaitu kualiti kurikulum dan pengajaran, "Program Learning Outcome" (PLO), penasihatan akademik dan pensyarah kursus, serta kemudahan fasiliti dan sumber di politeknik. Kajian ini membentangkan dapatan penilaian hasil pembelajaran Program di Jabatan Perdagangan secara amnya dan Program Diploma Pemasaran secara khususnya. Dapatan kajian membuktikan bahawa pencapaian hasil pembelajaran program DPR berada pada tahap yang baik dengan semua elemen mencapai purata yang sangat tinggi. Secara keseluruhan, kajian ini dapat dijadikan sebagai sebahagian daripada usaha untuk menambahbaik kualiti sistem pendidikan dan latihan yang dilaksanakan di politeknik. Cadangan penambahbaikan turut disediakan bagi kegunaan penyelidikan pada masa hadapan.

Kata Kunci: Kualiti kurikulum, pengajaran, PLO, Penasihat Akademik, Pensyarah Kursus, kemudahan, sumber

1. PENGENALAN

1.1 Pendahuluan

Kementerian Pendidikan Malaysia telah berusaha memperkenalkan satu sistem pendidikan yang baru di Politeknik bagi memastikan sistem pendidikan negara mencapai tahap yang membanggakan. Sebagai sebuah Politeknik yang cemerlang, Politeknik Kota Kinabalu (PKK) sentiasa peka dan penambahbaikan kepada perkhidmatan yang ditawarkan kepada pihak – pihak berkepentingan. Untuk tujuan tersebut PKK pada setiap akhir sesi pengajian akan menjalankan kajian 'exit Survey' yang bertujuan untuk mengenal pasti persepsi pelajar semester akhir terhadap aspek kualiti kurikulum di PKK yang merangkumi aspek pengajaran dan pembelajaran, program 'learning outcome', penilaian terhadap pensyarah dan penasihat akademik dan fasiliti yang disediakan di PKK.

1.2 Latar Belakang Kajian

PES (Program Exit Survey) ialah kaedah mengumpul maklumat tentang kualiti pendidikan diploma dari perspektif pelajar bergraduat apabila tamat program diploma mereka. Laporan ini merujuk kepada kaedah pengukuran tidak langsung dengan cara penilaian kendiri berdasarkan persepsi individu untuk penilaian kualiti kurikulum dan pengajaran , PLO, penasihatan akademik dan pensyarah kursus dan kemudahan fasiliti dan sumber. Kualiti kurikulum dan pengajaran adalah faktor utama yang menentukan sejauh mana program diploma dapat memenuhi keperluan pelaajr dan memastikan mereka mendapat pengetahuan dan kemahiran yang diperlukan untuk berjaya dalam kerjaya pada masa akan datang. Kurikulum yang direka dengan baik serta pengajaran yang berkesan mampu menghasilkan graduan yang berkualiti tinggi dan kompetitif. PLO (Programme Learing Outcome) ialah penyataan khusus pengetahuan, kemahiran dan sikap graduan yang diperoleh pada akhir program sebagai bukti pencapaian objektif program. PLO ini merangkumi hasil pembelajaran yang diharapkan dan menjadi indikator utama dalam menilai keberkesanan sesuatu program. PLO juga membantu memastikan bahawa graduan memiliki kompetensi yang diperlukan untuk memasuki dunia pekerjaan atau melanjutkan pengajian ke peringkat yang lebih tinggi, selaras dengan standard industri dan keperluan pasaran semasa. Penasihatan akademik dan pensyarah kursus ialah elemen yang penting yangmembnatu pelajar dalam merancang laluan akdemik mereka, memahami keprluan kursus dan mencapai matlamat akademik. Peranan penasihat akademik dan pensyarah dalam membimbing dan membnatu pelajar

memberi kesan besar terhadap kejayaan akademik pelajar. Kemudahan fasiliti dan sumber pula adalah infrastruktur dan peralatan yang disediakan oleh institusi pendidikan untuk menyokong proses pembelajaran pelajar. Ini termasuk bilik kuliah yang dilengkapi dengan peralatan yang lengkap, teknologi terkini, makmal, perpustakaan serta kemudahan-kemudahan lain. Kelengkapan dan kemudahan yang mencukupi adalah penting dalam memastikan pelajar dapat menjalani pengalaman pembelajaran yang menyelurus dan berkesan. PES ini dijalankan untuk menilai kepuasan dan persepsi pelajar siswazah tentang pelbagai aspek pengalaman akademik mereka. 100% pelajar semester akhir dari program DPR telah mengambil bahagian dalam tinjauan tersebut.

1.3 Pernyataan Masalah

Permintaan awam yang meningkat untuk pendidikan tinggi telah menyebabkan pasaran pendidikan tinggi menjadi sangat kompetitif. Kedua-duanya, institusi pengajian tinggi awam dan swasta bersaing untuk mendapatkan pelajar. Permintaan terhadap perkhidmatan pengajian tinggi semakin meningkat disebabkan oleh banyak faktor. Persaingan telah menekankan kepentingan strategik kepuasan dan kualiti dalam persaingan untuk memenangi pilihan pengguna dan mengekalkan kelebihan daya saing yang mampan. Politeknik juga perlu mengambil tindakan untuk bersaing dengan institusi lain bagi menarik minat pelajar memilih politeknik sebagai institusi melanjutkan pengajian. Pelajar merupakan pelanggan yang penting kepada politeknik, maka maklum balas kepuasan mereka sangat diperlukan untuk menambah baik kualiti perkhidmatan politeknik (Siti Noorzilawati et al., 2018). Bagi mengenal pasti sama ada politeknik kini memberikan perkhidmatan yang berkualiti, kepuasan pelajar perlu diukur. Kajian ini diharapkan dapat memberikan pandangan yang berharga untuk politeknik kerana institusi ini berusaha untuk membangunkan strategi untuk meningkatkan kelebihan daya saing mereka dalam persekitaran pendidikan tinggi Malaysia yang kompetitif. Justeru kajian ini adalah untuk mengenal pasti persepsi pelajar semester akhir terhadap perkhidmatan yang ditawarkan di Politeknik Kota Kinabalu.

1.4 Objektif Kajian

Secara umum, Kajian ini dijalankan untuk menjawab beberapa permasalahan kajian iaitu:

1.4.1 Mengenal pasti persepsi pelajar Semester Akhir DPR terhadap kualiti kurikulum dan pengajaran yang ditawarkan di Politeknik Kota Kinabalu bagi Sesi II 2022/2023

1.4.2 Mengenal pasti persepsi pelajar Semester Akhir DPR terhadap “program learning outcome” di Politeknik Kota Kinabalu bagi Sesi II 2022/2023

1.4.3 Mengenal pasti tahap penilaian pelajar Semester Akhir DPR terhadap penasihat akademik dan pensyarah di Politeknik Kota Kinabalu bagi Sesi II 2022/2023

1.4.4 Mengenal pasti persepsi pelajar Semester Akhir DPR terhadap kemudahan yang ditawarkan Politeknik Kota Kinabalu bagi Sesi II 2022/2023

1.5 Persoalan Kajian

Terdapat empat soalan kajian dalam kajian ini, iaitu:

1.5.1 Apakah persepsi pelajar Semester Akhir DPR terhadap kualiti kurikulum dan pengajaran yang ditawarkan di Politeknik Kota Kinabalu bagi Sesi II 2022/2023?

1.5.2 Apakah persepsi pelajar Semester Akhir DPR terhadap “program learning outcome” di Politeknik Kota Kinabalu bagi Sesi II 2022/2023?

1.5.3 Apakah tahap penilaian pelajar Semester Akhir DPR terhadap penasihat akademik dan pensyarah di Politeknik Kota Kinabalu bagi Sesi II 2022/2023?

1.5.4 Apakah persepsi pelajar Semester Akhir DPR terhadap kemudahan yang ditawarkan Politeknik Kota Kinabalu bagi Sesi II 2022/2023?

1.6 Skop kajian

Kajian ini melibatkan pelajar sesi pengambilan Jun 2020 di Politeknik Kota Kinabalu Sabah. Kajian ini hanya melihat aspek-aspek seperti persepsi pelajar terhadap kualiti kurikulum dan pengajaran, penasihat akademik dan pensyarah, “program learning outcome” dan kemudahan yang ditawarkan di Politeknik Kota Kinabalu sepanjang pengajian. Kajian ini melibatkan responden seramai 24 orang.

1.7 Kepentingan Kajian

1.7.1 Pelajar Politeknik Kota Kinabalu

Pelajar dapat menikmati perkhidmatan yang berkualiti dari pihak politeknik jika penambahbaikan dilakukan oleh pihak institusi.

1.7.2 Pensyarah

Pensyarah dapat memperbaiki dan meningkatkan kualiti perkhidmatan terutama dalam aspek pengajaran dan penasihatan akademik.

1.7.3 Bahagian Pengurusan Politeknik Kota Kinabalu

Pihak Pengurusan dapat memperbaiki dan meningkatkan kualiti perkhidmatan terutama dalam aspek fasiliti politeknik dan memantau prestasi pengajaran pensyarah dan sistem penasihatan akademik berdasarkan keperluan pelajar.

1.7.4 JPPKK

Diharapkan pihak JPPKK akan memberikan perhatian yang sewajarnya ke arah pembangunan kurikulum yang berkualiti, memberi peruntukan yang diperlukan untuk membangunkan/ menambah baik fasiliti di politeknik dan program-program peningkatan prestasi pensyarah.

2. SOROTAN KAJIAN

Perkara utama yang akan dibincangkan dalam kajian ini adalah berkaitan persepsi pelajar Semester Akhir DPR terhadap beberapa perkara yang disediakan oleh institusi. Hujah-hujah dan bukti empirikal dari kajian yang lepas akan diketengahkan untuk menyokong pembolehubah dalam kajian.

Berdasarkan kajian, kualiti kurikulum dalam program diploma adalah aspek penting yang menentukan keberkesanan pendidikan dan kemahiran yang diperoleh oleh pelajar. Menurut Shamsuddin et al. (2018), kandungan kursus yang komprehensif dan relevan dengan keperluan industri pemasaran moden adalah sangat diperlukan. Kurikulum perlu merangkumi topik seperti pemasaran digital, analisis data, dan kemahiran komunikasi yang berkesan. Penyelidikan menunjukkan bahawa pelajar yang terdedah kepada kandungan yang terkini dan relevan cenderung lebih bersedia untuk menghadapi cabaran pekerjaan pada masa akan datang. Kaedah pengajaran yang interaktif dan praktikal juga memainkan peranan penting dalam meningkatkan kualiti kurikulum. Kajian oleh Ahmad et al. (2019) mendapati penggunaan teknik pembelajaran berasaskan projek (PBL) dan simulasi dapat membantu pelajar mengaplikasikan teori ke dalam amalan. Ini tidak hanya meningkatkan pemahaman pelajar tetapi juga dapat mengasah kemahiran praktikal mereka yang diperlukan dalam industri. Program Learning Outcomes (PLO) atau Hasil Pembelajaran Program merupakan pernyataan jelas tentang apa yang pelajar seharusnya tahu, faham, dan boleh lakukan setelah menyelesaikan program pendidikan tertentu. Menurut kajian oleh Muda dan Kadir (2020), PLO yang dirangka dengan baik dapat meningkatkan kualiti pendidikan dengan menyediakan panduan yang jelas untuk pelajar dan pengajar. PLO membantu dalam memastikan bahawa semua elemen dalam program pendidikan diselaraskan untuk mencapai matlamat yang sama. Kajian oleh Syed dan Aziz (2021) menekankan pentingnya merangka PLO yang spesifik, boleh diukur, boleh dicapai, relevan, dan berjangka masa (SMART). PLO yang dirangka berdasarkan prinsip SMART lebih mudah untuk dinilai dan lebih berkesan dalam memastikan pelajar mencapai tahap kompetensi yang diperlukan. Selain dari kualiti kurikulum dan pengajaran, serta PLO yang dibangunkan, peranan penasihat akademik dan pensyarah kursus juga adalah sangat penting. Sari dan Iskandar (2020) melalui kajian yang dilaksanakan di STIKes Dharma Husada Bandung menunjukkan bahawa penasihat akademik memainkan peranan kritikal dalam memantau dan membimbing pelajar agar dapat mencapai prestasi akademik yang lebih baik. Kajian ini juga mendapati bahawa penasihat akademik memberikan motivasi, panduan berkaitan pemilihan kursus dan khidmat nasihat kepada pelajar untuk memastikan mereka terus berada di landasan yang betul dalam mencapai kejayaan akademik. Kemudahan fasiliti dan sumber yang disediakan oleh IPT juga memainkan peranan penting dan sering dikaitkan dengan hasil pembelajaran yang diperoleh pelajar. Kemudahan fasiliti di IPT merangkumi perpustakaan, makmal, bilik kuliah, pusat sukan, teknologi maklumat, dan perkhidmatan sokongan pelajar. Fasiliti ini bukan sahaja memudahkan proses pembelajaran tetapi juga meningkatkan kualiti pengalaman pendidikan pelajar. Kajian menunjukkan bahawa fasiliti yang lengkap dan berkualiti dapat meningkatkan motivasi dan prestasi akademik pelajar (Mahajan, 2018).

3. METODOLOGI KAJIAN

3.1 Pendahuluan

Bab ini membincangkan secara ringkas mengenai reka bentuk kajian, populasi kajian dan sampel kajian, instrumen kajian, kesahan dan kebolehpercayaan kajian, prosedur kajian, dan prosedur analisis data.

3.2 Reka Bentuk Kajian

Kajian ini akan menggunakan kaedah pengumpulan data secara kualitatif yang mana data dikumpul daripada melalui borang soal selidik yang diedarkan kepada pelajar melalui platform *google form.* Kaedah soal selidik ini sering digunakan dalam kajian pendidikan kerana ia dapat memberikan respons yang berstruktur daripada sampel yang besar dan sesuai untuk kajian yang melibatkan persepsi (Creswell, 2014).

3.3 Populasi dan sampel

Kajian yang digunakan untuk menentukan sampel bagi kajian ini adalah menggunakan teknik persampelan "judgment" berdasarkan kepada kriteria tertentu yang telah ditetapkan. Kajian ini memilih 24 sampel pelajar semester akhir daripada Diploma Pemasaran (DPR) yang telah tamat menjalani latihan industri pada sesi II 2022/2023. Seterusnya untuk penentuan populasi kajian, terdiri dari jumlah pelajar semester akhir daripada jabatan perdagangan untuk sesi sesi II 2022/2023 iaitu seramai 97 pelajar. Teknik ini sesuai digunakan apabila pengkaji mempunyai pengetahuan tertentu mengenai populasi yang dikaji, dan sampel dipilih berdasarkan kepentingan tertentu (Etikan et. al., 2016).

3.4 Instrumen Kajian

Bahagian ini membincangkan tentang pembolehubah-pembolehubah yang digunakan dalam kajian ini adalah pembolehubah bersandar (DV) dan pembolehubah tidak bersandar (IV). Bagi pembolehubah bersandar (DV) dalam kajian ini adalah melihat persepsi dan tahap penilaian pelajar Semester Akhir DPR. Manakala pembolehubah tidak bersandar (IV) dalam kajian ini adalah Kualiti kurikulum dan pengajaran, "program learning outcome" (PLO), penasihat akademik dan pensyarah, dan seterusnya kemudahan yang ditawarkan di politeknik. Penggunaan pembolehubah ini membantu untuk menjelaskan faktor-faktor yang mempengaruhi persepsi pelajar terhadap kualiti perkhidmatan (Kothari, 2004).

3.5 Prosedur Kajian

Kajian ini mengunakan data dari Jabatan Hal Ehwal Pelajar Politeknik Kota Kinabalu. Data yang dikumpulkan adalah pelajar semester akhir DPR untuk sesi II 2022/2022 bagi 1 kohot sahaja iaitu pelajar pada ambilan Jun 2020. Penggunaan data daripada kohort tertentu membantu untuk mendapatkan hasil yang lebih fokus dan sesuai dengan objektif kajian (Patton, 2015).

3.6 Prosedur analisis data

Data yang diperolehi daripada borang soal selidik yang diedarkan kepada pelajar melalui platform *google form* dikumpul dan dianalisis dengan menggunakan perisian *Statistical Package For Sosial Science (SPSS) Versi 27*. Untuk dapatan kajian, hanya analisis statistik deskriptif yang akan digunakan dalam kajian ini untuk menerangkan nilai min. Pendekatan ini sering digunakan untuk memberikan gambaran umum tentang data yang dikumpulkan, terutama dalam kajian yang melibatkan soal selidik (Pallant, 2020).

4. DAPATAN KAJIAN

4.1 Pendahuluan

Dua analisis yang dilakukan dan ditunjukkan dalam kajian ini iaitu profil responden dan analisis deskriptif.

4.2 Maklumat Demografi Responden

Seramai 24 responden yang terlibat dalam kajian ini. Berdasarkan Jadual 1, jumlah responden mengikut jantina adalah sama iaitu 12 pelajar lelaki dan 12 pelajar perempuan. Majoriti responden yang menjawab soal selidik adalah pelajar Bumitera Sabah (70.8%) diikuti dengan pelajar Melayu dan lain-lain (12.5%) dan pelajar Cina hanya 4.2%. Pelajar Bumitera Sabah lebih ramai menjawab soal selidik kerana berpandukan geografi dan lokasi institusi yang terletak di Negeri Sabah.

JADUAL 1: Profil responden

Ciri	Kategori	Bilangan	Peratus (%)
Jantina	Lelaki	12	50.0
	Perempuan	12	50.0
		24	
Bangsa	Melayu	3	12.5
	Cina	1	4.2
	Bumitera Sabah	17	70.8
	Lain-lain	3	12.5
		24	

4.3 Analisis Deskriptif

Kajian ini menganalisis setiap pembolehubah mengikut kaedah Julat Nilai Min seperti yang dicadangkan oleh Creswell (2011). Jadual 2 menunjukkan julat min untuk mentafsirkan nilai skor min yang diperolehi.

JADUAL 2: Interpretasi nilai skor min

Skor Min	Interpretasi
1.00 – 1.80	Sangat Rendah
1.81 – 2.60	Rendah
2.61 – 3.40	Sederhana
3.41 – 4.20	Tinggi
4.21 – 5.00	Sangat Tinggi

Jadual 3 menunjukkan nilai min bagi kualiti kurikulum dan pengajaran, Program Learning Outcome (PLO), Penasihat Akademik (PA) dan pensyarah serta kemudahan dan sumber berada dalam julat 4.23 ke 4.67 yang membawa maksud keempat-empat pembolehubah berada pada tahap sangat tinggi. Tafsiran min ini adalah mengikut pengukuran seperti jadual di bawah.

JADUAL 3: Analisis deskriptif

Pembolehubah	Purata	Tahap
Kualiti kurikulum dan pengajaran	4.40	Sangat tinggi
Program Learning Outcome (PLO)	4.54	Sangat tinggi
PA dan pensyarah	4.67	Sangat tinggi
Kemudahan dan sumber	4.23	Sangat tinggi

5. RUMUSAN, PERBINCANGAN DAN CADANGAN

5.1 Kesimpulan

Hasil kajian mendapati persepsi pelajar Semester Akhir DPR terhadap kualiti kurikulum dan pengajaran, PLO, PA dan pensyarah serta kemudahan politeknik berada pada tahap yang sangat tinggi. Dapatan kajian membuktikan bahawa pencapaian hasil pembelajaran program DPR berada pada tahap yang baik dengan semua elemen mencapai purata yang sangat tinggi. Secara keseluruhan, kajian ini dapat dijadikan sebagai sebahagian daripada usaha untuk menambahbaik kualiti sistem pendidikan dan latihan yang dilaksanakan di politeknik.

5.2 Cadangan

Cadangan hasil dari kajian ini adalah dengan memperkukuh pembangunan profesional pensyarah dan penasihat akademik melalui latihan berterusan, serta memastikan kemudahan fasiliti sentiasa mencukupi dan lengkap. Selain itu, pemantauan berterusan dan penilaian terhadap pelaksanaan program perlu dijalankan melalui maklum balas pelajar dan analisis prestasi. Akhir sekali, memperkuatkan penglibatan industri dan alumni dapat memastikan program yang ditawarkan relevan dan membekalkan pelajar dengan kemahiran yang diperlukan untuk berjaya dalam dunia pekerjaan.

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Behavioral and Emotional Problems of Children Under Institutional Homes

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Abstract

This study aims to investigate the behavioural and emotional challenges faced by children in institutional homes in Perlis, Malaysia. The objective is to gain insight into the characteristics of children in institutional settings and explore the types of behavioural and emotional issues they experience. The study addresses a gap in research on the prevalence of these problems among children in institutional homes in Malaysia. The study utilizes a quantitative and cross-sectional approach. Data collection involves probability sampling using simple random sampling techniques. The study focuses on children in institutional homes in the northern part of Malaysia as respondents. A questionnaire was distributed to 118 children. The data collected was coded and analysed using version 27 Statistical Package for Social Sciences (IBM SPSS). The study indicates that the overall level of behavioural and emotional problems among children at institutional homes is generally low to moderate. However, there are specific challenges, particularly related to prosocial difficulties. A significant concern is the presence of prosocial problems among the children, which may impact their social interactions, empathy, and cooperation. The findings highlight the need for targeted intervention and support within institutional settings to address these challenges and enhance the well-being of children in institutional homes

Keywords: - Behavioural, emotional challenge, Institutional homes, prevalence, prosocial.

1. Introduction

In recent years, there has been a growing focus on the well-being of children living in institutional homes. These settings play a crucial role in shaping their early experiences and development. The transition from a family environment to an institutional setting can be a significant adjustment for children, potentially leading to various behavioural and emotional challenges. Behavioural and emotional problems among children living in institutional homes are a concerning issues with significant impact on the well-being and development. Previous research has shown that children in institutional homes are more likely to experience behavioural and emotional problems compared to those living with their families (Agrawal et al., 2022; Krishnaswami et al., 2019). Kaur et al. (2018) also stated that the prevalence of emotional and behavioural problems is higher among children in institutional homes than children of similar ages raised by their own families.

Children living in institutional homes are among the most vulnerable groups in society. This vulnerability stems from their exposure to repeated neglect, abuse, or fear (Idris, 2017). While providing these children with a new safe home is crucial, it often falls short in fully repairing the damage caused by early abnormal stress on their developing nervous system. Extensive research has demonstrated that children who have experienced neglect and abuse frequently encounter behaviour and emotional difficultie s (Mohammadzadeh, Awang, Ismail, & Kadir Shahar, 2019; Lassi, Mahmud, Syed, & Janjua, 2011). These difficulties can manifest as conduct problems, hyperactivity, challenges in peer relationships, and a lack of pro-social behaviour (Krishnaswami et al., 2019). Moreover, Makhija and Singh (2019) point out that parentless, runaway, or abandoned children raised in institutions are particularly susceptible to developing behavioural and emotional problems.

Agrawal et al. (2022) stated that the prevalence of emotional and behavioural issues among orphaned and other vulnerable children ranges from 18.3 percent to 64.73 percent, compared to a reported range of 8.7 percent to 18.7 percent in normal communities. Studies have shown that children in institutional homes have a disproportionately high prevalence of these problems, with between 50 percent and 80 percent of them suffering from moderate to severe mental health issues (Allen & Hendricks, 2013; Inkelas & Halfon, 2002). Research by Makhija and Singh (2019) has also demonstrated that children and adolescents raised in institutional homes exhibit a greater occurrence of emotional and behavioural problems than children of the same age who are cared for by their own families. If left untreated, these problems may continue into adulthood and even progress into psychiatric issues (Idris, 2017). Additionally, emotional and behavioural problems increase the risk of substance abuse, delinquency, and relationship problems (Idris, 2017; SantanaeISSN: 2976-3606 et al., 2012). Therefore, it is crucial to detect these problems early in order to prevent them from developing into more

serious issues.

Research consistently shows that institutional homes can have negative effects on the growth and development of children, rather than promoting their overall well-being. Several studies (Agrawal et al., 2022; Krishnaswami et al., 2019; Makhija & Singh, 2019) have found that the longer children stay in institutional settings, the more likely they are to experience emotional, behavioural, and cognitive difficulties. In Malaysia, the number of children in need of care and protection has been steadily increasing each year. According to data from the Department of Social Welfare (JKM), there were 5,858 cases in 2020, 6,144 cases in 2021, and 6,770 cases in 2023. A recent report by JKM highlighted that between January and May 2023, there were 2,959 cases of child neglect and abuse, including physical, sexual, and emotional abuse. Therefore, conducting this study is crucial to address these issues at an early stage.

Based on the literature, it is found that limited research has been done on the prevalence and types of behavioural and emotional problems specifically among children living in institutional homes in Malaysia. Idris (2017) and Ahmad et al. (2015) suggest further studies is needed to assess the current prevalence of emotional and behavioral problems in young and older children, its stability over time and to identify a potentially effective method of intervention. Therefore, this study aims to investigate th e children's profile living in institutional homes and the types of behavioural and emotional problems among children under institutional homes. Developing strategies that promote healthy childhoods within institutional settings is crucial. Additionally, early identification and targeted treatment by mental health professionals can improve outcomes for these vulnerable children.

2. Literature Review

2.1 Behavioural and Emotional Problems

Behavioural problems encompass various classifications, including conduct disorder (CD), attention deficit hyperactivity disorder (ADHD), oppositional defiant disorder (ODD), and disruptive behaviour disorder, among others (Idris, 2017). Among these classifications, conduct disorder exhibits a particularly high prevalence and is delineated by a recurrent and enduring pattern of behavior that infringes upon the fundamental rights of others or significantly contravenes age-appropriate societal norms and regulations (Krishnaswami et al., 2019). These behavioral disturbances frequently manifest early in a child's developmental trajectory and may persist throughout their growth. Prior research has established a notable comorbidity between internalizing and externalizing disorders. For example, conduct disorder is often found to co-occur with anxiety and depression

Emotional difficulties are evidenced through the internalization of symptoms, including anxiety, depression, and specific phobias, whereas behavioral difficulties are characterized by externalizing symptoms, such as conduct disorders, hyperactivity, and disruptive behaviors (Idris, 2017). Although certain emotional disorders in pediatric and adolescent populations may spontaneously remit over time, a significant proportion endure into adulthood, manifesting as anxiety or affective disorders, frequently evolving into chronic conditions in the absence of timely intervention. It is often challenging for caregivers to detect emotional difficulties in their offspring

Reviewing the literature, several studies have been conducted to investigate the behavioral and emotional problems experienced by children living in institutional care. A descriptive study carried out in India discovered that these children are more susceptible to such issues compared to their counterparts who grow up in a family environment (Kaur et al., 2018). The study revealed that 42% of the children in institutional care exhibited conduct problems and faced peer pressure, while 34% experienced emotional problems. Another study conducted in Egypt found that institutional upbringing is associated with increased rates of emotional disturbance in childhood (Marwa G. Abdelrehim et al., 2022). The study assessed behavioral and emotional problems among institutionalized children and found that 5% exhibited abnormal prosocial behavior, 37.5% were at risk for hyperactivity disorder, 12.5% had severe peer problems, and 5% experienced emotional problems (Marwa G. Abdelrehim et al., 2022).

A cross-sectional descriptive investigation undertaken in Pakistan revealed that the aggregate prevalence of behavioral issues among children residing in orphanage facilities was 33% (Lassi et al., 2011). The study compared the behavioral challenges faced by children living in an institutional home, which aims to replicate a familial setting, with those living in conventional orphanages. The findings indicated that the groups exhibited no significant differences in their overall behavioral issues; however, they were markedly dissimilar on the peer problem scale (Lassi et al., 2011). Another study conducted by Kaur et al. in India (2018) found that orphans and other vulnerable children living in institutional homes are more prone to behavioural and

emotional problems compared to those who have a family support system. The study also revealed significant associations between emotional and behavioural problems and factors such as age, sex, reason for being in the institution, age of admission, and length of stay in the home. Similarly, Rahman et al. found a high prevalence of 40.35% of behavioural and emotional disorders among orphan children and adolescents in institutional care (2012). In a separate study conducted by El Koumi et al. in Cairo (2012), the prevalence of behavioural disturbances among those in institutional homes was 64.53%. These findings underscore the urgent need for targeted interventions and support systems to address the mental health needs of children in such environments

In Malaysia, scholarly inquiry into behavioral and emotional disorders remains considerably underdeveloped. Idris (2017) undertook an investigation aimed at elucidating the complexities surrounding emotional and behavioral issues, encompassing aspects such as their definitions, prevalence rates, etiological factors, long-term ramifications, and therapeutic interventions. Furthermore, the research scrutinized mental health challenges within a non-Western context, specifically that of Malaysia, addressing both the prevalence of such issues and the strategic interventions designed to mitigate this pressing concern. The review article accentuates the necessity of executing a rigorously structured epidemiological study within Malaysia to evaluate the present prevalence rates of emotional and behavioral disorders among young children and adolescents (Idris, 2017).

2.2 Institutional Homes

Institutional homes refer to an institution established or designated under Section 54 (Safe Place) of the Child Act 2001 in Malaysia. The main purpose of institutional homes is to provide care and protection for children. This includes providing alternate care for children and promoting their physical, emotional, and mental well-being. The environment within institutional homes is designed to create a harmonious family atmosphere for the children residing there. The admission of children to Institutional homes occurs through a Court Order issued under Paragraph 30(1)(c)(i) (temporary placement with foster parents) and 30(1)(d) (safe place for 3 years/ until the age of 18) of the Child Act 2001 in Malaysia. The period of protection for the children is three years or until they reach the age of 18, depending on which period is shorter. Meanwhile, there is the ability to release children from institutional homes before the end of the protection period. This can be achieved by amending, changing, or revoking the original court order that directed the placement of the child into the institution. This action may involve a court process that requires a reassessment of the child's circumstances and a decision on whether the conditions are suitable for early release. This decision may also involve the authority's decision regarding the welfare of the child. In Malaysia, the number of children in need of care and protection has been increasing each year. According to the Social Welfare Department (JKM), there were 5,858 cases in 2020, 6,144 cases in 2021 and 6,770 cases in 2023. A report from the Social Welfare Department (JKM) also revealed that between January to May 2023, there were 2,959 cases of child neglect and abuse, involving physical, sexual and emotional abuse (Bernama, 18 September 2023).

3. Methodology

The research design for this research is a quantitative cross-sectional survey, utilizing the questionnaire method to collect data. This research design was selected due to its suitability for the population and the number of respondents involved. In this study, the population consists of children who stayed at institutional homes in a northern part of Malaysia. The sample size for this study is determined using Krejcie and Morgan's Sample size Table (1970) as shown in Table 1.

Table 1: Krejcie and Morgan's Sample size Table

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Based on Table 1, the number of populations is 172, thus the number of samples for this study is 118. Data

were collected based on probability sampling using simple random sampling. A set of questionnaires were distributed via face to face to the selected sample. The questionnaire contains two sections. Section A of the questionnaire was designed to analyse the demographics of the respondents. Section B contains twenty-five (25) close-ended questions with a three-point Likert scale: 1 for Not True, 2 for Somewhat True and 3 for Certainly True. The questionnaire used in this study was adopted from the parent and teacher versions of the Strength and Difficulties Questionnaire (SDQ) developed by Santana in 2012 (Santana, 2012). Data gathered were analysed using Statistical Package for Social Sciences (IBM-SPSS) version 27. Data analysed involve descriptive analysis.

4. Finding and Analysis

The measures of behavioural and emotional problems obtained from respondents are determined through an analysis of the study's findings and results. In this study, several key factors are considered. These factors include the demographics of the respondents, the types of behavioural and emotional problems among children under institutional care, and the strategies for overcoming these problems to foster a healthy childhood in the future.

In order to analyze the children's profile living in institutional homes, the frequencies, percentage and crosstabulation analysis were used. The collection of the data for 120 respondents in institutional homes in northern part of Malaysia is used for descriptive analysis. A total of 120 participants participated in this study. A total of 63 individuals, representing 53%, belong to the age group of 7 to 14 years, while 55 individuals or 46% are from the age group of 15 to 17 years. Only 2 respondents consist of children aged below 7 years, and both of them are aged 6 to 7 years old. All the respondents were female.

4.1 Reasons for Being the Institute

Table 2: Reason for being Institute

Age	Reason for being Institutional Homes			
	Death of parents	**Abandoned by family**	**Social Problems**	**Total**
Below than 7 years old	0	2	0	**2**
7– 14 years old	5	39	19	**63**
15– 17 years old	3	33	19	**55**
Total	**8**	**74**	**38**	**120**

Table 2 illustrates the reasons for respondents being instituted in institutional homes. The main reason for respondents being instituted in institutional homes is family abandonment, which is 74 of respondents out of 120. Among these, 39 respondents fall within the age range of 7 to 14 years old, 33 respondents are between 15 to 17 years old, and only 2 respondents are below 7 years old. The second most common reason for respondents being instituted in institutional homes is social problems, which is 38 respondents out of 120. Of these, 19 respondents are aged between 7 to 14 years old, and the same number are between 15 to 17 years old. Only 8 respondents cite the death of parents as the reason for being at the institute, with 3 falling in the age range of 15 to 17 years old and 5 in the age range of 7 to 14 years old.

4.2 Years of Stay in Institutional Home

Table 3: Years of Stay in Institutional Home

Age	Years of stay in Institutional Homes			
	Less than 1 year	**1-3 years**	**4 years and above**	**Total**
Below than 7 years old	2	0	0	2
7– 14 years old	16	41	6	63
15– 17 years old	10	29	16	55
Total	28	70	22	120

Table 3 provides details on the age and duration of stay for respondents at institutional homes. Out of a total of 120 respondents, 70 indicated a stay of 1 to 3 years. Among these, 41 were between 7 and 14 years old, and 29 were between 15 and 17 years old. Additionally, 28 respondents stated a stay of less than 1 year, with 16 between 7 and 14 years old, 10 between 15 and 17 years old, and 2 under 7 years old. Furthermore, 22 respondents mentioned a stay of more than 4 years, with 16 between 15 and 17 years old, and 6 between 7 and 14 years old.

4.3 Academic Performance and Years Stay at Institutional Home

Table 4: Academic Performance

Years of stay in Institutional Homes	Academic Performance			
	Poor	Average	Good	Total
Less than 1 year	8	15	5	28
1-3 years	18	33	19	70
4 years and above	3	13	6	22
Total	29	61	30	120

Table 4 presents the academic performance of the participants based on their length of stay in institutional homes. Out of the 120 respondents, 61 exhibited an average level of academic performance, while 30 demonstrated good academic performance and 29 had poor academic performance. Among the participants who stayed for 1 to 3 years, 33 displayed an average academic performance, 19 showed good performance, and 18 performed poorly. For those who stayed for less than 1 year, 15 showed average academic performance, 8 performed poorly, and 5 performed well. Additionally, for those who stayed 4 years or longer, 13 showed average performance, 6 performed well, and only 3 performed poorly.

4.4 Relationship Between Reason for Being Institute and Academic Performance

Table 5: Academic Performance and Reason for Being Institute

Reason for being institute	Academic Performance			
	Poor	Average	Good	Total
Death of parents	4	3	1	8
Abandoned by family	17	39	18	74
Social Problems	8	19	11	38
Total	29	61	30	120

Table 5 displays the connection between academic performance and the reasons for institutionalization. Out of the 120 respondents, 74 individuals who encountered family abandonment had an average academic performance. Meanwhile, 18 respondents demonstrated good performance, and 17 showed poor performance. In terms of social problems, 19 respondents had an average performance, 11 achieved good performance, and 8 struggled with poor performance. As for the third reason, which is the death of parents, 4 respondents performed poorly academically, 3 had an average performance, and only 1 performed well.

4.5 Types of Behavioural and Emotional Problems Among Children Under Institutional Homes

This study assesses the behavioural and emotional problems among children in institutional homes across five (5) common assessment areas which are prosocial, hyperactivity, emotional, conduct problems and peer problems. The results are analysed using mean score analysis, based on scoring guidelines established by Jamil (2002) (refer table 6).

Table 6: Mean Score Interpretation Table

Mean Score	Interpretation of Mean Score
1.00 – 2.33	Low
2.34 – 3.67	Average/ Moderate
3.68 – 5.00	High

Source: Jamil (2002)

Table 7**:** Types of Behavioural and Emotional Problems

Types of Behavioural & Emotional Problems	N	Mean	Standard Deviation	Interpretation of Mean Score
Prosocial problems	120	2.43	0.447	Average/ Moderate
Hyperactivity problems	120	2.15	0.457	Low
Emotional problems	120	2.08	0.484	Low
Conduct problems	120	1.92	0.358	Low
Peer problems	120	2.25	0.327	Low

The findings of this study indicate that the behavioural and emotional problems in institutional homes are at low to average level (Refer Table 7). Respondents at institutional homes have a low level of four (4) types behavioural and emotional problems which are hyperactivity, emotional, conduct and peer problems. Results show that only prosocial problems are at an average or moderate level which means the mean value is 2.43.

The findings of this study indicate that children at institutional homes have behavioural and emotional problems. This finding is consistent with previous studies which found that children in institutional homes experience behavioural and emotional problems (Kaur et al., 2018; Makhija & Singh, 2019). However, findings show that behavioural and emotional problems in institutional homes are at low to moderate levels. This is because, based on interviews with caregivers at institutional homes, they stated that mental health assessments are conducted every 3 months. Therefore, preventive measures against behavioural and emotional problems among children can be addressed early especially for prosocial problems. Prosocial thought and feelings may be defined as a sense of responsibility for other individuals and a higher likelihood of experiencing empathy both emotionally and cognitively (Deepty Gupta & Geeta Thapliyal, 2015). Caring, helping, sharing and volunteering are the example of prosocial behaviour.

5. Conclusion

Several recommendations were made in light of the research findings to lessen behavioural and emotional issues in children residing in institutional settings. First, this study suggests that institutional home's management conduct routine mental health screenings and offer early interventions. These actions can greatly enhance children's healthy development and guarantee that they grow up to be well-adjusted adults. These kids have the right to resources that support them in addressing behavioural and emotional issues and enhancing their general wellbeing, regardless of their personal circumstances. This means improving the psychosocial and emotional support as well as encouraging cooperation between educational institutions to promote the formal education or skill-based learning that protects children from harm. It's also critical that these kids don't experience feelings of alienation or marginalization; instead, they should be given the chance to participate in constructive peer competition and make a positive contribution to their communities.

In addition, as previously said, it is imperative to apply various therapeutic activities in a realistic way in order to continuously assist children who require assistance. These exercises give children new avenues for understanding and expressing their feelings. Even though the evidence that is now available indicates that these children's emotional difficulties are controllable, it is important to begin proactive surveillance and awareness early on to avoid any potential deterioration of their condition.

In conclusion, this study highlights the behavioral and emotional challenges faced by children living in institutional homes. Utilizing a quantitative approach with simple random sampling, the research provides valuable insights into the profiles of these children and the common behavioral and emotional issues they experience. The findings reveal that, although the overall level of behavioral and emotional problems among children at institutional homes is generally low to moderate, there is a significant concern regarding prosocial difficulties. This emphasizes the need for targeted interventions and support systems specifically designed to address these challenges. It is crucial to develop comprehensive strategies to reduce behavioral and emotional problems among institutionalized children. By eliminating harmful factors, enhancing available resources, reducing stressors, and implementing innovative solutions, stakeholders can create a more supportive and nurturing environment that promotes the well-being of these children.

This research contributes valuable insights to the existing literature on the psychological welfare of children in institutional homes, emphasizing the importance of further exploration and intervention in this domain. Moving forward, concerted efforts from policymakers, caregivers, and community stakeholders are essential in implementing evidence-based strategies to support the holistic development and emotional resilience of children living in institutional settings and beyond.

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Faktor Pembaziran Dalam Pengurusan Sisa Makanan Oleh Pengusaha Restoran Di Alam Mesra, Kota Kinabalu, Sabah.

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Abstract

Food waste that is disposed of can result in wasted costs. Restaurants often prepare more food than necessary to sell and buy food in excess and imperfect food storage and Malaysians produce 17,100 tons of food waste a day. As for the objective of the study, it is to determine the level of knowledge of food operators about food waste management and the impact of food waste and to determine the level of awareness of food operators about food waste management and the factor of food waste. The research method is quantitative and a total of 110 respondents were involved. Questionnaires were distributed face-to-face. The data of this study was analyzed using SPSS software (Statistical Package for the Social Sciences) version 27 SPSS. The total average mean score for the items regarding the level of knowledge of food waste management and the impact on food waste is rated as agreeable is at a very high level of 4.03 while the average mean score for the item regarding the level of awareness of food waste management and the impact on food waste is rated as agreeable at a high level which is 3.77.It has been described in the respondent's profile which includes employment status and type of food service at Alam Mesra. Based on the findings obtained, it can be concluded that the level of knowledge and level of awareness among food operators is at a satisfactory level. This gives a clear picture of how well food operators know how to manage food waste in restaurants. Therefore, if food waste management and the factor of food waste among food operators are increased, the implementation of food waste management will be more efficient.

***Keywords**: Food Waste Management, Impact on Food Waste, Knowledge, Awareness.*

Restoran sering menyediakan lebih banyak makanan daripada yang perlu dijual, membeli bahan makanan secara berlebihan, dan melakukan penyimpanan makanan yang tidak sempurna dan rakyat Malaysia menghasilkan 17,100 tan sisa makanan sehari.. Objektif kajian ini adalah untuk mengenal pasti sejauh mana tahap pengetahuan pengendali makanan mengenai pengurusan sisa makanan dan faktor pembaziran makanan serta tahap kesedaran mereka mengenai pengurusan sisa makanan serta impak pembaziran makanan. Kajian ini menggunakan kaedah kuantitatif dengan melibatkan 110 responden. Pengumpulan data dijalankan dengan mengedarkan borang soal selidik secara bersemuka kepada responden. Data kajian dianalisis menggunakan perisian SPSS (*Statistical Package for the Social Sciences*) versi 27. Jumlah purata skor min bagi item terhadap tahap pengetahuan pengurusan sisa makanan dan faktor terhadap pembaziran makanan dinilai sebagai setuju adalah berada pada tahap sangat tinggi iaitu 4.03 manakala purata skor min bagi item terhadap tahap kesedaran pengurusan sisa makanan dan impak terhadap pembaziran makanan dinilai sebagai setuju adalah berada pada tahap tinggi iaitu 3.77. Berdasarkan hasil dapatan yang diperolehi dapat disimpulkan bahawa tahap pengetahuan dan tahap kesedaran di kalangan pengendali makanan adalah pada tahap yang memuaskan. Oleh itu, jika pengurusan sisa makanan dan impak pembaziran makanan di kalangan pengendali makanan ditingkatkan, pelaksanaan pengurusan sisa makanan akan menjadi lebih efisien.

Kata kunci: Pengurusan sisa makanan, Faktor pembaziran makanan, Pengetahuan, Kesedaran

1. Pengenalan

Sisa makanan pada umumnya merujuk kepada bahan-bahan makanan yang tidak lagi diingini sama ada bahan tersebut mentah atau masak dan sisa makanan tersebut dibuang berpunca daripada proses pengeluaran, pemprosesan, pengangkutan, pengagihan dan pengambilan makanan. Jumlah pembaziran sisa makanan yang dijana adalah 17,100 tan sehari (My Metro, 2019). Jika sisa makanan yang telah dihasilkan ini tidak dilupuskan dengan kaedah yang betul ia boleh memberikan impak negatif kepada alam sekitar. Sisa makanan yang dibuang ke dalam tong sampah dan akhirnya dilupuskan di tapak pelupusan boleh menghasilkan gas metana rumah hijau yang 21 kali lebih merbahaya daripada karbon dioksida. Dianggarkan sebanyak 7% gas rumah hijau yang terhasil di seluruh dunia disebabkan oleh sisa makanan (*Change for Climate*, 2014).

Terdapat pelbagai kajian yang telah dijalankan bagi memahami dan meningkatkan kesedaran awam tentang sisa makanan dan kaitannya dengan keselamatan makanan, pembangunan mampan, kesan alam sekitar

dan sumber yang berkurangan (Pinto & Cordovil, 2018). Dapatan kajian turut merumuskan impak negatif terhadap kesan alam sekitar yang berpunca daripada pengeluaran sisa makanan telah menyebabkan menjadi salah satu masalah kemampanan global utama. Juga memberikan kesan kepada ekonomi yang menjurus kepada kos yang tinggi akibat pembaziran makanan. Serta memberi kesan impak social (Liu et al., 2021). Oleh sebab itu, pemahaman mengenai kebolehcapaian dan kualiti tentang sisa makanan dapat menjejaki kerberkesanan sasaran mitigasi, menganalisis akibat alam sekitar dan menyiasat prosedur pengurangan bagi sisa makanan (Xue et al., 2017).

Kaedah pengurusan sisa makanan di Malaysia juga kelihatan masih lemah dan menyebabkan hal ini sukar untuk ditangani. Kesan daripada isu ini telah menyebabkan masalah kepada kesihatan manusia selain mencemari persekitaran (Dearman et al., 2007). Untuk mengetahui pengurusan sisa makanan dalam kalangan pengendali makanan, kami memilih pengedali makanan di Alam Mesra, Kota Kinabalu, Sabah sebagai lokasi membuat kajian. Kajian ini dilakukan bertujuan untuk mengenalpasti tahap pengetahuan dan faktor dalam pembaziran sisa makanan oleh pengendali makanan di Alam Mesra, Kota Kinabalu.

2. Kajian Terdahulu

Pengetahuan pengendali makanan adalah penting dalam mencegah pembaziran makanan di restoran. Walaupun pengendali makanan mungkin mempunyai pengetahuan yang mencukupi, pengetahuan tersebut tidak selalu diterjemahkan ke dalam amalan yang betul di tempat kerja (Lee at al., 2017). Menurut F. Jarjusey (2017), pemahaman yang lemah tentang pengurusan penyediaan makanan akan menyumbang kepada lebih banyak sisa makanan. Pengendali makanan yang mempunyai tahap pengetahuan yang lebih tinggi tentang sisa makanan lebih cenderung untuk melaksanakan amalan pengurangan sisa, seperti dengan melakukan teknik pembahagian dan penyimpanan yang betul (Reynolds et al., 2013). Pengusaha yang telah mendapat latihan pengendalian makanan dan pengurusan sisa makanan menunjukkan Peningkatan pengetahuan, sikap dan tingkahlaku (Graham-Rowe et al., 2014; Evans et al., 2014)

2.1. Isu Pengurusan Sisa Buangan Makanan Dalam Industri Makanan

Isu pengurusan sisa makanan merupakan salah satu isu besar di Malaysia. Statistik daripada Kementerian Perumahan dan Kerajaan Tempatan (KPKT) menunjukkan tahap sampah di Malaysia agak tinggi, dengan sisa buangan makanan menjadi salah satu jenis sisa yang paling banyak dicatatkan (MStar, 2016). Menurut Pertubuhan Makanan dan Pertanian (FAO), hampir 15,000 tan makanan dibazirkan setiap hari. Daripada jumlah tersebut, sebanyak 20 peratus atau 3,000 tan adalah lebihan makanan yang tidak disentuh dan masih boleh dimakan (Sinar Harian, 2021).

Industri pemprosesan makanan seperti restoran akan menjanakan banyak sisa buangan makanan pada setiap hari. Jika keadaan ini berterusan, negara kita mungkin akan menghadapi masalah penyediaan tapak pelupusan, kerana jumlah tapak pelupusan yang ada semakin penuh dan tidak mampu menampung sisa pepejal yang dihasilkan setiap hari. Faktor utama yang menyumbang kepada penghasilan sisa makanan ini berlaku adalah pada fasa penyediaan iaitu sebanyak 45% atau disebabkan oleh kemerosotan makanan sebanyak 21% dan sisa makanan yang tidak habis dimakan oleh pelanggan sebanyak 34% (Pricilla et al., 2022). Jika faktor ini terus berlaku ia akan mengakibatkan kesan terhadap ekonomi dalam industri makanan serta menyebabkan kesan yang negatif terhadap persekitaran dan sosial. Menurut Papargyropoulou et al. (2016), terdapat dua punca utama penghasilan sisa buangan makanan di restoran. Pertama, adalah sisa yang dihasilkan melalui proses penyediaan makanan, seperti pengeluaran makanan berlebihan, pengupasan, pemotongan, tamat tempoh, kerosakan bahan memasak, dan memasak berlebihan. Kedua, adalah sisa makanan yang telah dihidang namun tidak dihabiskan oleh pelanggan. Keadaan ini mengakibatkan penghasilan sisa buangan makanan yang banyak dan menjadikan proses pengurusan sisa makanan lebih rumit.

Pembaziran makanan memerlukan kos pelupusan yang tinggi. Kos untuk melupuskan makanan yang dibazirkan oleh setiap isi rumah di Malaysia mencecah kira-kira RM210 sebulan, atau RM2,600 setahun (*Malaysia Now*, 2022). Menurut Pengarah *Green Technology Corporation* Malaysia, Datin Paduka Che Asmah Ibrahim, yang juga bekas Pengarah Alam Sekitar Selangor, pembuangan sisa makanan seperti sayur - sayuran dan buah-buahan yang telah tamat tempoh boleh dikitar semula menjadi produk pencuci pinggan atau lantai organik (Bharian, 2016). Produk ini bukan sahaja bebas kimia dan mesra alam, tetapi juga dapat menjimatkan kos perbelanjaan isi rumah. Salah satu penyelesaian lain terhadap isu sisa makanan adalah memprosesnya menjadi makanan haiwan yang bernutrisi tinggi (Michael, 2000).

2.2. Pembaziran Makanan Dalam Industri Perkhidmatan Makanan

Salah satu langkah atau kaedah yang boleh diambil dalam pengurusan sisa makanan restoran adalah melalui kaedah pengkomposan (Leow et al.,2010) Sisa makanan yang lembap, kaya dengan bahan organik dan zat galian mudah diuraikan oleh mikroorganisma, menjadikannya sangat sesuai untuk kaedah

pengkomposan dalam menyelesaikan masalah pengurusan sisa makanan di restoran. Kesan negatif alam sekitar yang berpunca daripada pengeluaran sisa makanan telah menyebabkan menjadi salah satu masalah kemampanan global utama, menimbulkan kebimbingan daripada penggubal dasar, penyelidik, masyarakat dan syarikat (Liu et al., 2021). Dengan pemahaman mengenai kebolehcapaian dan kualiti tentang sisa makanan dapat menjejaki kerberkesanan sasaran mitigasi, menganalisis akibat alam sekitar dan menyiasat prosedur pengurangan bagi sisa makanan (Xue et al., 2017).

Dalam kajian yang telah dilakukan oleh Electrolux Malaysia, majoriti responden kajian mengakui membazir sekurang-kurangnya satu pinggan makanan yang masih elok setiap minggu (Astro Awani, 2016). Pengguna sering membuang makanan yang masih selamat untuk dimakan kerana tidak pasti sama ada ia telah rosak ataupun tidak (Harrison, 2019). Menurut McDonald (2010), perubahan corak kekayaan akan mengubah corak pengeluaran makanan dan penggunaan makanan sehingga menjejaskan alam sekitar. Impak pembaziran makanan ini berlaku terhadap sumber alam seperti tanah, air, tenaga dan lebih besar lagi meningkatkan pengeluaran gas karbon dioksida ke udara (FAO, 2016).

3. Metodologi Kajian

Kajian ini menggunakan kaedah kuantitatif bagi mencapai objektif kajian iaitu mengenalpasti tahap pengetahuan dan kesedaran tentang kaedah pengurusan sisa makanan oleh pengendali makanan di Alam Mesra Kota Kinabalu. Kajian ini menggunakan kaedah kuantitatif dan berbentuk deskriptif dengan mengedarkan borang soal selidik menggunakan aplikasi *Google Form*. Bagi mendapatkan data kajian, borang soal selidik diedarkan secara bersemuka kepada responden. Kaedah persampelan secara rawak mudah digunakan dan seramai 110 responden telah mengambil bahagian dalam kajian ini.

Soal selidik yang digunakan adalah daripada format jenis *Likert* 5 skala. 1 mewakili Sangat Tidak Setuju, 2 Tidak Setuju, 3 Kurang Pasti, 4 Setuju, dan 5 Sangat Setuju sebagai jawapan pada soalan. Item soal selidik telah diadaptasi daripada kajian lepas dengan beberapa item disesuaikan dengan keperluan kajian. Sumber soal selidik adalah merujuk kepada kajian lepas yang dijalankan oleh Noor Nazurah et al., 2022 yang dijalankan di Petaling Jaya, Kuala Lumpur. Soalan soal selidik ini terbahagi kepada 2 bahagian iaitu bahagian pertama merangkumi data demografi responden yang mengandungi status pekerjaan dan jenis perkhidmatan makanan yang dijalankan di Alam Mesra. Bahagian kedua merangkumi data skala *Likert* iaitu Sangat Tidak Setuju, Tidak Setuju, Kurang Pasti, Setuju dan Sangat Setuju. Data telah dianalisis menggunakan perisian *IBM SPSS* 27.

4. Hasil Dapatan

Jadual 1 menunjukkan aspek yang diterangkan dalam bahagian demografi seperti status pekerjaan dan jenis perkhidmatan makanan. Dari segi status pekerjaan bagi kategori pengusaha restoran iatu hanya 17 orang meliputi 13.7% diikuti bagi kategori pengurus restoran iaitu 32 orang meliputi 25.8% manakala kategori pekerja iaitu 61 orang dan 49.2%. Respon berkaitan dengan jenis perkhidmatan makanan bagi kategori restoran iaitu mempunyai sebanyak 73 kekerapan meliputi 58.9% dan bagi kategori *Cafe* mempunyai 11 kekerapan meliputi 8.9%. Selain itu, bagi kategori *Food Court* mempunyai 9 kekerapan meliputi 7.3% manakala, bagi kategori *Kiosk* mempunyai 14 kekerapan meliputi 11.3%. Akhir sekali, bagi kategori *Bakery* hanya mempunyai 3 kekerapan dan 2.4%

Jadual 1: Profil Responden

Pembolehubah Demografik	Kategori	Kekerapan	Peratus%
Status pekerjaan	Pengusaha restoran	17	13.7
	Pengurus restoran	32	25.8
	Pekerja	61	49.2
Jenis perkhidmatan makanan	Restoran	73	58.9
	Cafe	11	8.9
	Food Court	9	7.3
	Kiosk	14	11.3
	Bakery	3	2.4

Jadual 2: Interpretasi Skor Min

Skala likert	Interval	Interpretasi
1	1.00-1.80	Sangat Rendah
2	1.81-2.60	Rendah
3	2.61-3.40	Sederhana
4	3.41-4.20	Tinggi
5	4.21-5.00	Sangat Tinggi

Sumber: Izani&Yahya (2014)

Jadual 3: Nilai Skor Min Bagi Setiap Item Terhadap Tahap Pengetahuan Pengendali Makanan Mengenai Pengurusan Sisa Makanan Dan Impak Pembaziran Makanan

Item	**Sisihan Piawai**	**Min**	**Interpretasi Skor Min**
1. Saya sentiasa membuat senarai bahan yang perlu dibeli dan mengikuti senarai bahan tersebut.	0.498	4.56	Sangat Tinggi
2. Saya sentiasa memeriksa stor penyimpanan bahan mentah.	0.494	4.59	Sangat Tinggi
3. Saya dapati peti ais saya sentiasa terdapat bahan mentah yang rosak.	1.145	2.14	Rendah
4. Saya membuang lebihan makanan yang tidak habis.	1.320	3.76	Tinggi
5. Saya menghabiskan kesemua barangan terutama bahan mentah mengikuti kaedah *First In First Out* (FIFO).	0.846	4.38	Sangat Tinggi
6. Saya memastikan stor penyimpanan makanan kering hendaklah bebas daripada sebarang lembapan untuk mengelakkan makanan mudah rosak	0.421	4.77	Sangat Tinggi
Purata Skor Min	**4.0348**		**Tinggi**

Interpretasi nilai min adalah berdasarkan kepada Izani&Yahya (2014) seperti di Jadual 2. Jadual 3 di atas menunjukkan skor min bagi setiap item yang digunakan untuk mengukur tahap pengetahuan terhadap pengurusan sisa makanan dan impak terhadap pembaziran makanan dinilai berdasarkan nilai min dan sisihan piawai. Min bagi item pertama "Saya sentiasa membuat senarai bahan yang perlu dibeli dan mengikuti senarai bahan tersebut" ialah 4.56 iatu pada tahap Sangat Setuju dan sisihan piawai adalah 0.498. Min bagi i tem kedua "Saya sentiasa memeriksa stor penyimpanan bahan mentah" ialah 4.59 iaitu pada tahap Sangat Setuju dan sisihan piawai adalah 0.494. Min bagi item yang ketiga "Saya dapati peti ais saya sentiasa terdapat bahan mentah yang rosak" ialah 2.14 iatu pada tahap Kurang Pasti dan sisihan piawai adalah 1.145. Min bagi item keempat "Saya membuang lebihan makanan yang tidak habis" ialah 3.76 iaitu pada tahap Setuju dan sisihan piawai adalah 1.320. Min bagi item kelima "Saya menghabiskan kesemua barangan terutama bahan mentah mengikuti kaedah *First In First Out* (FIFO) ialah 4.38 iaitu pada tahap setuju dan sisihan piawai adalah 0.486. Min bagi item keenam "Saya memastikan stor penyimpanan makanan kering hendaklah bebas daripada sebarang lembapan untuk mengelakkan makanan mudah rosak" ialah 4.77 iaitu pada tahap Sangat Setuju dan sisihan piawai 0.421. Jumlah purata skor min bagi item terhadap tahap pengetahuan pengurusan sisa makanan dan impak terhadap pembaziran makanan adalah berada pada tahap sangat tinggi iaitu 4.03.

Jadual 4: Nilai Skor Min Bagi Setiap Item Terhadap Faktor Berlakunya Pembaziran Makanan

Item	Sisihan Piawai	Min	Interpretasi Skor Min
1. Saya membuang makanan yang telah melepasi tarikh luput tanpa melihat keadaan makanan tersebut.	0.737	4.45	Sangat Tinggi
2. Saya menyimpan lebihan makanan untuk dimakan kemudian.	1.051	2.40	Rendah
3. Saya mendapati sisa makanan daripada pelanggan yang tidak menghabiskan makanan tersebut.	1.158	3.39	Sederhana
4. Saya peka terhadap label tarikh luput pada produk makanan dan minuman.	0.598	4.57	Sangat Tinggi
5. Saya membuat sisa makanan untuk dijadikan sebagai kompos untuk tanaman.	0.959	3.33	Sederhana
6. Saya dapat mengenalpasti makanan yang masih boleh dimakan dan makanan yang sudah rosak.	0.646	4.47	Sangat Tinggi
Purata Skor Min	**3.7682**		**Tinggi**

Jadual 4 di atas menunjukkan skor min bagi setiap item yang digunakan untuk mengukur faktor berlakunya pembaziran makanan berdasarkan min dan sisihan piawai. Min bagi item pertama "Saya membuang makanan yang telah melepasi tarikh luput tanpa melihat keadaan makanan tersebut" ialah 4.45 iaitu pada tahap Sangat Setuju dan sisihan piawai adalah 0.737. Min bagi item kedua "Saya menyimpan lebihan makanan untuk dimakan kemudian" ialah 2.40 iaitu pada tahap Tidak Setuju dan sisihan piawai adalah 1.051. Min bagi item ketiga "Saya menjadikan sisa makanan tersebut untuk dijadikan sebagai makanan haiwan peliharaan (contoh; kucing dan anjing)" ialah 3.39 iaitu pada tahap Kurang Pasti dan sisihan piawai adalah 1.158. Min bagi item keempat "Saya peka terhadap label tarikh luput pada produk makanan dan minuman" ialah 4.57 iaitu pada tahap Sangat Setuju dan sisihan piawai adalah 0.598. Min bagi item kelima "Saya membuat sisa makanan untuk dijadikan sebagai kompos untuk tanaman" ialah 3.33 iaitu pada tahap Kurang Pasti dan sisihan piawai adalah 0.959. Min bagi item keenam "Saya dapat mengenalpasti makanan yang masih boleh dimakan dan makanan yang sudah rosak" ialah 4.47 iaitu pada tahap Sangat Setuju dan sisihan piawai adalah 0.646. Jumlah purata skor min bagi item terhadap tahap kesedaran pengurusan sisa makanan dan impak terhadap pembaziran makanan adalah berada pada tahap tinggi iaitu 3.77.

5. Rumusan dan Perbincangan

Dalam kajian yang telah dijalankan, didapati faktor yang mempengaruhi pembaziran makanan yang menyebabkan berlakunya penghasilan sisa ialah melalui sisa dapur yang telah tamat tempoh dan kerosakan bahan memasak. Hasil kajian ini juga bersetuju dengan dapatan kajian yang dijalankan oleh Papargyropoulou et al. (2016), Dearman dan Bentham, (2007) dan Pricilla et al., (2022). Menyimpan lebihan makanan untuk dimakan kemudian dan dengan hasil kajian yang telah dilakukan oleh syarikat Electrolux Malaysia yang telah disiarkan di Astro Awani (2016), Harrison (2019) dan (Sinar Harian, 2021) para pengendali makanan tidak melakukan kaedah menyimpan lebihan makanan yang masih elok untuk dimakan kemudian dan para pengendali juga membuang makanan yang masih boleh dimakan kerana tidak pasti tentang makanan tersebut telah rosak ataupun tidak. Seterusnya, dalam kajian yang telah dijalankan oleh Michael L. (2000), di mana ia menyatakan bahawa membuat sisa makanan untuk digunakan sebagai makanan haiwan adalah merupakan jalan penyelesaian yang berdaya maju dan mampan untuk mengurangkan sisa makanan. Namun begitu, pernyataan ini masih pada tahap yang sederhana dimana ianya masih belum berada pada tahap yang disokong sepenuhnya. Berdasarkan bukti di atas,

dapat dikatakan bahawa tahap pengetahuan dan kesedaran pengendali makanan dengan kajian yang telah dijalankan oleh Reynolds et al., (2013) dan Evans et al,. (2017).

Kesimpulan kajian ini mengemukakan keseluruhan tentang tahap pengetahuan dan kesedaran pengendali makanan mengenai pengurusan sisa makanan dan impak terhadap pembaziran makanan yang telah dilaksanakan. Kajian ini memberikan penilaian yang menyeluruh terhadap tahap pengetahuan dan kesedaran pengendali di Alam Mesra, Kota Kinabalu, Sabah. Melalui analisis data, dapat disimpulkan bahawa tahap pengetahuan dan kesedaran pengendali makanan berkait rapat dengan pengurusan sisa makanan dan impak terhadap pembaziran makanan. Tafsiran hasil pula, menunjukkan bahawa pencapaian objektif kajian dengan memberikan gambaran yang jelas tentang sejauh manakah pengendali makanan tahu bagaimana cara untuk mengurus sisa makanan dan pembaziran makanan di restoran. Ulasan menyentuh kelemahan dan kelebihan metodologi kajian memberikan kefahaman yang mendalam tentang isu ini. Secara keseluruhan, kajian ini memberikan pandangan yang baik terhadap tahap pengetahuan dan kesedaran mengenai pengurusan sisa makanan dan impak terhadap pembaziran makanan dalam kalangan pengendali makanan di dan Alam Mesra, Kota Kinabalu, Sabah. Hal ini demikian, dijangkakan harapan untuk kajian yang akan datang untuk terus meningkatkan pengetahuan dan kesedaran pengendali makanan dalam pengurusan sisa makanan dan impak terhadap pembaziran makanan ini bertujuan untuk mengurangkan kesan alam sekitar dan meningkatkan pelaksanaan pengurusan sisa makanan yang lebih efisien.

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POLITEKNIK KOTA KINABALU

Analisis Faktor Pendorong Kerja Sambilan dalam Kalangan Pelajar di Kolej Komuniti Kelana Jaya

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Abstract

This study aims to understand the factors that motivate Kelana Jaya Community College students to work part-time during their studies. The study involved 59 full-time students who were randomly selected. Data were collected through a questionnaire covering demographic background, part-time job information, and factors influencing the decision to work part-time. Descriptive statistical analysis showed that the majority of students who work part-time are Malay (84.7%), mostly in their second semester (52.5%). The most popular part-time jobs among students are in logistics (37.5%), followed by food and beverages (30.4%) and retail (21.4%). The study found that internal factors such as financial needs (Mean = 4.0678) and skill enhancement (Mean = 4.5424) are the main motivations for students to work part-time, while external factors such as peer influence and filling free time are less significant. Correlation tests found a significant relationship between family income and the decision to work part-time ($r = 0.229$, $p < 0.05$), indicating that students from low-income families are more likely to work part-time. In conclusion, part-time work can provide financial benefits and skill enhancement to students. Therefore, the study suggests that additional support be provided to students from low-income families and better skill enhancement programs be offered to help students manage their part-time work and studies more effectively.

Keywords: part-time work; students; factors; community college

Abstrak

Kajian ini bertujuan untuk memahami faktor-faktor yang mendorong pelajar Kolej Komuniti Kelana Jaya bekerja sambilan semasa pengajian. Kajian ini melibatkan 59 orang pelajar sepenuh masa yang dipilih secara rawak. Data dikumpulkan melalui soal selidik yang merangkumi latar belakang demografi, maklumat pekerjaan sambilan dan faktor-faktor yang mempengaruhi keputusan bekerja sambilan. Analisis statistik deskriptif menunjukkan bahawa majoriti pelajar yang bekerja sambilan terdiri daripada pelajar Melayu (84.7%) yang kebanyakannya berada di semester dua (52.5%). Jenis pekerjaan sambilan yang paling popular dalam kalangan pelajar adalah dalam bidang logistik (37.5%), diikuti oleh makanan dan minuman (30.4%) dan peruncitan (21.4%). Kajian mendapati faktor dalaman seperti keperluan kewangan (Min = 4.0678) dan peningkatan kemahiran (Min = 4.5424) adalah motivasi utama pelajar bekerja sambilan, manakala faktor luaran seperti pengaruh rakan dan mengisi masa lapang adalah kurang signifikan. Ujian korelasi yang dijalankan mendapati hubungan yang signifikan antara pendapatan keluarga dan keputusan untuk bekerja sambilan ($r = 0.229$, $p < 0.05$), menunjukkan bahawa pelajar dari keluarga berpendapatan rendah lebih cenderung untuk bekerja sambilan. Kesimpulannya, kerja sambilan dapat memberikan manfaat kewangan dan peningkatan kemahiran kepada pelajar. Justeru, kajian mencadangkan agar sokongan tambahan diberikan kepada pelajar dari keluarga berpendapatan rendah dan program peningkatan kemahiran yang lebih baik disediakan untuk membantu pelajar mengurus kerja sambilan dan pelajaran mereka dengan lebih efektif.

Kata Kunci: kerja sambilan; pelajar; faktor; kolej komuniti

1. Pengenalan

Pekerjaan sambilan di kalangan pelajar institusi pengajian tinggi semakin menjadi amalan yang lazim di Malaysia. Menurut laporan oleh Kementerian Pendidikan Malaysia (2020), lebih daripada 40% pelajar di institusi pengajian tinggi terlibat dalam pekerjaan sambilan untuk menampung perbelanjaan harian mereka dan mengurangkan beban kewangan keluarga. Ini kerana kerja sambilan bukan sahaja dapat memberi peluang kepada pelajar untuk memperoleh pengalaman kerja yang berharga malah dapat meningkatkan kemahiran yang relevan dengan industri. Smith et al. (2021) menyatakan bahawa kerja sambilan membolehkan pelajar membina jaringan profesional yang boleh memberikan manfaat besar kepada kerjaya masa depan mereka. Kajian oleh Wolff (2019) pula menunjukkan bahawa pelajar dari latar belakang sosio-ekonomi tertentu lebih

cenderung untuk bekerja sambilan bagi menampung keperluan kewangan mereka. Ini menunjukkan bahawa kerja sambilan bukan sahaja penting dari segi ekonomi tetapi juga memberikan platform kepada pelajar untuk membina kemahiran dan hubungan profesional. Walau bagaimanapun, terdapat kebimbangan bahawa pelajar yang bekerja sambilan mungkin menghadapi cabaran dalam mengimbangi komitmen akademik dan pekerjaan mereka. Kajian oleh Butler (2007) dan Nguyen et al. (2020) misalnya mendapati bahawa pelajar yang bekerja sambilan cenderung mempunyai prestasi akademik yang lebih rendah berbanding mereka yang tidak bekerja. Ini menunjukkan walaupun kerja sambilan mempunyai manfaat, ia juga boleh memberi kesan negatif jika tidak diurus dengan baik. Selain itu, faktor-faktor yang mendorong pelajar untuk bekerja sambilan masih kurang difahami dengan mendalam. Faktor dalaman seperti keperluan kewangan dan peningkatan kemahiran sering dianggap sebagai motivasi utama (Callender & Jackson, 2008; Curtis & Shani, 2002), namun pengaruh faktor luaran seperti pengaruh rakan dan keperluan untuk mengisi masa lapang juga perlu diterokai (Watts & Pickering, 2000).

Oleh itu, penting untuk memahami faktor-faktor yang mendorong pelajar untuk bekerja sambilan dan bagaimana mereka menguruskan keseimbangan antara kerja dan pelajaran. Kajian ini akan meneliti latar belakang demografi pelajar yang bekerja sambilan, jenis pekerjaan yang dilakukan serta mengenalpasti faktor yang mempengaruhi pelajar bekerja sambilan semasa pengajian. Kajian ini juga akan melihat kepada strategi yang boleh membantu pelajar menguruskan masa dan tekanan dengan lebih baik untuk mencapai keseimbangan yang optimum antara kerja dan pelajaran.

2. Kajian Literatur

2.1 Pengenalan

Kerja sambilan boleh didefinisikan sebagai pekerjaan yang dilakukan oleh pelajar di luar waktu kuliah untuk menambah pendapatan atau mendapatkan pengalaman kerja yang relevan (Smith et al., 2021). Definisi ini merangkumi pelbagai bentuk pekerjaan yang boleh dilakukan secara tetap atau tidak tetap, separuh masa atau berdasarkan projek tertentu (Robotham, 2012). Menurut Richardson et al. (2009), kerja sambilan juga melibatkan pekerjaan yang tidak memerlukan komitmen masa penuh dan membolehkan pelajar menyesuaikan jadual kerja mereka dengan keperluan akademik. Kajian oleh Miller (2019) menambah bahawa kerja sambilan termasuk pekerjaan sementara, kontrak jangka pendek, dan kerja bebas (freelancing) yang semakin popular di kalangan pelajar masa kini.

Laporan oleh Kementerian Pendidikan Malaysia (2020) melaporkan lebih daripada 40% pelajar di institusi pengajian tinggi di Malaysia terlibat dalam kerja sambilan untuk menyokong kehidupan harian mereka. Kajian oleh Hall (2010) menyatakan bahawa pelajar sering terlibat dalam kerja sambilan untuk menampung keperluan kewangan mereka serta mendapatkan pengalaman praktikal yang dapat memperkaya kemahiran insaniah mereka. Dapatan kajian ini disokong oleh Park dan Sprung (2013) yang menyatakan bahawa kerja sambilan bukan sahaja dapat memberi pendapatan tambahan tetapi juga peluang untuk mempraktikkan teori yang dipelajari dalam kelas di tempat kerja. Menurut Smith et al.,(2021), kerja sambilan bukan sahaja membantu pelajar menampung kos hidup tetapi juga menyediakan peluang untuk mendapatkan pengalaman kerja yang berharga dan meningkatkan kemahiran yang relevan dengan industri. Menurut Robotham (2012) pula, pengalaman bekerja sambilan membantu pelajar mengembangkan kemahiran insaniah seperti pengurusan masa, penyelesaian masalah, dan komunikasi. Kajian terbaru oleh Turner (2021) juga mendapati bahawa pelajar yang bekerja sambilan cenderung lebih mahir dalam pengurusan masa dan memiliki daya tahan yang lebih tinggi berbanding pelajar yang tidak bekerja.

Selain dilihat sebagai cara untuk menambah pendapatan, kerja sampingan juga boleh membantu pelajar memahami budaya kerja dan meningkatkan daya tahan serta kemahiran kepimpinan mereka (Curtis & Shani, 2002). Menurut Brown dan Lee (2022), pelajar yang bekerja sambilan sering menunjukkan tahap kematangan dan tanggungjawab yang lebih tinggi, yang boleh menjadi aset berharga dalam kerjaya masa depan mereka. Kajian oleh Park et al. (2018) juga menekankan bahawa pelajar yang bekerja sambilan memperoleh kelebihan kompetitif di pasaran kerja kerana mereka memiliki pengalaman praktikal dan kemahiran yang dicari oleh majikan. Semua kajian ini menunjukkan bahawa kerja sambilan mempunyai manfaat yang lebih luas daripada sekadar menambah pendapatan, antaranya termasuk pembangunan kemahiran dan peluang jaringan profesional.

2.2 Jenis Pekerjaan Sambilan yang Popular di Kalangan Pelajar

Kajian oleh Curtis dan Lucas (2001) mendapati bahawa pekerjaan dalam bidang logistik, makanan dan minuman, serta peruncitan adalah antara yang paling popular di kalangan pelajar. Pekerjaan ini biasanya tidak memerlukan komitmen waktu yang ketat dan membolehkan pelajar menyesuaikan jadual kerja mereka dengan jadual akademik. Kajian oleh Miller (2019) turut menunjukkan bahawa pekerjaan sambilan dalam sektor perkhidmatan seperti khidmat pelanggan, kafe dan restoran, serta runcit terus menjadi pilihan utama pelajar kerana fleksibiliti yang ditawarkan. Pelajar boleh bekerja pada waktu petang, hujung minggu atau cuti semester, yang membolehkan mereka menyeimbangkan antara kerja dan pelajaran. Menurut kajian ini,

pekerjaan dalam sektor perkhidmatan juga membantu pelajar mengembangkan kemahiran komunikasi dan interpersonal yang penting dalam persekitaran kerja yang sebenar.

Kajian oleh Park dan Sprung (2018) mendapati bahawa dengan kemajuan teknologi, pekerjaan sambilan dalam bidang digital seperti pemasaran digital, pengurusan media sosial, dan penulisan bebas (freelance writing) semakin popular di kalangan pelajar. Pekerjaan ini menawarkan fleksibiliti yang lebih tinggi kerana pelajar boleh bekerja dari mana-mana sahaja dan pada bila-bila masa. Selain itu, pelajar juga boleh mendapatkan pengalaman kerja yang relevan dengan bidang pengajian mereka, seperti pemasaran, komunikasi, atau penulisan kreatif, yang dapat meningkatkan kebolehpasaran mereka selepas tamat pengajian.

Di samping itu, kajian oleh Turner (2021) menunjukkan bahawa pekerjaan dalam bidang peruncitan dan hospitaliti masih menjadi pilihan utama pelajar di universiti-universiti di Eropah dan Amerika Syarikat. Pekerjaan dalam bidang ini tidak hanya menawarkan fleksibiliti waktu tetapi juga peluang untuk pelajar berinteraksi dengan pelanggan dari pelbagai latar belakang, yang membantu meningkatkan kemahiran interpersonal mereka. Pekerjaan sambilan ini juga menyediakan peluang untuk pelajar membina jaringan profesional yang boleh bermanfaat untuk kerjaya masa depan mereka.

2.3 Faktor-faktor yang Mempengaruhi Pelajar Bekerja Sambilan

Faktor-faktor yang mempengaruhi keputusan pelajar untuk bekerja sambilan boleh dibahagikan kepada faktor dalaman dan faktor luaran. Faktor dalaman meliputi keperluan kewangan dan peningkatan kemahiran. Kajian oleh Callender dan Jackson (2008) mendapati bahawa keperluan kewangan adalah faktor utama yang mendorong pelajar untuk bekerja sambilan. Pelajar yang berasal dari keluarga berpendapatan rendah lebih cenderung untuk bekerja sambilan bagi menampung kos pengajian dan perbelanjaan harian mereka. Selain itu, peningkatan kemahiran juga merupakan motivasi penting dalam pemilihan pekerjaan sampingan. Menurut Curtis dan Shani (2002), pelajar yang bekerja sambilan dapat meningkatkan kemahiran komunikasi, pengurusan masa, dan kebolehan bekerja dalam pasukan. Pengalaman kerja ini bukan sahaja berguna untuk kerjaya masa depan tetapi juga dapat meningkatkan keyakinan diri pelajar.

Faktor luaran pula adalah berkaitan pengaruh rakan dan keperluan untuk mengisi masa lapang. Watts dan Pickering (2000) mendapati bahawa pelajar sering dipengaruhi oleh rakan-rakan mereka untuk bekerja sambilan. Pengaruh sosial ini boleh menjadi motivasi yang kuat, terutamanya dalam kalangan pelajar yang ingin bersama-sama rakan-rakan mereka dalam pekerjaan sambilan. Selain itu, pelajar juga mungkin memilih untuk bekerja sambilan sebagai cara untuk mengisi masa lapang mereka dengan aktiviti yang produktif. Kajian oleh Brown dan Lee (2022) menunjukkan bahawa pelajar yang terlibat dalam kerja sambilan dapat mengurangkan kebosanan dan merasa lebih produktif.

3. Metodologi

3.1 Reka Bentuk Kajian

Kajian ini menggunakan kaedah kuantitatif dalam memahami faktor-faktor yang mempengaruhi pelajar dalam melakukan kerja sambilan dan prestasi akademik mereka. Kaedah ini dipilih kerana ia membolehkan penyelidik mengumpul data numerik yang boleh dianalisis secara statistik (Creswell, 2014). Populasi kajian terdiri daripada 59 orang pelajar Kolej Komuniti Kelana Jaya yang bekerja sambilan sepanjang pengajian di institusi. Responden dipilih secara rawak untuk memastikan keterwakilan yang mencukupi bagi populasi pelajar (Sekaran & Bougie, 2016).

3.2 Instrumen Kajian

Instrumen utama yang digunakan dalam kajian ini ialah soal selidik yang dibangunkan berdasarkan objektif kajian. Soal selidik ini dibahagikan kepada tiga bahagian utama seperti yang ditunjukkan dalam Jadual 1.

Jadual 1. Bahagian Soal Selidik

Bahagian	Bilangan Item
A. Maklumat Demografi	6
B: Maklumat Pekerjaan Sambilan	5
C: Faktor Bekerja Sambilan	8

3.3 Kesahan Kajian

Kesahan kajian merujuk kepada sejauh mana alat pengukuran yang digunakan dalam kajian ini mampu mengukur apa yang sepatutnya diukur dengan tepat dan konsisten. Salah satu cara untuk menilai kesahan alat pengukuran adalah melalui analisis kebolehpercayaan menggunakan pekali Alpha Cronbach. Dalam kajian ini, nilai Alpha Cronbach yang diperoleh adalah sangat baik iaitu 0.84 (George dan Mallery, 2018). Ini menunjukkan soal selidik yang digunakan adalah sah dan boleh dipercayai untuk mengukur faktor-faktor yang mempengaruhi pelajar bekerja sambilan.

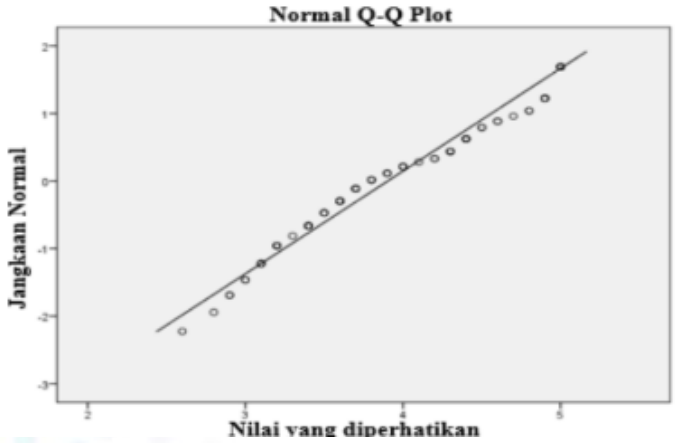
3.4 Analisis Data

Kajian ini menggunakan perisian statistik SPSS untuk menganalisis data yang diperolehi daripada responden. Terlebih dahulu, analisis secara statistik deskriptif telah dijalankan untuk menggambarkan profil demografi responden secara keseluruhan. Kemudian, ujian kenormalan dijalankan untuk menentukan sama ada data yang dikumpul dalam kajian ini bertabur secara normal atau tidak. Jadual 2 menunjukkan ujian Kolmogorov-Smirnov dan Shapiro-Wilk yang dilaksanakan bagi mengenalpasti taburan data responden. keputusan bagi kedua-dua ujian menunjukkan bahawa nilai signifikans (Sig.) adalah kurang daripada 0.05. Nilai ini menunjukkan bahawa taburan data adalah tidak normal.

Jadual 2. Ujian Kenormalan Data

Ujian Kenormalan	Statistik	df	Sig.
Kolmogorov-Smirnov	0.109	76	0.027
Shapiro-Wilk	0.954	76	0.007

Selain daripada ujian statistik, analisis grafikal melalui Q-Q plot juga digunakan untuk menilai kenormalan data. Berdasarkan Rajah 1, taburan data kelihatan tidak simetri, dengan tumpuan data pada stem 3 dan 4. Ini juga menunjukkan bahawa data prestasi tidak mematuhi taburan normal data yang ideal.



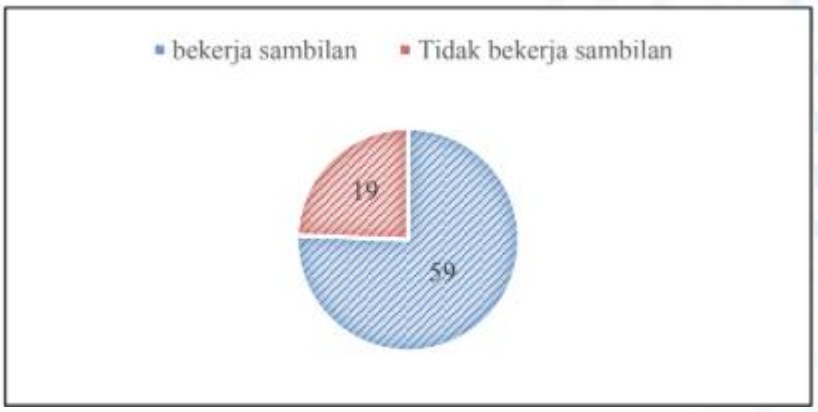
Rajah 1. Analisis Grafik Kenormalan Data

Memandangkan kedua-dua jenis analisis menunjukkan taburan data adalah tidak normal, analisis non-parametrik Spearman digunakan untuk mengenal pasti faktor-faktor utama yang mempengaruhi pelajar bekerja sambilan.

4 Analisis Kajian

4.1 Demografi

Sebelum kajian menganalisis latar belakang responden yang bekerja sambilan, kajian turut mendapatkan bilangan sebenar pelajar yang terlibat dengan kerja sambilan semasa pengajian. Statistik bilangan pelajar ini ditunjukkan dalam Rajah 2. Kajian mendapati bilangan pelajar yang bekerja sambilan adalah sebanyak 59 orang manakala bilangan pelajar yang tidak bekerja sambilan adalah sebanyak 19 orang. Nilai ini mewakili 76% daripada keseluruhan populasi pelajar di Kolej Komuniti Kelana Jaya.



Rajah 2. Bilangan Pelajar Bekerja Sambilan

Jadual 3 pula menunjukkan latar belakang pelajar yang bekerja sambilan berdasarkan empat kategori utama iaitu bangsa, semester pengajian, sumber pengajian, dan pendapatan keluarga. Majoriti responden adalah pelajar Melayu, dengan frekuensi sebanyak 50 pelajar yang mewakili 84.7% daripada keseluruhan sampel. Ini diikuti oleh pelajar India yang berjumlah 8 pelajar atau 13.6%. Terdapat juga satu pelajar dari bangsa lain yang mewakili 1.7% daripada keseluruhan sampel. Dapatan ini menunjukkan bahawa populasi pelajar yang bekerja sambilan di Kolej Komuniti Kelana Jaya didominasi oleh pelajar Melayu. Analisis data mendapati sebahagian besar pelajar yang bekerja berada di semester dua, dengan jumlah 31 pelajar (52.5%). Ini diikuti oleh pelajar semester 1 dengan 20 pelajar (33.9%) dan pelajar semester 3 yang berjumlah 8 pelajar (13.6%). Ini menunjukkan bahawa pelajar yang berada di awal pertengahan pengajian mereka lebih cenderung untuk terlibat dalam kerja sambilan berbanding pelajar yang baru memulakan atau hampir menamatkan pengajian mereka.

Bagi sumber pengajian, terdapat dua kategori mempunyai nilai yang sama iaitu bilangan pelajar yang dibiayai oleh ibu bapa atau keluarga dan pelajar yang menerima elaun atau biasiswa, masing-masing sebanyak 24 pelajar (40.7%). Sebaliknya, 11 pelajar (18.6%) lagi menanggung kos pengajian mereka secara persendirian. Ini menunjukkan bahawa sebilangan besar pelajar mendapat sokongan kewangan dari keluarga atau menerima bantuan kewangan dalam bentuk elaun atau biasiswa. Berdasarkan pendapatan keluarga, kebanyakan pelajar datang dari keluarga berpendapatan rendah, dengan 33 pelajar (55.9%) berasal dari keluarga miskin tegar yang berpendapatan RM2500 dan ke bawah (B40-1). Kumpulan pendapatan kedua terbesar adalah keluarga yang berpendapatan RM4310 hingga RM5249 (B40-2) dan RM2560 hingga RM3439 (B40-2), masing-masing dengan 10 pelajar (16.9%). Hanya 4 pelajar (6.8%) yang berasal dari keluarga dengan pendapatan dalam kategori RM5250 hingga RM6339 (M40). Dapatan ini menunjukkan bahawa majoriti pelajar yang bekerja sambilan berasal dari keluarga berpendapatan sangat rendah, yang mungkin menjadi faktor pendorong utama untuk mereka bekerja sambilan bagi menambah pendapatan keluarga.

Jadual 3. Latar Belakang Demografi Pelajar Bekerja Sambilan

Kategori	**Frekuensi**	**Peratus (%)**
Bangsa		
Melayu	50	84.7
India	8	13.6
Lain-lain	1	1.7
Semester Pengajian		
Semester 1	20	33.9
Semester 2	31	52.5

Kategori	Frekuensi	Peratus (%)
Semester 3	8	13.6
Sumber Pengajian		
Persendirian	11	18.6
Ibu bapa/Keluarga	24	40.7
Elaun/Biasiswa	24	40.7
Pendapatan Keluarga		
RM2500 dan ke bawah (B40-1)	33	55.9
RM2560-RM3439 (B40-2)	10	16.9
RM3440-RM4309 (B40-3)	2	3.4
RM4310-RM5249 (B40-4)	10	16.9
RM5250-RM6339 (M40)	4	6.8

4.2 Jenis Pekerjaan Sambilan

Jadual 4 menunjukkan jenis pekerjaan sambilan yang dilakukan oleh pelajar Kolej Komuniti Kelana Jaya, beserta frekuensi dan peratusan setiap jenis pekerjaan serta kedudukan popularitinya. Jenis pekerjaan sambilan yang paling popular adalah dalam bidang logistik, dengan 21 pelajar (37.5%) terlibat dalam pekerjaan ini. Pekerjaan dalam sektor makanan dan minuman merupakan jenis pekerjaan sambilan kedua paling popular dengan 17 pelajar (30.4%) terlibat. Sebanyak 12 pelajar (21.4%) pula bekerja dalam sektor peruncitan, menjadikan ia pekerjaan sambilan ketiga paling popular.

Sebanyak 6 pelajar (10.7%) terlibat dalam pekerjaan sambilan dalam bidang automotif sesuai dengan jurusan yang diambil. Pekerjaan dalam sektor ini mungkin memerlukan kemahiran teknikal tertentu dan minat dalam bidang automotif. Walaupun kurang popular berbanding sektor lain, pekerjaan dalam bidang automotif menawarkan peluang untuk belajar kemahiran teknikal yang spesifik dan relevan dengan industri automotif.

Pekerjaan dalam bidang sukan hanya melibatkan 2 pelajar (3.6%). Pekerjaan ini melibatkan tugas-tugas seperti menjadi pembantu jurulatih, penjaga kemudahan sukan, atau pengurus acara sukan. Hanya 1 pelajar (1.8%) yang terlibat dalam pekerjaan sambilan dalam sektor pertanian.

Jadual 4: Jenis Pekerjaan Sambilan

Jenis Pekerjaan	Frekuensi	Peratus (%)	Kedudukan
Logistik	21	37.5	1
Makanan dan Minuman	17	30.4	2
Peruncitan	12	21.4	3
Automotif	6	10.7	4
Sukan	2	3.6	5
Pertanian	1	1.8	6

4.3 Faktor Pendorong Pelajar Bekerja Sambilan

Jadual 5 menunjukkan faktor yang mempengaruhi keputusan pelajar untuk bekerja sambilan. Analisis data menunjukkan bahawa faktor dalaman seperti kewangan dan peningkatan kemahiran adalah motivasi utama untuk pelajar bekerja sambilan. Pelajar mencatatkan min yang tinggi untuk kewangan (4.0678) dan peningkatan kemahiran (4.5424), menunjukkan bahawa keperluan untuk menambah pendapatan dan mendapatkan pengalaman kerja adalah faktor pendorong yang kuat. Faktor luaran seperti pengaruh rakan dan mengisi masa lapang juga dikenal pasti, tetapi dengan min yang lebih rendah (3.3686). Ini menunjukkan bahawa walaupun faktor luaran memainkan peranan, ia tidaklah sepenting faktor dalaman.

Jadual 5: Statistik Deskriptif Faktor Pelajar Bekerja Sambilan

Faktor	N	Min	Sisihan Piawai
Faktor Dalaman	59	4.3051	0.62296
Kewangan	59	4.0678	0.85328
Tingkat Kemahiran	59	4.5424	0.69659
Faktor Luaran	59	3.3686	0.86398
Pengaruh Rakan	59	2.6101	1.4990
Isi Masa Lapang	59	4.1271	0.82834

4.4 Analisis Korelasi

Analisis korelasi dilakukan untuk melihat hubungan antara pelbagai faktor seperti pendapatan keluarga, sumber pengajian, dan semester pengajian dengan keputusan pelajar untuk bekerja sambilan.

Jadual 4: Korelasi Antara Faktor dan Keputusan Bekerja Sambilan

Korelasi	Korelasi Spearman	Sig. (2-tailed)	N
Pendapatan Keluarga	0.229*	0.047	76
Sumber Pengajian	0.045	0.701	76
Semester Pengajian	0.038	0.744	76

(* Korelasi adalah signifikan pada tahap 0.05)

Hasil korelasi menunjukkan bahawa terdapat hubungan yang signifikan antara pendapatan keluarga dan keputusan untuk bekerja sambilan ($r = 0.229$, $p < 0.05$). Ini menunjukkan bahawa pelajar dari keluarga dengan pendapatan yang lebih rendah lebih cenderung untuk bekerja sambilan bagi menambah pendapatan mereka. Sebaliknya, tiada hubungan yang signifikan antara sumber pengajian dan semester pengajian dengan keputusan untuk bekerja sambilan, menunjukkan bahawa faktor-faktor ini tidak mempengaruhi keputusan pelajar untuk bekerja sambilan.

5. Perbincangan

Kajian menunjukkan bahawa majoriti pelajar yang bekerja sambilan adalah dari kalangan pelajar Melayu (84.7%), diikuti oleh pelajar India (13.6%) dan lain-lain (1.7%). Majoriti responden berada di semester 2 (52.5%), diikuti oleh semester 1 (33.9%) dan semester 3 (13.6%). Ini mencerminkan demografi pelajar di Kolej Komuniti Kelana Jaya yang sebahagian besarnya terdiri daripada pelajar Melayu dan pelajar yang berada di awal pertengahan pengajian mereka. Penemuan ini selari dengan kajian lain yang menunjukkan bahawa pelajar dari latar belakang demografi tertentu lebih cenderung terlibat dalam kerja sambilan untuk menyokong kehidupan mereka di kolej (Wolff, 2019).

Melalui kajian ini, didapati bahawa jenis pekerjaan sambilan yang paling popular dalam kalangan pelajar adalah dalam bidang logistik (37.5%), diikuti oleh makanan dan minuman (30.4%), peruncitan (21.4%), automotif (10.7%), sukan (3.6%), dan pertanian (1.8%). Penemuan ini menunjukkan bahawa pelajar cenderung memilih pekerjaan yang mudah diakses dan mungkin menawarkan jadual kerja yang fleksibel yang boleh disesuaikan dengan jadual kuliah mereka. Kajian oleh Curtis dan Lucas (2001) menyokong dapatan ini, dengan menyatakan bahawa pelajar sering memilih pekerjaan yang boleh menyesuaikan diri dengan jadual akademik mereka.

Analisis faktor menunjukkan bahawa faktor dalaman seperti kewangan dan peningkatan kemahiran adalah motivasi utama untuk pelajar bekerja sambilan. Pelajar mencatatkan min yang tinggi untuk kewangan (4.0678) dan peningkatan kemahiran (4.5424), menunjukkan bahawa keperluan untuk menambah pendapatan dan mendapatkan pengalaman kerja adalah faktor pendorong yang kuat. Kajian oleh Callender dan Jackson (2008) juga menunjukkan bahawa keperluan kewangan adalah faktor utama yang mendorong pelajar untuk bekerja sambilan. Faktor luaran seperti pengaruh rakan dan mengisi masa lapang juga dikenal pasti sebagai faktor yang mendorong pelajar bekerja sambilan, tetapi dengan nilai min yang lebih rendah (3.3686). Ini menunjukkan bahawa walaupun faktor luaran memainkan peranan, ia tidaklah sepenting faktor dalaman.

Penemuan ini selari dengan kajian oleh Watts dan Pickering (2000) yang mendapati bahawa faktor intrinsik lebih berpengaruh dalam keputusan pelajar untuk bekerja sambilan.

Hasil korelasi pula menunjukkan bahawa terdapat hubungan yang signifikan antara pendapatan keluarga dan keputusan untuk bekerja sambilan ($r = 0.229$, $p < 0.05$). Ini menunjukkan bahawa pelajar dari keluarga dengan pendapatan yang lebih rendah lebih cenderung untuk bekerja sambilan bagi menambah pendapatan mereka. Sebaliknya, tiada hubungan yang signifikan antara sumber pengajian dan semester pengajian dengan keputusan untuk bekerja sambilan, menunjukkan bahawa faktor-faktor ini tidak mempengaruhi keputusan pelajar untuk bekerja sambilan. Kajian oleh Robotham (2012) menyokong penemuan ini, dengan menunjukkan bahawa pelajar dari latar belakang sosio-ekonomi yang rendah lebih cenderung untuk terlibat dalam kerja sambilan.

6. Kesimpulan

Secara umumnya, kebanyakan pelajar yang bekerja sambilan terdiri daripada kaum Melayu dan berada pada semester dua pengajian. Pendapatan keluarga pula didapati mempengaruhi keputusan pelajar untuk bekerja sambilan. Kajian turut mendedahkan bahawa faktor kewangan dan peningkatan kemahiran adalah motivasi utama di sebalik keputusan pelajar untuk bekerja sambilan. Selain itu, kajian mendapati pelajar cenderung memilih pekerjaan yang menawarkan fleksibiliti, kemudahan akses, dan peluang untuk mengembangkan kemahiran yang relevan. Sektor logistik, makanan dan minuman, serta peruncitan merupakan pilihan utama di kalangan pelajar kerana faktor-faktor tersebut. Kajian juga mendapati walaupun pekerjaan dalam bidang automotif, sukan, dan pertanian kurang popular namun masih menjadi pilihan kepada pelajar kerana ia menawarkan pengalaman kemahiran yang berharga.

Kesimpulannya, walaupun kerja sambilan boleh memberikan manfaat tertentu, adalah penting untuk memastikan agar ia tidak mengganggu pencapaian akademik pelajar. Justeru, kajian mencadangkan agar sokongan tambahan diberikan kepada pelajar dari keluarga berpendapatan rendah dan menekankan kepentingan program peningkatan kemahiran yang disesuaikan dengan keperluan pelajar. Kajian masa depan juga perlu dijalankan untuk terus memahami dinamik kerja sambilan di kalangan pelajar dan bagaimana ia mempengaruhi kehidupan mereka. Kajian ini secara khusus dapat memberi gambaran yang lebih jelas tentang fenomena kerja sambilan di kalangan pelajar Kolej Komuniti Kelana Jaya. Hasil kajian ini boleh digunakan oleh pihak institusi pendidikan untuk merangka dasar dan program yang lebih baik bagi menyokong pelajar yang terlibat. Selain itu, kajian ini juga boleh memberi panduan kepada pelajar tentang cara mengurus masa dan tanggungjawab mereka dengan lebih efektif untuk mencapai keseimbangan antara kerja dan pelajaran.

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Pembangunan dan Kebolehpercayaan Soal Selidik Maths Anxiety dalam Kalangan Pelajar Engineering Mathematics 3 di Politeknik Kota Kinabalu, Sabah.

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Abstract

Math Anxiety is a condition where an individual experiences fear, anxiety, or discomfort when faced with tasks or assignments involving mathematics. This issue has had a somewhat negative impact on student's math achievements, regardless of their educational level. It is known that the problem of Mathematic achievement has become a global issue. Therefore, this study aims to present the development and reliability procedures of the Math Anxiety questionnaire to measure the level of Math Anxiety among students while studying mathematics courses. This study was conducted among Engineering Mathematics 3 students at Kota Kinabalu Polytechnic, and the data were analyzed using SPSS 27.0. A total of 122 semesters 3 students for the 2024/2025 first session acted as respondents for this study. The adapted questionnaire aims to measure the level of Math Anxiety among students while studying mathematics courses. The findings of this study indicate that this questionnaire instrument is capable of measuring the level of Math Anxiety among higher education students with Cronbach's alpha value 0.883. This study also aims to see the extent to which Math Anxiety negatively affects student's learning during the teaching and learning sessions of mathematics courses. This research can be expanded using different measurement methods, such as the Rasch Measurement Model, which provides validity from various perspectives.

Keywords: Maths Anxiety; Reliability; SPSS

Abstrak

Maths Anxiety merupakan satu keadaan di mana seseorang merasakan ketakutan, cemas, atau tidak selesa apabila menerima sesuatu kerja atau tugasan yang melibatkan Matematik. Permasalahan ini telah serba sedikit memberi impak negatif kepada pencapaian Matematik para pelajar tidak mengira tahap pendidikan dimana kita mengetahui masalah pencapaian Matematik telah menjadi permasalahan sejagat. Oleh itu, kajian ini bertujuan membentangkan prosedur pembangunan dan kebolehpercayaan soal selidik *Maths Anxiety* bagi mengukur tahap *Maths Anxiety* para pelajar semasa mempelajari kursus Matematik. Kajian ini dijalankan dalam kalangan pelajar *Engineering Mathematics* 3 di Politeknik Kota Kinabalu dan data dianalisis menggunakan SPSS 27.0. Seramai 122 orang pelajar semester 3 sesi 1 2024/2025 telah bertindak sebagai responden bagi kajian ini. Soal selidik yang telah dibangunkan adalah bertujuan untuk mengukur tahap *Maths Anxiety* para pelajar semasa mempelajari kursus Matematik. Dapatan kajian ini menjelaskan bahawa instrumen soal selidik ini berupaya untuk mengukur tahap *Maths Anxiety* para pelajar pendidikan tinggi dengan nilai Cronbach's alpha sebanyak 0.883. Dapatan kajian ini juga ingin melihat sejauh mana permasalahan *Maths Anxiety* ini memberikan kesan negatif kepada pembelajaran para pelajar dalam sesi pengajaran dan pembelajaran kursus Matematik. Kajian ini boleh dikembangkan dengan menggunakan kaedah pengukuran yang berbeza seperti Model Pengukuran Rasch yang memberikan kesahan dari pelbagai sudut.

Keywords: Maths Anxiety; Kebolehpercayaan; SPSS

1. Pengenalan

Maths Anxiety adalah isu biasa dalam kalangan pelajar, terutamanya di institusi teknikal seperti politeknik. Pembangunan instrumen yang boleh dipercayai untuk mengukur kebimbangan atau keresahan ini adalah penting untuk memahami kelaziman dan kesannya terhadap prestasi akademik pelajar. Kajian ini memfokuskan kepada pembangunan dan pengesahan Soal Selidik Maths Anxiety yang direka khusus untuk pelajar politeknik. Instrumen ini akan mengenalpasti pencetus kebimbangan yang berkaitan subjek Matematik dalam demografi ini, memberikan pandangan berharga untuk para pendidik dan ahli psikologi dalam usaha membantu pelajar mengatasi kebimbangan dengan lebih baik.

Pembangunan soal selidik Maths Anxiety ini mengikuti proses yang ketat, bermula dengan kajian literatur untuk mengenalpasti dimensi utama Maths Anxiety. Item telah diadaptasi dimana penggubalannya adalah berdasarkan situasi yang menimbulkan kebimbangan yang biasa diperhatikan seperti penyelesaian masalah, mengambil ujian Matematik dan berinteraksi dengan guru Matematik. Setelah kajian rintis ini dijalankan, maklum balas daripada pelajar yang menjadi responden telah dikumpul dan dianalisis untuk memastikan s oal selidik yang diberikan adalah jelas dan dapat difahami oleh pelajar dengan baik. Soal selidik akan diperhalusi sekiranya tidak memenuhi kriteria kebolehpercayaan yang dikehendaki.

Kebolehpercayaan bagi kajian rintis soal selidik Maths Anxiety ini adalah menggunakan Alpha Cronbach dalam mengukur konsistensi dalaman. Taber (2017) menjelaskan Alpha Cronbach digunakan adalah bagi menunjukkan bahawa ujian dan skala yang dibina untuk projek penyelidikan adalah sesuai dengan tujuan, biasanya sebagai ukuran kebolehpercayaan. Banyak perbandingan kaedah untuk melihat nilai yang paling optimal bagi melihat kebolehpercayaan sesuatu item. Namun kajian ini kekal untuk mengetengahkan Alpha Cronbach kerana ianya lebih dipercayai untuk anggaran kebolehpercayaan daripada omega McDonald's, terutamanya apabila bilangan item dan korelasi di antara mereka adalah kecil (Orcan, 2023). Kaedah ujian semula akan dijalankan setelah analisis bagi kajian rintis ini selesai dalam memastikan ketekalan dalam respons dari masa ke semasa. Kaedah ini menjadikan Soal Selidik Maths Anxiety sebagai alat yang boleh dipercayai untuk menilai kebimbangan dalam subjek Matematik bagi pelajar politeknik khususnya. Hasilnya akan membantu para pendidik dalam mereka bentuk intervensi untuk mengurangkan kebimbangan sekaligus meningkatkan penglibatan dan prestasi pelajar dalam kursus Matematik.

2. Sorotan Kajian

2.1 Definisi Maths Anxiety

Maths Anxiety adalah keadaan psikologi yang dicirikan oleh perasaan ketegangan, kebimbangan, dan ketakutan yang mengganggu kemampuan untuk melaksanakan sebarang tugas Matematik. Keadaan ini memberi kesan kepada individu dari pelbagai kumpulan umur dan tahap pendidikan yang membawa kepada impak yang signifikan terhadap prestasi akademik dan aktiviti kehidupan seharian mereka. Menurut Khasawneh et al. (2021), *Maths Anxiety* didefinisikan sebagai perasaan ketegangan dan kebimbangan yang mengganggu kemampuan prestasi Matematik, manipulasi nombor, dan penyelesaian masalah Matematik dalam pelbagai situasi. Passolunghi et al. (2016) dalam kajiannya juga mentafsirkan bahawa *Maths Anxiety* sebagai perasaan ketegangan dan kebimbangan yang mengganggu manipulasi nombor dan penyelesaian masalah Matematik dalam pelbagai permasalahan kehidupan biasa dan akademik. O'Leary et al. (2017) pula menyifatkan bahawa *Maths Anxiety* didefinisikan sebagai perasaan tidak menyenangkan yang berkaitan dengan ketegangan dan kebimbangan yang menghalang kemampuan untuk mengatasi nombor dan Matematik dalam sesuatu situasi.

2.2 Faktor Penyumbang Maths Anxiety

Masalah *Maths Anxiety* ini tidak mungkin terjadi tanpa faktor-faktor penyumbang. Dengan mengetahui faktor-faktor tersebut, para pendidik boleh memikirkan kaedah atau metodologi agar permasalahan ini dapat ditangani dengan segera. Kajian Khasawneh et al. (2021) menjelaskan bahawa *Maths Anxiety* dalam kalangan pelajar universiti dipengaruhi oleh jantina, kesedaran diri, kebolehan numerik, dan kesukaran pembelajaran, dengan keyakinan diri untuk memberi impak positif terhadap prestasi. Misalnya perempuan secara a mnya lebih cenderung mempunyai *Maths Anxiety* yang lebih tinggi berbanding lelaki, namun dipengaruhi oleh stereotaip dan jangkaan masyarakat. *Maths Anxiety* juga berkait rapat dengan pengalaman tertentu dengan Matematik, tetapi tidak semua, misalnya sokongan di sekolah menengah oleh para guru dengan memberikan banyak contoh tidak akan meningkatkan *Maths Anxiety* seseorang pelajar itu (O'Leary et al., 2017). Selain itu, gaya pengajaran dan sikap guru serta ibu bapa terhadap Matematik boleh mempengaruhi perkembangan *Maths Anxiety*. Persekitaran yang menyokong dan positif boleh mengurangkan *Maths Anxiety*, manakala persekitaran yang negatif atau bertekanan tinggi boleh meningkatkannya (Ashcraft, 2002; Luttenberger et al., 2018).

2.3 Kesan Maths Anxiety

Kajian oleh Tomasetto et al. (2020) menegaskan bahawa *Maths Anxiety* di peringkat awal sekolah akan menyebabkan jurang pengetahuan yang terkumpul, menghalang kemampuan untuk mempelajari konsep dan prosedur baru dalam kelas Matematik biasa. Oleh hal demikian, sekiranya masalah ini dibiarkan merebak dan tidak dirawat dengan segera, maka masalah ini berkemungkinan menjadi 'barah' ketika mereka memasuki tahap pendidikan yang lebih tinggi. *Maths Anxiety* yang tinggi memberi impak negatif kepada pencapaian matematik pelajar dan ingatan kerja, tetapi tidak menjejaskan kemahiran membaca dan menulis tetap (Passolunghi et al., 2016). Walaupun begitu, masalah ini sangat penting untuk dirawat agar tidak mengganggu pembelajaran ketika mereka berada dalam sistem pendidikan tinggi yang mana permasalahan Matematik yang mereka perlu hadapi adalah lebih rumit dan kompleks. *Maths Anxiety* dan sikap negatif terhadap matematik juga memberi impak negatif kepada pencapaian akademik pelajar universiti dalam kursus metodologi seperti Reka Bentuk

Penyelidikan (Nunez et al., 2013).

Maths Anxiety adalah isu yang meluas yang terhasil oleh perasaan ketegangan dan ketakutan yang tinggi yang mampu menganggu prestasi Matematik. Masalah ini akan mempengaruhi proses kognitif pelajar, membawa kepada pencapaian yang lebih rendah dan penghindaran daripada sebarang aktiviti yang melibatkan Matematik. Pelbagai faktor yang menyumbang kepada *Maths Anxiety* ini antaranya adalah pengalaman lalu, jantina dan pengaruh dari persekitaran. Oleh itu, para pendidik perlu untuk menghasilkan intervensi bersasa r dalam menangani faktor-faktor dan mengurangkan kesan negatif *Maths Anxiety* kepada pelajar.

3. Pernyataan Masalah

Walaupun kepentingan kemahiran Matematik dalam bidang teknikal, ramai pelajar politeknik menunjukkan cabaran yang ketara dalam pencapaian matematik. Kajian Mohamed et al. (2024) menjelaskan penguasaan Matematik pelajar lepasan politeknik adalah lebih rendah berbanding dengan pelajar lepasan matrikulasi. Hal ini akan menyebabkan pelajar politeknik gagal memenuhi standard kompetensi minimum dalam matematik, yang memberi kesan negatif terhadap prestasi akademik keseluruhan mereka dan kebolehpasaran. Faktor-faktor yang menyumbang kepada isu ini termasuk tahap *Maths Anxiety* yang tinggi, kaedah pengajaran yang tidak mencukupi, dan kekurangan persekitaran pembelajaran yang menyokong. Situasi ini bukan sahaja menghalang kemampuan pelajar untuk memahami konsep Matematik yang penting tetapi juga memberi kesan kepada keyakinan dan motivasi mereka dalam mengejar kerjaya teknikal. Dalam mengatasi cabaran ini adalah penting untuk meningkatkan hasil pendidikan dan prospek masa depan pelajar politeknik.

4. Objektif Kajian

Kajian yang dijalankan adalah merupakan kajian rintis bertujuan untuk menjelaskan cara terhasilnya Soal Selidik *Maths Anxiety* dan kebolehpercayaan soal selidik yang telah diolah mengikut kesesuaian responden yang telah dipilih iaitu sebahagian pelajar di institusi pengajian tinggi. Responden yang dipilih adalah pelajar semester 3 dari Jabatan Kejuruteraan Mekanikal, Politeknik Kota Kinabalu, Sabah.

5. Metodologi Kajian

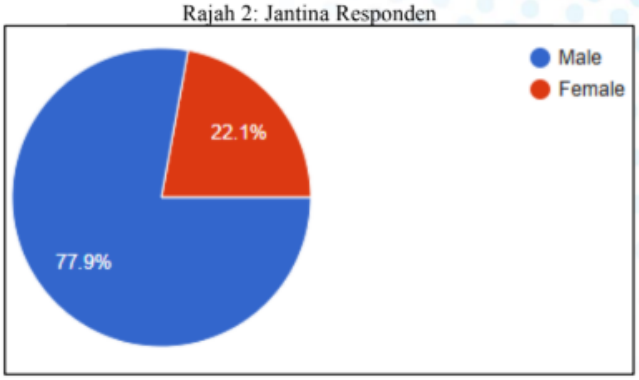
Metodologi kajian adalah berbentuk kuantitatif, di mana pengiraan kebolehpercayaan instrumen Soal Selidik *Maths Anxiety* dianalisis dengan menggunakan perisian SPSS 27.0. Soal Selidik Maths Anxiety ini telah diadaptasi dari Mahmood & Khatoon (2011) yang mengkaji instrumen ini terhadap pelajar-pelajar sekolah menengah. Instrumen ini terdiri daripada 14 soalan yang ditulis dengan menggunakan dua bahasa iaitu Bahasa Melayu dan Bahasa Inggeris. Penggunaan dwibahasa adalah bagi memudahkan para responden ketika menjawab soalan-soalan dalam instrumen ini. Instrumen ini menggunakan skala Likert 5 iaitu 5 -Sangat Setuju, 4-Setuju, 3-Tidak Pasti, 2-Tidak Setuju dan 1-Sangat Tidak Setuju seperti yang ditunjukkan dalam Rajah 1. Pemilihan responden adalah secara rawak dari populasi pelajar semester 3. Seramai 122 orang pelajar semester 3 dari Jabatan Kejuruteraan Mekanikal Politeknik Kota Kinabalu, Sabah bertindak sebagai responden bagi kajian ini.

Rajah 1: Skala Likert

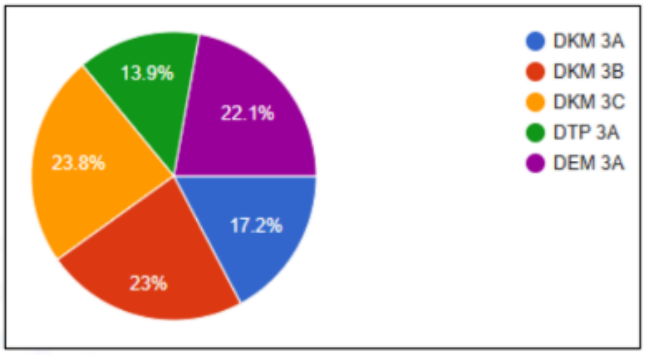
6. Hasil Dapatan Kajian

Responden bagi kajian ini adalah terdiri daripada 77.9% pelajar lelaki sementara 22.1% adalah pelajar perempuan. Responden-responden bagi kajian ini terdiri daripada 64% pelajar Diploma Kejuruteraan Mekanikal, 13.9% adalah dari Diploma Teknologi Pembuatan dan 22.1% adalah Diploma Kejuruteraan Mekatronik.

Rajah 2: Jantina Responden



Rajah 3: Pembahagian Kelas Responden



Setelah pelajar menjawab soalan demografi diri, pelajar diminta menjawab soal selidik *Maths Anxiety*. Soal selidik ini mengandungi 14 soalan dan kesemua soalan diberikan dalam dwibahasa. Soalan-soalan yang diberikan terbahagi kepada dua bahagian iaitu soalan positif dan soalan negatif. Sebanyak 7 soalan merupakan soalan negatif dan 7 soalan adalah soalan berbentuk soalan positif seperti yang ditunjukkan dalam Jadual 1 di bawah.

Jadual 1: Dimensi pernyataan dalam Soal Selidik Maths Anxiety.

Pernyataan	**Dimensi**
1. Matematik membuatkan saya berasa selesa dan mudah. *1. Mathematic makes me feel comfortable and easy.*	Positif
2. Matematik adalah subjek yang paling ditakuti bagi saya. *2. Mathematic is most dreaded subject for me.*	Negatif
3. Saya berasa risau sebelum memasuki kelas Matematik. *3. I feel worried before entering the Mathematic's class.*	Negatif
4. Saya rasa Matematik menarik. *4. I find Mathematic interesting.*	Positif
5. Matematik adalah salah satu mata pelajaran kegemaran saya. *5. Mathematic is one of my favorite subjects.*	Positif
6. Saya sentiasa takut dengan peperiksaan Matematik. *6. I am always afraid of Mathematic's examination.*	Negatif

7. Menyelesaikan masalah Matematik sentiasa menyenangkan saya. *7. Solving Mathematic problems is always pleasant for me.*	Positif
8. Saya berasa gementar apabila saya hendak membuat kerja rumah Matematik. *8. I feel nervous when I am about to do Mathematic's homework.*	Negatif
9. Saya berasa gembira dan teruja dalam kelas Matematik berbanding dengan mana-mana kelas lain. *9. I feel happy and excited in a Mathematic class as compared to any other class.*	Positif
10. Saya lebih suka Matematik sebagai salah satu subjek saya dalam pengajian tinggi. *10. I would prefer Mathematic as one of my subjects in higher studies.*	Positif
11. Matematik memeningkan kepala saya. *11. Mathematic is a headache for me.*	Negatif
12. Saya takut untuk bertanya soalan dalam kelas Matematik. *12. I am afraid to ask questions in Mathematics class.*	Negatif
13. Matematik tidak menakutkan saya sama sekali. *13. Mathematics doesn't scare me at all.*	Positif
14. Fikiran saya menjadi kosong apabila guru bertanyakan soalan Matematik. *14. My mind goes blank when teacher asks Mathematic questions.*	Negatif

Setelah data diterima dari semua responden, data ini kemudiannya dianalisis dengan menggunakan SPSS 27.0 dengan melihat nilai Cronbach's Alpha. Cronbach's Alpha ialah ukuran kebolehpercayaan objektif yang digunakan secara meluas dalam penyelidikan pendidikan, yang menunjukkan konsistensi dalaman dan ralat pengukuran ujian atau skala dan ianya dinyatakan dalam bentuk nombor antara 0 hingga 1 (Tavakol & Dennick, 2011). Menurut Kilic (2016) nilai Cronbach's Alpha yang melebih nilai 0.70 menunjukkan soal selidik tersebut adalah diterima dan baik. Jadual 2 dibawah menunjukkan kriteria konsistensi dalaman dari interpretasi nilai Cronbach's Alpha yang dijelaskan oleh Salkind (2015).

Jadual 2: Nilai Interpretasi nilai Cronbach's Alpha

Cronbach's Alpha	**Konsistensi Dalaman**
$\alpha \geq 0.9$	Cemerlang (*Excellent*)
$0.9 > \alpha \geq 0.8$	Baik (*Good*)
$0.8 > \alpha \geq 0.7$	Boleh Diterima (*Acceptable*)
$0.7 > \alpha \geq 0.6$	Boleh Dipersoalkan (*Questionable*)
$0.6 > \alpha \geq 0.5$	Lemah (*Poor*)
$0.5 > \alpha$	Tidak Boleh Diterima (*Unacceptable*)

Rajah 3 pula merupakan hasil dapatan pengiraan kebolehpercayaan bagi Soal Selidik *Maths Anxiety* dari perisian SPSS 27.0. Hasil ujian kebolehpercayaan terhadap data yang diterima menunjukkan nilai Cronbach's Alpha bagi soal selidk ini adalah sebanyak 0.883.

Rajah 3: Nilai Cronbach's Alpha bagi Soal Selidik Maths Anxiety

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	122	100.0
	Excluded[a]	0	.0
	Total	122	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.883	14

Berpandukan kepada nilai Cronbach's Alpha yang dijelaskan oleh Salkind (2015), maka nilai kebolehpercayaan terhadap instrumen soal selidik ini adalah diterima dan dalam kategori baik kerana berada dalam lingkungan $0.9 > \alpha \geq 0.8$. Hal ini menunjukkan item-item bagi instrumen dalam kajian ini boleh dipercayai dan sesuai untuk digunakan dalam mengukur tahap *Maths Anxiety* seseorang pelajar. Walaubagaimanapun, instrumen ini masih boleh diuji dengan menggunakan pekali yang berlainan bagi memastikan ianya benar-benar mengukur apa yang sepatutnya diukur.

7. Kepentingan Kajian

Kajian rintis bagi sesuatu soal selidik yang baru dihasilkan untuk responden yang tertentu adalah sangat penting dalam memastikan soal selidik yang digunakan dalam kajian lanjutan bagi *Maths Anxiety* ini adalah baik dan boleh dipercayai agar hasil kajian lanjutan tersebut tepat dan benar seterusnya boleh digunapakai dalam kajian akan datang. Seandainya sesuatu instrumen yang digunapakai adalah tidak sah dan boleh dipercayai, mak kebarangkalian untuk kajian tersebut untuk menghasilkan kesalahan adalah tinggi. Hal ini berkemungkinan disebabkan oleh tiada pemurnian yang akan dijalankan terhadap soal selidik tersebut seandainya masalah untuk memahami ayat-ayat dalam soal selidik tersebut tidak dikaji terlebih dahulu.

8. Kesimpulan

Sebagai konklusinya, setiap instrumen yang dibangunkan atau diadaptasi hendaklah melalui prosedur yang betul, agar semua item dalam instrumen yang dihasilkan adalah baik dan jelas. Tambahan pula, ujian kebolehpercayaan akan membantu penyelidik untuk melihat sejauh mana konsistensi dalaman sesuatu instrumen. Justeru, penyelidik mencadangkan penyelidik akan datang untuk menguji instrumen ini dengan menggunakan skop kajian yang berbeza seperti responden yang berlainan tahap atau menggunakan alat pengukran yang lebih terperinci seperti model pengukuran Rasch dalam mendapatkan keutuhan sesuatu instrumen.

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POLITEKNIK KOTA KINABALU

Strategi Pelajar Menghadapi Corak Pengajaran Berbeza Daripada Pensyarah

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Abstrak

Kajian ini membincangkan isu yang dihadapi oleh pelajar dalam menyesuaikan diri dengan corak pengajaran yang berbeza daripada pensyarah mereka. Oleh yang demikian, objektif kajian ini adalah untuk mengenal pasti strategi yang digunakan oleh pelajar untuk mengatasi cabaran tersebut dan bagaimana pelajar bertindak terhadap pensyarah yang bukan pilihan mereka. Sampel kajian terdiri daripada pelajar Diploma Akauntasi, Jabatan Perdagangan, di Politeknik Kota Kinabalu, Sabah. Data dikumpulkan melalui soal selidik yang diedarkan secara dalam talian menggunakan *Google Form*. Maklum balas dari responden akan dianalisis deskriptif untuk mendapatkan skor yang tertinggi. Hasil kajian menunjukkan bahawa pelajar menggunakan pelbagai strategi apabila berhadapan dengan pelbagai pensyarah. Kajian ini juga mendapati bahawa sokongan akademik dan emosi daripada rakan dan pihak universiti adalah penting dalam membantu pelajar menyesuaikan diri. Dengan mengenal pasti tindakan yang digunakan oleh pelajar dalam menghadapi corak pengajaran yang berbeza, institusi pembelajaran mahupun pensyarah dapat memahami lebih baik keperluan dan cabaran yang dihadapi oleh pelajar. Ini membolehkan pihak pentadbir, penasihat akademik dan pensyarah memperbaiki pendekatan pengajaran mereka, mempelbagaikan teknik pengajaran, dan menyediakan sokongan yang lebih sesuai bagi meningkatkan pengalaman pembelajaran pelajar.

***Kata kunci**: corak pengajaran, strategi pelajar, pensyarah pilihan*

1. PENGENALAN

Institusi Pengajian Tinggi (IPT) merupakan platform pembelajaran peringkat tertinggi kepada pelajar, yang meliputi diploma, ijazah sarjana muda, ijazah sarjana, dan kedoktoran dalam pelbagai bidang ilmu. Ini bertujuan untuk melahirkan graduan yang berpengetahuan dan mempunyai berkemahiran tinggi dalam bidang tertentu. Di IPT pelajar akan merasai pengalaman pelbagai sikap, corak dan gaya pengajaran pensyarah kepada pelajar mereka. Adalah menjadi lumrah bahawa sikap individu boleh menjadi positif atau negatif. Sikap positif pensyarah terhadap pelajar, begitu juga pelajar terhadap pensyarah adalah penting dalam persekitaran akademik yang menjadikan proses pengajaran dan pembelajaran sangat berkesan. Kaedah pengajaran merujuk kepada prinsip umum, pedagogi dan strategi pengurusan yang digunakan untuk pengajaran bilik darjah. Pilihan kaedah pengajaran pensyarah juga bergantung pada kaedah yang sesuai dengan pelajar, falsafah pendidikan, demografi bilik kuliah, bidang subjek dan misi institusi. Kepelbagaian dalam pendekatan pengajaran ini boleh memperkayakan pengalaman pembelajaran dengan mendedahkan pelajar kepada pelbagai perspektif dan teknik

Corak pengajaran adalah tidak sama dan mempunyai karenah tersendiri. Terdapat personaliti pensyarah yang menjadi pilihan pelajar iaitu mesra, tegas, prihatin, menepati masa, dan rajin seperti yang diterangkan dalam kajian Khalid & Ismail (2019). Walaupun begitu, pelajar juga perlu menghargai pensyarah yang tegas kerana mereka membawa struktur dan penyampaian yang jelas kepada pelajar, yang boleh mewujudkan persekitaran pembelajaran yang fokus dan berdisiplin. Pensyarah yang tegas biasanya mempunyai sta ndard yang tinggi, yang boleh mendorong pelajar untuk melakukan yang terbaik dan membangunkan etika pembelajaran yang betul. Ketegasan ini juga boleh membawa kepada pemahaman yang lebih mendalam tentang subjek yang diajar kerana pelajar digalakkan untuk melibatkan diri dengan aktif dalam kelas (Shaari, 2001). Tambahan pula, ketegasan boleh memupuk rasa adil dan konsisten, kerana pelajar akan diterapkan dengan peraturan dan tarikh akhir penghantaran sesuatu tugasan. Walaupun begitu, bagi pensyarah yang tegas biasanya tidak semua pelajar selesa dengan pensyarah seperti ini. Mungkin disebabkan cara penyampaian pensyarah dan lain-lain faktor.

Berdasarkan senario ini, kajian ini dijalankan untuk mengenal pasti apakah cabaran, strategi dan sikap yang diambil oleh pelajar apabila terdapat corak pengajaran yang berbeza di kalangan pensyarah mereka. Kajian ini perlu dijalankan kerana corak pengajaran yang berbeza daripada pensyarah boleh memberi impak yang signifikan terhadap keberkesanan pembelajaran pelajar. Setiap pensyarah mempunyai pendekatan pengajaran yang unik, dan ini boleh menimbulkan cabaran kepada pelajar untuk menyesuaikan diri, terutama apabila mereka perlu berinteraksi dengan pelbagai pensyarah dalam tempoh yang singkat. Lashari et al. (2013) menunjukkan bahawa pendekatan pengajaran yang sesuai dapat meningkatkan penglibatan pelajar dan membantu mereka beradaptasi dengan lebih baik.Selain itu, sikap pelajar terhadap pensyarah yang bukan pilihan mereka juga boleh mempengaruhi motivasi dan prestasi akademik mereka. Dengan memahami cabaran ini dan mengenal pasti

strategi yang digunakan oleh pelajar, institusi pendidikan dapat menyediakan sokongan yang lebih baik untuk membantu pelajar menyesuaikan diri dengan pelbagai corak pengajaran, seterusnya meningkatkan pengalaman pembelajaran secara keseluruhan.

1.1 Objektif Kajian

Kajian ini dijalankan adalah untuk:

a) mengenal pasti tahap cabaran yang dihadapi oleh pelajar daripada corak pengajaran yang berbeza dari pensyarah.
b) mengenal pasti strategi pelajar Politeknik Kota Kinabalu menghadapi corak pengajaran berbeza daripada pensyarah.
c) mengenal pasti sikap pelajar terhadap pensyarah bukan pilihan.

2. Sorotan Kajian

Seperti pelajar berhadapan dengan corak pembelajaran pensyarah yang berlainan, pensyarah di setiap institusi juga akan berhadapan dengan karenah pelajar mereka yang boleh mendatang stres kepada pensyarah (Ramlee, 2015). Setiap pensyarah mempunyai corak mengajar yang berbeza seperti perbezaan dari segi teknik pembelajaran (Shaari, 2001), penggunaan alat bantu mengajar (Lambri & Mahamood, 2019), e-pembelajaran (Damit & Omar, 2019), pengalaman mengajar (Ismail et al., 2021). Kajian oleh Buckles dan McMahon (2011) mendapati bahawa pelajar cenderung menyukai sikap pensyarah yang adil, bertimbang rasa, dan yang gemar memberi kata-kata pujian yang sesuai, seperti memuji apabila pelajar memperoleh markah cemerlang. Walau bagaimanapun, kajian tersebut juga menunjukkan bahawa pelajar tidak gemar apabila pensyarah suka berleter dan menyindir (Khalid & Ismail, 2019), kerana mungkin sikap sebegini boleh menimbulkan perasaan tidak selesa dan mengurangkan motivasi pelajar. Setiap pelajar juga mempunyai teknik tersendiri dal am mengajar pelajar pintar dan lemah. Karenah pelajar pintar cerdas kadang-kadang menyebabkan ketidaktentuan emosi dan sikap yang menyebabkan orang lain tidak selesa dengan mereka, justeru pensyarah perlu mempunyai pendekatan tersendiri terhadap mereka (Ismail et al., 2021). Tidak dinafikan juga apabila pelajar menghadapi sesuatu perkara yang tidak diingini dari segi kualiti pembelajaran pensyarah dan sebagainya di institusi, mereka juga akan membuat aduan (Ali et al., 2011). Bahkan sikap pelajar yang tidak disenangi juga akan menyebabkan pensyarah akan membuat aduan ke atas mereka (Mazlan & Nik Abdullah, 2021).

3. Metodologi Kajian

Kajian ini dijalankan menggunakan pendekatan kajian kuantitatif yang dijalankan dalam bentuk tinjauan. Kajian ini dijalankan dalam kalangan pelajar iaitu pelajar Diploma Akauntansi, Jabatan Perdagangan, Politeknik Kota Kinabalu, Sabah (PKK). Item kajian dibina sendiri berdasarkan pengalaman penyelidik sebagai seorang pensyarah lebih dari 10 tahun mengajar. Ini kerana tiada rujukan item yang tepat untuk membina soal selidik. Walaupun dibina sendiri, namun item telah disemak oleh beberapa pensyarah berlainan dan meminta pandangan mereka terhadap tingkah laku pelajar mereka. Item tingkah laku pelajar dalam kajian ini dibina berdasarkan beberapa pandangan pelajar senior terhadap pensyarah mereka. Untuk mencapai objektif kajian, soal selidik utama dibahagikan kepada 4 bahagian iaitu a) demografi responden; b) Cabaran Corak Pengajaran Yang Berbeza Dari Pensyarah; c) Strategi Pelajar Dalam Menghadapi Corak Pengajaran Berbeza Daripada Pensyarah; dan d) Sikap Pelajar Terhadap Pensyarah Bukan Pilihan.

Kaedah pungutan data yang digunakan dalam kajian ini adalah menggunakan teknik pensampelan rawak mudah, di mana instrumen yang digunakan adalah borang soal selidik yang diedarkan secara dalam talian. Pautan soal selidik telah diedarkan kepada semua pelajar dan seramai 123 pelajar mengambil bahagian untuk menjawab soal selidik ini. Item kajian adalah ditadbir sendiri berdasarkan beberapa pandangan kajian lepas berkaitan dengan sikap pelajar kepada pelajar mereka. Semua item diukur pada skala Likert 5-point di mana 1 = sangat tidak setuju, 2 = tidak setuju, 3 = neutral, 4 = setuju dan 5 = sangat setuju. Analisis yang digunakan untuk mencapai semua objektif kajian adalah analisis deskriptif untuk menentukan tahap bagi setiap item. Penentuan tahap-tahap dalam analisis adalah diukur berdasarkan nilai skor min bermula dari 1.00 – 1.99 (Lemah); 2.00– 2.99 (Rendah); 3.00– 3.99 (Sederhana); 4.00– 5.00 (Tinggi) (Ngadiman et al., 2019).

4. Hasil Kajian Dan Perbincangan

a) Latar Belakang Responden

Jadual 1: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	44	35.8
	Perempuan	79	64.2
Semester	1	15	12.2
	2	38	30.9
	3	2	1.6
	4	36	29.3
	5	32	26.0
HPNM	1.00 - 2.00	1	0.8
	2.00 - 2.99	20	16.3
	3.00 - 3.33	18	14.6
	3.43 - 3.67	26	21.1
	3.68 - 4.00	44	35.8
	Semester 1 (Tiada HPNM)	14	11.4
Lebih selesa belajar dengan pensyarah lelaki atau perempuan	Selesa dengan pensyarah lelaki	24	19.5
	Selesa dengan pensyarah Perempuan	99	80.5

Jadual 1 menunjukkan sebanyak 123 pelajar terlibat dalam kajian ini, di mana majoritinya adalah perempuan (64.2%) berbanding lelaki (35.8%), majoriti responden berada di semester 2 (30.9%) dan semester 4 (29.3%). Dari segi pencapaian akademik, kebanyakan responden memiliki HPNM antara 3.68 hingga 4.00 (35.8%). Menariknya, sebanyak 80.5% daripada responden yang lebih selesa belajar dengan pensyarah perempuan berbanding dengan pensyarah lelaki.

b) Cabaran Corak Pengajaran Yang Berbeza Dari Pensyarah

Jadual 2: Cabaran Daripada Corak Pengajaran Yang Berbeza Dari Pensyarah

No	Item	Min	S.P	Tahap
1	Kesukaran memahami bahan pengajaran	2.585	1.221	Rendah
2	Kurang motivasi	2.496	1.250	Rendah
3	Masa yang tidak mencukupi untuk menyesuaikan diri	2.341	1.100	Rendah
4	Tekanan akademik	2.528	1.257	Rendah

Jadual 2 menunjukkan 4 cabaran yang dihadapi oleh pelajar berdasarkan corak pengajaran yang berbeza dari pensyarah mereka. Analisis menunjukkan cabaran utama adalah kesukaran untuk memahami bahan pengajaran (Min = 2.585), diikuti oleh tekanan akademik (Min = 2.528). Walaupun begitu, semua item menunjukkan tahap cabaran yang rendah. Dapatan ini juga menjelaskan bahawa pelajar pada umumnya masih mampu mengatasi cabaran tersebut. Namun begitu, terdapat ruang untuk pensyarah memperbaiki pendekatan pengajaran mereka agar lebih sesuai dengan keperluan pelajar, membantu mereka memahami bahan pengajaran dengan lebih baik dan mengurangkan tekanan akademik. Ini kerana kajian Biggs dan Tang (2011)

menunjukkan pelajar mungkin mengalami kesukaran dalam memahami konsep-konsep yang kompleks jika pensyarah tidak menggunakan strategi pengajaran yang sesuai dengan gaya pembelajaran mereka. Manakala kajian Misra dan McKean (2000), tekanan akademik boleh memberi kesan negatif terhadap kesihatan mental dan kesejahteraan pelajar.

c) Strategi Pelajar Dalam Menghadapi Corak Pengajaran Berbeza Daripada Pensyarah

Jadual 3: Strategi Pelajar Terhadap Corak Pengajaran Berbeza Daripada Pensyarah

No	Item	Min	S.P	Tahap
1	Saya akan menyesuaikan diri dengan semua gaya pengajaran pensyarah.	4.033	0.877	Tinggi
2	Saya tetap tenang dan bersikap positif dengan semua pensyarah.	4.268	0.666	Tinggi
3	Saya bersikap terbuka terhadap sikap pensyarah dalam pengajaran yang berbeza	4.171	0.721	Tinggi
4	Saya menerima kelemahan setiap pensyarah dalam pengajaran dengan hati terbuka	4.138	0.750	Tinggi
5	**Saya anggap setiap pengalaman pembelajaran berbeza sebagai peluang untuk belajar sesuatu yang baru.**	**4.301**	**0.701**	**Tinggi**
6	Saya sentiasa mengambil hati semua pensyarah dengan sentiasa bertanya soalan	3.561	0.976	Sederhana
7	Saya akan terima kritikan dengan positif dari semua pensyarah	4.098	0.762	Tinggi
8	Saya sentiasa membuat persediaan awal sebelum menghadiri setiap kelas berbeza.	3.772	0.904	Sederhana
9	Saya berbincang secara langsung dengan pensyarah mengenai sebarang kekeliruan atau masalah yang saya dihadapi	3.602	1.030	Sederhana
10	**Saya tunjukkan komitmen saya dengan kehadiran penuh di setiap kelas**	**4.333**	**0.697**	**Tinggi**
11	Saya sentiasa memahami dan mengikuti semua arahan yang diberikan oleh pensyarah dengan tepat	4.122	0.742	Tinggi
12	Saya akan tunjukkan kepada setiap pensyarah kesungguhan saya dalam pembelajaran	4.228	0.687	Tinggi
13	Jika saya menghadapi kesukaran dengan topik tertentu, minta bantuan secara peribadi daripada pensyarah	3.821	0.915	Sederhana

Jadual 3 menunjukkan strategi yang diambil oleh pelajar terhadap corak pengajaran berbeza daripada setiap pensyarah mereka. Item memperoleh item tertinggi iaitu pelajar menunjukkan komitmen dengan kehadiran penuh di setiap kelas (min = 4.333). Ini kerana Menurut Jilardidamavandi et al. (2011), pelajar yang hadir secara konsisten dalam kelas cenderung untuk mencapai prestasi akademik yang lebih baik, kerana mereka mendapat akses langsung kepada bahan pengajaran dan interaksi dengan pensyarah (Rani et al., 2020). Manakala yang kedua ialah pelajar anggap setiap pengalaman pembelajaran berbeza sebagai peluang untuk belajar sesuatu yang baru (4.301). Pelajar juga menunjukkan sikap positif dengan menganggap setiap pengalaman pembelajaran sebagai peluang untuk belajar sesuatu yang baru. Sikap ini adalah penting dalam konteks pendidikan, kerana ia mendorong pelajar untuk melihat cabaran sebagai peluang untuk berkembang. Pizon dan Ytoc (2022) menekankan bahawa motivasi dan sikap positif terhadap pembelajaran dapat meningkatkan pencapaian akademik, terutama

apabila strategi pengajaran sepadan dengan gaya pembelajaran pelajar (Alharbi et al., 2020). Dengan menganggap pengalaman pembelajaran sebagai peluang, pelajar dapat mengatasi perbezaan dalam corak pengajaran dan memanfaatkan pelbagai pendekatan yang digunakan oleh pensyarah mereka.

d) Sikap Pelajar Terhadap Pensyarah Bukan Pilihan

Jadual 4: Sikap Pelajar Terhadap Pensyarah Yang Mereka Tidak Suka

No	Item	Min	S.P	Tahap
1	Saya akan minta pensyarah mengikuti rentak pembelajaran saya	1.813	0.890	Lemah
2	Saya akan membuat aduan kepada pihak pentadbiran pensyarah yang saya tidak suka	1.935	0.990	Lemah
3	Saya akan meminta untuk menukar pensyarah yang saya tidak suka	1.919	0.980	Lemah
4	Saya akan meminta tukar ke kelas yang lain sekiranya ada kekongan	1.821	0.967	Lemah
5	Saya akan menangguhkan untuk mengambil subjek tersebut	1.545	0.760	Lemah
6	Saya akan mencari kesalahan pensyarah supaya mudah untuk membuat aduan	1.520	0.717	Lemah
7	Saya sentiasa akan mengadu dengan penasihat akademik tentang pensyarah yang saya tidak suka	1.911	1.016	Lemah
8	Saya akan membanding-bandingkan pensyarah yang saya suka dan tidak suka.	1.805	0.989	Lemah
9	Saya akan buat aduan dengan Majlis Perwakilan Pelajar (MPP)	1.675	0.910	Lemah
10	Saya akan uar-uarkan kelemahan pensyarah yang saya tidak suka	1.593	0.857	Lemah

Sementara itu, Jadual 4 menunjukkan sikap pelajar terhadap pensyarah yang bukan pilihan. Oleh yang demikian, berdasarkan analisis deskriptif daripada nilai min yang diperoleh, secara keseluruhan, pelajar tidak bersetuju terhadap kesemua item kajian. Sikap pelajar yang baik juga berkait rapat dengan penglibatan mereka dalam pembelajaran. Jamal (2023) menekankan bahawa pendekatan pembelajaran berasaskan projek (PjBL) dapat meningkatkan sikap sosial pelajar, yang seterusnya membantu mereka dalam memahami nilai -nilai sosial dan meningkatkan keterampilan komunikasi serta kerjasama (Jamal, 2023). Dengan sikap yang positif, pelajar lebih cenderung untuk terlibat dalam aktiviti pembelajaran dan berkolaborasi dengan rakan sekelas, yang meningkatkan pengalaman pembelajaran secara keseluruhan. Oleh yang demikian, secara rumusannya, responden mempamerkan sikap yang menunjukkan tingkah laku yang baik terhadap pensyarah mereka walaupun pensyarah tersebut bukan pensyarah pilihan atau kegemaran mereka.

5. Kesimpulan

Objektif utama kajian ini adalah bertujuan untuk mengenal pasti apakah strategi pelajar Politeknik Kota Kinabalu dalam menghadapi corak pengajaran berbeza daripada pensyarah. Hasil dapatan secara deskriptif dengan membandingkan nilai min, mendapati bahawa secara puratanya pelajar menunjukkan bahawa merek a tetap tenang, lebih berdikari dan bersikap positif dengan semua pensyarah walaupun corak pengajaran pengajaran pensyarah adalah berbeza. Pelajar juga tetap mempamerkan sikap yang baik dan positif terhadap pensyarah mereka walaupun pensyarah tersebut bukanlah pensyarah pilihan atau kegemaran mereka. Walau apa pun

sikap pensyarah terhadap mereka, mereka tetap menerima seadanya dan cuba untuk mengikut rentak dan kemahuan pensyarah. Diharapkan pelaksanaan kajian ini dapat memberikan sedikit gambaran kepada pensyarah-pensyarah bagaimana strategi pelajar dalam menghadapi corak pengajaran yang berbeza. Untuk kajian yang akan datang, pengkaji mencadangkan agar kajian boleh diperluaskan kepada pelajar di bidang lain dan mengkaji corak ataupun kaedah pengajaran yang lebih sesuai digunakan untuk generasi sekarang.

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Hibah Sebagai Instrumen Perancangan Harta Islam Dan Peranannya Kepada Golongan Kritikal

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Abstrak

Hibah merupakan instrumen perancangan harta dalam Islam yang penting dan fleksibel, terutamanya bagi golongan kritikal seperti anak angkat, individu dengan anak OKU, pasangan tanpa anak, individu yang hanya mempunyai anak perempuan, dan individu yang tidak berkahwin. Artikel ini bertujuan menjelaskan peranan hibah dalam konteks perancangan harta Islam, dengan meneliti bagaimana ia memenuhi keperluan khas golongan tersebut. Di samping itu, kajian ini juga mengenal pasti beberapa cabaran dalam pelaksanaan hibah kepada golongan kritikal serta membuat perbandingan ringkas antara hibah, wasiat, dan faraid. Kajian ini menggunakan pendekatan kualitatif melalui analisis literatur dan kajian kes untuk memahami konsep, peranan, cabaran pelaksanaan hibah, dan perbezaan hibah dengan instrumen perancangan harta lain. Melalui metodologi ini, penulis menganalisis teks-teks utama, kes-kes praktikal, serta pandangan yang dikumpulkan daripada literatur dan sumber yang dihasilkan oleh pakar serta pengamal dalam bidang perancangan harta Islam. Penemuan kajian menunjukkan bahawa hibah menawarkan penyelesaian yang efektif dalam memastikan pembahagian harta yang adil serta mengurangkan risiko pertikaian selepas kematian. Hibah juga membolehkan perancangan harta yang lebih fleksibel dan memenuhi keperluan khusus golongan kritikal, yang mungkin tidak sepenuhnya dilindungi oleh sistem faraid. Tambahan pula, penggunaan hibah dapat mengatasi beberapa kekangan dalam pembahagian harta berasaskan faraid dengan memberikan kebebasan kepada pemberi hibah untuk menentukan penerima dan jumlah harta yang diagihkan. Sehubungan itu, isu-isu berkaitan hibah perlu diatasi dengan meningkatkan kesedaran dan memberikan panduan yang jelas mengenai proses hibah agar umat Islam, khususnya golongan kritikal, dapat memanfaatkannya. Kajian ini diharapkan dapat memberikan panduan berguna kepada umat Islam dalam merancang harta dengan lebih berkesan dan adil. Dengan ini, hibah dapat digunakan sebagai alat strategik dalam perancangan harta untuk memenuhi keperluan khusus dan mencegah konflik yang mungkin timbul pada masa hadapan.

***Kata Kunci**: Hibah, perancangan harta Islam, golongan kritikal, faraid, keadilan dalam pembahagian harta.*

1. Pengenalan

Perancangan harta merupakan aspek penting dalam pengurusan kewangan peribadi, khususnya bagi umat Islam. Dalam Islam, perancangan harta bertujuan untuk memastikan pengagihan harta yang adil dan berkesan kepada waris dan penerima yang layak, selaras dengan prinsip syariah. Salah satu instrumen utama dalam perancangan harta adalah hibah, yang membolehkan pemberi hibah mengagihkan harta kepada penerima pilihan semasa mereka masih hidup, berbanding dengan wasiat yang hanya berkuat kuasa selepas kematian (Ahmad, 2020).

Sejak zaman awal Islam, hibah telah diterima sebagai mekanisme penting dalam pengagihan harta. Dalam konteks sejarah Islam, hibah bukan sahaja menjaga hak waris tetapi juga berperanan dalam menyelesaikan konflik berkaitan harta serta memastikan kesejahteraan masyarakat (Ali, 2015). Walaupun hibah diiktiraf secara meluas dalam undang-undang syariah, pelaksanaannya di Malaysia masih menghadapi pelbagai cabaran. Kajian oleh Zainuddin dan Yusoff (2021) mendapati bahawa kurangnya pemahaman mendalam mengenai konsep hibah dalam kalangan masyarakat merupakan halangan utama kepada pelaksanaan yang efektif.

Hibah merupakan alat perancangan harta yang fleksibel berbanding instrumen lain seperti wasiat dan faraid, kerana ia dapat mengurangkan komplikasi dalam pembahagian harta yang sering menyebabkan pertikaian dalam keluarga (Ahmad, 2020). Meskipun demikian, laporan Jabatan Agama Islam Malaysia (JAI, 2020) menunjukkan bahawa hanya 25 peratus umat Islam di Malaysia telah membuat perancangan harta melalui hibah, menekankan keperluan mendesak untuk meningkatkan kesedaran dan pemahaman mengenai instrumen ini. Menurut Amanah Raya Berhad, jumlah harta beku di Malaysia dianggarkan mencecah lebih RM90 bilion pada tahun 2022. Faktor-faktor utama yang menyebabkan peningkatan ini termasuk ketiadaan dokumen sah dan kurangnya perancangan harta, seperti hibah atau wasiat, yang menyebabkan aset-aset ini

tidak dapat diuruskan dengan baik. Ini menunjukkan perlunya kesedaran yang lebih mendalam mengenai pentingnya perancangan harta di kalangan umat Islam di Malaysia (Amanah Raya Berhad, 2022).

Walaupun terdapat kajian mendalam mengenai aspek undang-undang hibah, kajian mengenai impaknya terhadap golongan kritikal masih terhad (Ariffin, 2021; Rahman & Jamil, 2022). Kajian-kajian terdahulu cenderung memfokuskan kepada aspek undang-undang dan teori, namun penekanan khusus terhadap bagaimana hibah memenuhi keperluan golongan kritikal ini masih kurang diberikan perhatian (Hassan, 2023; Zulkifli, 2023; Karim, 2023).

Budaya dan norma sosial di Malaysia turut memainkan peranan penting dalam mempengaruhi cara masyarakat melihat dan melaksanakan perancangan harta. Namun, kekurangan kesedaran dan pemahaman mengenai hibah dalam kalangan umat Islam, terutamanya golongan kritikal, menjadi halangan kepada pelaksanaan hibah yang lebih meluas. Oleh itu, kajian ini bertujuan untuk menjelaskan peranan hibah dalam konteks perancangan harta Islam dengan meneliti bagaimana ia memenuhi keperluan khas golongan tersebut. Selain itu, kajian ini juga mengenal pasti beberapa cabaran dalam pelaksanaan hibah kepada golongan kritikal serta membuat perbandingan ringkas antara hibah, wasiat, dan faraid. Diharapkan kajian ini dapat mengisi jurang dalam literatur sedia ada dan menyediakan panduan yang lebih baik dalam pengurusan harta bagi golongan yang memerlukan.

2. Objektif Kajian

Kajian ini bertujuan menjelaskan peranan hibah sebagai instrumen perancangan harta dalam Islam, dengan fokus khusus kepada manfaatnya untuk golongan kritikal seperti anak angkat, individu dengan anak OKU, pasangan tanpa anak, individu yang hanya mempunyai anak perempuan, dan individu yang tidak berkahwin. Kajian ini menilai bagaimana hibah memenuhi keperluan khas golongan ini serta membantu dalam perancangan harta yang lebih adil dan berkesan. Selain itu, kajian ini juga mengenal pasti beberapa cabaran dalam pelaksanaan hibah kepada golongan kritikal dan membuat perbandingan ringkas antara hibah, wasiat, dan faraid.

3. Kepentingan Kajian

Kajian ini memberikan sumbangan teoretikal penting dengan menjelaskan peranan hibah dalam perancangan harta Islam, khususnya bagi golongan kritikal dalam umat Islam. Melalui analisis ini, kajian ini memperkaya literatur akademik mengenai hibah dan memberikan perspektif baru yang lebih mendalam tentang fungsinya. Selain itu, penemuan kajian ini berpotensi menjadi panduan praktikal bagi individu dan keluarga dalam merancang harta mereka, menawarkan pendekatan yang lebih sesuai untuk memenuhi keperluan khas golongan kritikal dalam masyarakat Islam.

Dalam konteks sosial, kajian ini bertujuan untuk mengisi jurang dalam literatur sedia ada dan memberi impak positif kepada masyarakat dengan meningkatkan kesedaran mengenai kepentingan hibah sebagai instrumen perancangan harta. Penemuan kajian ini dijangka memberikan manfaat kepada pelbagai pihak berkepentingan, termasuk Jabatan Agama yang bertanggungjawab dalam pengawalan dan penyebaran ilmu mengenai perancangan harta. Institusi hibah seperti Amanah Raya dan syarikat amanah atau syarikat pewarisan harta lain, serta pengamal perundangan dan institusi kewangan, juga akan mendapat panduan berharga untuk memperbaiki perkhidmatan mereka. Selain itu, pihak berkuasa tempatan, akademik, penyelidik, dan penyedia perkhidmatan kewangan akan diuntungkan daripada pengetahuan yang diperoleh melalui kajian ini, seterusnya menyokong pengukuhan amalan perancangan harta dalam kalangan umat Islam di Malaysia.

Akhirnya, kajian ini diharapkan dapat menyumbang kepada pengukuhan amalan perancangan harta yang lebih adil dan berkesan dalam kalangan umat Islam di Malaysia, menjadikan hibah sebagai pilihan utama dalam perancangan harta mereka.

4. Metodologi Kajian

Kajian ini menggunakan pendekatan konseptual untuk menjelaskan peranan hibah dalam perancangan harta Islam, dengan tumpuan khusus kepada manfaatnya untuk golongan kritikal. Pendekatan ini melibatkan analisis literatur dan teori bagi memahami fungsi serta implikasi hibah. Data utama diperoleh melalui tinjauan literatur yang merangkumi artikel jurnal, buku akademik, dan dokumen undang-undang berkaitan hibah.

Di samping itu, data sekunder termasuk kajian kes yang diterbitkan akan digunakan untuk memberikan perspektif praktikal mengenai aplikasi hibah. Penyelidikan literatur dilakukan untuk mengenal pasti tema-tema utama dan isu-isu berkaitan hibah, wasiat, dan faraid. Kajian kes dipilih berdasarkan relevansi dan kemampuannya untuk menerangkan aplikasi hibah dalam konteks sebenar.

Analisis tematik digunakan untuk mengenal pasti dan menilai tema-tema penting. Untuk memastikan kebolehpercayaan maklumat, kajian ini menggunakan sumber akademik yang berkualiti dan melaksanakan analisis secara teliti, sehingga kesimpulan yang dihasilkan adalah berdasarkan bukti yang kukuh.

5. Hasil Kajian

5.1. Konsep Hibah dalam Islam

5.1.1 Pengertian Hibah

Hibah dalam Islam merujuk kepada pemberian harta secara sukarela dan tanpa balasan kepada seseorang. Pemberian ini dilakukan dengan niat baik dan tanpa paksaan, di mana harta dipindahkan secara mutlak dari pemberi kepada penerima. Hibah bukan merupakan kontrak jual beli, melainkan tindakan kemurahan hati yang sangat digalakkan dalam Islam (Ibn Qudamah, 2021; Kamali, 2020).

5.1.2 Ciri-Ciri Hibah

Hibah mempunyai beberapa ciri utama yang membezakan ia daripada bentuk pemberian atau kontrak lain.

i. Pemberian sukarela: Hibah dilaksanakan tanpa sebarang bayaran atau balasan. Ia dilakukan semata-mata atas dasar kemurahan hati dan keinginan untuk membantu orang lain (Al-Suyuti, 2020; Al-Jassas, 2019).
ii. Pemindahan hak milik: Harta yang dihibahkan berpindah hak miliknya dari pemberi kepada penerima tanpa syarat balasan. Penerima mempunyai hak penuh untuk menguruskan dan menggunakan harta tersebut menurut kehendaknya (Ibn Qudamah, 2021; Ali, 2021).
iii. Penerimaan oleh penerima: Penerima hibah mesti menerima harta tersebut dengan kerelaan hati, dan penerimaan ini perlu dilakukan secara nyata atau simbolik (Al-Suyuti, 2020; Badran, 2022).

5.1.3 Hukum dan Pensyariatan Hibah

Hibah adalah amalan yang dibenarkan dan disyariatkan dalam Islam. Ia didorong oleh prinsip amal jariah dan kemurahan hati yang diajar oleh Nabi Muhammad SAW. Hukum memberi hibah dalam segala bentuk iaitu merangkumi hadiah dan sedekah adalah sunat. Dalil-dalil yang menyokong pensyariatan hibah termasuk:

i. Firman Allah SWT dalam Surah al-Baqarah, ayat 261, yang mengibaratkan pemberian harta di jalan Allah seperti benih yang tumbuh menjadi tujuh tangkai. Ini menunjukkan betapa besar ganjaran dan manfaat pemberian amal di jalan Allah (Al-Qur'an 2:261).
ii. Nabi Muhammad SAW bersabda: "Tangan yang di atas (pemberi) lebih baik daripada tangan yang di bawah (penerima), dan mulakan dengan orang yang menjadi tanggunganmu." (Hadis Riwayat Bukhari dan Muslim). Hadis ini menunjukkan keutamaan memberi, termasuk dalam bentuk hibah, kerana ia digalakkan untuk membantu orang lain dan memenuhi keperluan mereka. Pemberian seperti hibah bukan sahaja membawa manfaat kepada penerima, tetapi juga menjadi amalan yang diberkati bagi pemberi.

5.1.4 Rukun Hibah dan Syaratnya

Hibah dalam Islam memerlukan beberapa rukun dan syarat agar ia sah dan diterima di sisi syariah. Rukun dan syarat ini memastikan bahawa hibah dilakukan dengan cara yang adil dan sesuai dengan prinsip -prinsip Islam. Berikut adalah rukun dan syarat utama dalam pelaksanaan hibah:

i. Pemberi hibah (*al-Wahib*): Pemberi hibah mestilah seorang yang mempunyai kapasiti hukum penuh, termasuk keupayaan untuk menguruskan harta dan membuat keputusan tanpa paksaan. Ketiadaan unsur paksaan atau penipuan dalam pemberian adalah syarat utama agar hibah sah di sisi syariah (Ibn Qudamah, 2021; Hasan, 2022).
ii. Penerima hibah (*al-Mawhub lahu*): Penerima hibah mestilah seorang yang sah dari segi hukum dan berkeupayaan untuk menerima harta tersebut dengan kerelaan hati dan tanpa sebarang paksaan (Al-Suyuti, 2020; Salim, 2023).
iii. Barang atau harta yang dihibahkan (*al-Mawhub*): Harta yang dihibahkan mestilah jelas milik pemberi dan boleh dipindah milik secara sah. Ia tidak boleh melibatkan harta yang tidak dimiliki sepenuhnya atau yang sedang dalam pertikaian (Ibn Qudamah, 2021; Ibrahim, 2022).
iv. Sighah (Ijab dan Kabul): Sighah merujuk kepada pernyataan rasmi pemberian (ijab) dan penerimaan (qabul). Proses ini boleh dilakukan secara lisan, bertulis, atau simbolik, dan memastikan bahawa hibah dilakukan dengan jelas tanpa keraguan mengenai status pemilikan (Al-Suyuti, 2020; Othman, 2021).

5.1.5 Penerimaan Barang (*al-Qabd*) dalam Hibah

Penerimaan barang atau harta yang dihibahkan oleh penerima adalah langkah penting dalam memastikan

sahnya hibah. Penerimaan boleh dilakukan secara fizikal, seperti penyerahan kunci atau dokumen hak milik, atau secara simbolik jika harta tidak dapat dipindahkan secara fizikal. Penerimaan ini menandakan bahawa harta telah berpindah hak milik kepada penerima (Ibn Qudamah, 2021; Abdullah, 2022).

5.1.6 Hukum Penarikan Balik atau Pembatalan Hibah

Dalam undang-undang syariah, penarikan balik atau pembatalan hibah yang telah dilaksanakan adalah tertakluk kepada syarat tertentu. Dalam mazhab Syafie dan Maliki, hibah yang telah sempurna tidak boleh dibatalkan kecuali dengan persetujuan penerima atau keputusan mahkamah syariah. Sebaliknya, dalam mazhab Hanafi, hibah boleh dibatalkan oleh pemberi selagi harta belum diambil oleh penerima. Pembatalan hibah perlu dilakukan dengan berhati-hati untuk memastikan hak semua pihak dipelihara (Al-Suyuti, 2020; Hadi, 2021).

5.1.7 Kadar Harta yang Boleh Dihibah

Islam membenarkan pemberian harta sebagai hibah dalam jumlah yang wajar dan tidak membebankan pemberi hibah. Walau bagaimanapun, dalam konteks faraid, hibah tidak boleh menjejaskan hak waris yang ditetapkan oleh undang-undang Islam. Oleh itu, hibah harus dilakukan dengan adil dan tidak mengurangkan hak waris-waris lain (Ibn Qudamah, 2021; Zain, 2023).

5.2. Definisi dan Identifikasi Golongan Kritikal Dalam Konteks Hibah

Dalam konteks hibah, "golongan kritikal" merujuk kepada kelompok individu atau pasangan yang menghadapi cabaran khusus dalam perancangan harta dan yang mungkin tidak sepenuhnya dilindungi oleh sistem faraid. Definisi golongan kritikal dalam kajian ini merangkumi:

i. Anak Angkat: Anak angkat tidak secara automatik termasuk dalam sistem faraid, menyebabkan mereka mungkin terlepas daripada hak-hak harta yang sepatutnya. Hibah membolehkan mereka mendapatkan hak harta dengan cara yang sah dan jelas (Rahman & Jamil, 2022).
ii. Individu dengan Anak OKU: Individu yang mempunyai anak dengan keperluan khas mungkin memerlukan pengagihan harta yang lebih fleksibel dan disesuaikan untuk memastikan kesejahteraan anak tersebut (Ali, 2021).
iii. Pasangan Tanpa Anak: Pasangan yang tidak mempunyai anak memerlukan strategi perancangan harta yang berbeza kerana mereka tidak mempunyai waris langsung yang akan mewarisi harta mereka. Hibah membolehkan mereka memilih penerima yang sesuai menurut keperluan mereka (Zulkifli, 2023).
iv. Individu yang Hanya Mempunyai Anak Perempuan: Dalam sistem faraid, anak perempuan menerima bahagian yang lebih kecil berbanding anak lelaki. Hibah membolehkan individu untuk memberikan hak yang lebih adil kepada anak perempuan mereka (Karim, 2023).
v. Individu yang Tidak Berkahwin: Individu yang tidak berkahwin tidak mempunyai waris yang sah dari sudut syariah. Hibah membolehkan mereka menentukan penerima harta yang diinginkan, yang mungkin termasuk keluarga terdekat atau orang lain yang dianggap penting bagi mereka (Hassan & Zulkifli, 2023).

Golongan ini dianggap kritikal kerana dalam sistem faraid, hak mereka mungkin tidak terjamin sepenuhnya atau mereka mungkin menghadapi cabaran unik yang memerlukan perancangan harta yang lebih fleksibel dan adil. Dengan menggunakan hibah, mereka dapat memastikan bahawa harta diagihkan mengikut kehendak peribadi, tanpa risiko pertikaian atau ketidakadilan yang mungkin timbul melalui kaedah pembahagian yang lain (Mohamed, 2024).

5.3 Peranan Hibah dalam Perancangan Harta

Hibah memainkan peranan yang signifikan dalam perancangan harta, terutamanya bagi golongan kritikal dalam kalangan umat Islam. Dengan menyediakan mekanisme yang fleksibel dan berkesan, hibah membolehkan individu untuk mengagihkan harta mereka mengikut kehendak peribadi dan keperluan khusus. Ini amat relevan bagi golongan kritikal seperti anak angkat, individu dengan anak OKU, pasangan tanpa anak, individu yang hanya mempunyai anak perempuan, dan individu yang tidak berkahwin. Antara peranan hibah adalah:

i. Pengurusan harta yang berkesan untuk golongan kritikal

Hibah membolehkan golongan kritikal merancang pengagihan harta dengan lebih teratur dan fleksibel. Dalam konteks ini, hibah memberikan kebebasan kepada individu untuk menentukan penerima harta berdasarkan keperluan dan kehendak peribadi, tanpa terikat kepada garis panduan yang ketat seperti dalam sistem faraid. Sebagai contoh, pasangan tanpa anak sering kali menghadapi dilema dalam merancang pengagihan harta mereka. Mereka mungkin ingin menyalurkan harta mereka kepada institusi kebajikan atau organisasi amal yang mereka sokong.

Dalam satu kes yang dikaji oleh Rahman dan Jamil (2022), pasangan tanpa anak telah memilih untuk menggunakan hibah sebagai cara untuk menyumbang kepada sebuah rumah perlindungan untuk anak -anak yatim. Dengan hibah, mereka dapat memastikan bahawa harta mereka tidak terabai dan memberi manfaat kepada golongan yang memerlukan, sekaligus memenuhi kehendak mereka untuk beramal. Ini bukan sahaja mencerminkan nilai kemanusiaan yang tinggi, tetapi juga memberikan impak positif kepada masyarakat secara keseluruhan.

Selain itu, hibah juga membolehkan mereka mengatur pengagihan harta secara spesifik, seperti menetapkan syarat atau tujuan tertentu bagi penggunaan harta tersebut. Misalnya, pasangan tersebut mungkin menetapkan bahawa sebahagian daripada harta mereka digunakan untuk pendidikan anak-anak di rumah perlindungan tersebut. Dengan cara ini, hibah bukan sahaja berfungsi sebagai alat perancangan harta, tetapi juga sebagai instrumen untuk menyumbang kepada pembangunan sosial dan pendidikan dalam komuniti (Zainuddin & Yusoff, 2021).

Hibah juga memberikan kelebihan dalam hal ketelusan dan keadilan. Dalam pengagihan harta melalui hibah, pemberi dapat menyampaikan kehendak mereka dengan jelas kepada penerima, sekaligus mengelakkan salah faham yang mungkin berlaku dalam proses pengagihan harta selepas kematian. Dengan cara ini, risiko pertikaian keluarga dan salah tafsir mengenai pengagihan harta dapat dikurangkan dengan ketara. Hal ini penting, terutamanya bagi golongan kritikal yang mungkin terdedah kepada eksploitasi atau ketidakseimbangan dalam sistem faraid (Ahmad, 2020).

Secara keseluruhannya, penggunaan hibah untuk pengurusan harta bagi golongan kritikal membolehkan mereka tidak hanya merancang dan mengagihkan harta dengan cara yang lebih adil dan berkesan, tetapi juga memberikan sumbangan yang bermakna kepada masyarakat. Ini mencerminkan bagaimana hibah bukan sekadar instrumen perancangan kewangan, tetapi juga alat untuk meningkatkan kesejahteraan sosial (Karim, 2023).

ii. Mengelakkan pertikaian dan konflik keluarga

Sistem faraid mempunyai struktur yang mungkin tidak sepenuhnya memenuhi keperluan semua golongan, seperti individu yang tidak berkahwin atau yang hanya mempunyai anak perempuan. Dalam situasi seperti ini, hibah menjadi alternatif yang bermanfaat untuk memastikan pengagihan harta yang lebih sesuai dengan keperluan individu tersebut. Dalam kes seorang ibu bapa yang mempunyai anak angkat, hibah digunakan untuk memastikan anak tersebut menerima harta daripada ibu bapa angkat mereka secara langsung. Ini mengelakkan sebarang kekeliruan dan konflik yang mungkin timbul di kalangan waris lain, kerana sistem faraid tidak mengiktiraf hak anak angkat sebagai penerima harta (Razak, 2019).

Hibah membolehkan pemberi untuk mengatur pengagihan harta dengan jelas, termasuk menetapkan syarat tertentu. Sebagai contoh, seorang individu yang tidak berkahwin mungkin ingin memberikan hibah kepada sahabat baik atau anggota keluarga lain, memastikan bahawa harta tersebut sampai kepada orang yang mereka percayai. Ini tidak hanya menyelesaikan isu ketidakadilan dalam sistem faraid, tetapi juga mengurangkan risiko pertikaian di masa hadapan.

Satu lagi aspek penting, hibah membolehkan pemberi untuk menyatakan kehendak mereka secara jelas dalam dokumen, mengurangkan salah faham yang boleh menyebabkan perselisihan di kalangan waris. Dalam konteks ini, hibah berfungsi sebagai alat untuk komunikasi yang lebih baik, di mana niat dan harapan pemberi dapat diterjemahkan dengan tepat kepada penerima. Hal ini adalah penting bagi golongan kritikal yang mungkin tidak mempunyai perlindungan yang sama dalam sistem faraid, seperti individu dengan anak OKU atau pasangan tanpa anak (Yusuf, 2022).

Dengan cara ini, hibah juga memainkan peranan sebagai instrumen untuk memperkuatkan hubungan keluarga. Kejelasan dalam pengagihan harta melalui hibah dapat menggalakkan rasa saling menghormati di dalam keluarga dan mengelakkan pergeseran yang mungkin timbul akibat persepsi ketidakadilan dalam pembahagian harta. Kesimpulannya, hibah memainkan peranan penting dalam mengelakkan pertikaian dan konflik keluarga dengan memberikan penyelesaian yang lebih adil dan jelas, serta meningkatkan keupayaan untuk merancang masa depan harta dengan cara yang lebih efektif.

iii. Memberi ketenangan jiwa kepada pemberi hibah

Hibah memberikan ketenangan jiwa kepada pemberi, terutama bagi golongan kritikal. Dalam konteks ini, hibah membolehkan individu merancang masa depan harta mereka dengan lebih yakin, kerana mereka mempunyai kawalan penuh terhadap pengagihan harta tersebut. Bagi ibu bapa yang mempunyai anak OKU, hibah sering kali menjadi pilihan utama untuk memastikan anak mereka mendapat sokongan kewangan yang diperlukan selepas ketiadaan mereka. Dalam satu kajian oleh Yusuf (2022), ibu bapa tersebut menggunakan hibah untuk menyediakan dana khusus yang akan digunakan untuk penjagaan dan pendidikan anak mereka.

Ini memberi mereka ketenangan fikiran, kerana mereka tahu bahawa masa depan anak mereka telah diambil kira secara sistematik dan berkesan.

Pemberian hibah juga memberikan peluang kepada individu untuk menyatakan kehendak mereka dengan jelas, yang sangat penting dalam konteks prinsip syariah. Pengetahuan bahawa harta mereka akan diagihkan mengikut kehendak dan nilai yang mereka pegang memberikan rasa selamat kepada pemberi. Hal ini sangat penting bagi golongan kritikal, di mana ketidakpastian mengenai masa depan dapat menimbulkan tekanan emosional yang signifikan (Salim, 2023).

Selain itu, hibah membolehkan pemberi untuk melibatkan diri dalam proses perancangan harta. Mereka dapat menetapkan syarat-syarat tertentu, seperti memastikan bahawa dana hibah digunakan untuk tujuan tertentu, contohnya pendidikan atau penjagaan harian. Ini bukan sahaja memberikan ketenangan kepada mereka tetapi juga memastikan bahawa harta tersebut digunakan dengan cara yang mereka percayai dan nilai.

Hibah juga berfungsi sebagai alat untuk menyampaikan nilai-nilai keluarga kepada generasi seterusnya. Dengan menggunakan hibah untuk membantu anak OKU atau anggota keluarga lain, pemberi dapat memastikan bahawa nilai-nilai seperti kasih sayang dan tanggungjawab sosial terus diteruskan. Ini memberikan dimensi tambahan kepada ketenangan jiwa yang mereka peroleh, kerana mereka tahu bahawa harta mereka tidak hanya memberi manfaat kepada penerima tetapi juga memperkukuhkan ikatan kekeluargaan.

Dengan demikian, hibah memainkan peranan penting dalam memberikan ketenangan jiwa kepada pemberi. Dengan memastikan bahawa harta diagihkan dengan cara yang sesuai dengan nilai dan keinginan mereka, hibah menjadi instrumen yang berharga dalam perancangan harta, terutama bagi golongan kritikal yang memerlukan kepastian dan sokongan berterusan.

iv. **Aplikasi praktikal dan sokongan sosial**

Peranan hibah dalam aplikasi praktikal adalah amat penting bagi golongan kritikal, kerana ia memberikan fleksibiliti dalam pengagihan harta. Sebagai contoh, individu yang tidak berkahwin sering kali menghadapi dilema mengenai siapa yang sepatutnya menerima harta mereka. Dengan menggunakan hibah, mereka dapat merancang pengagihan harta kepada saudara terdekat dan rakan-rakan yang dianggap sebagai keluarga. Ini bukan sahaja memastikan pengagihan yang lebih adil tetapi juga membantu mengelakkan konflik dengan waris lain yang mungkin tidak memahami niat mereka (Karim, 2023).

Hibah juga membolehkan individu merancang dengan lebih terperinci, termasuk menetapkan syarat-syarat tertentu dalam pengagihan harta. Contohnya, seseorang mungkin ingin memastikan bahawa sebahagian daripada harta mereka digunakan untuk menyokong pendidikan atau keperluan kesihatan bagi orang yang mereka sayangi. Dengan cara ini, hibah berfungsi sebagai alat yang berkuasa untuk mewujudkan legasi yang positif dan berterusan bagi penerima.

Di samping itu, hibah menyokong prinsip amal jariah yang digalakkan dalam Islam. Dengan membolehkan individu menyumbang kepada badan amal atau organisasi kebajikan, hibah menjadi cara untuk menyatakan nilai-nilai kemanusiaan dan tanggungjawab sosial. Misalnya, individu yang ingin memberi kembali kepada masyarakat dapat menggunakan hibah untuk menyalurkan harta mereka kepada projek-projek kebajikan yang memberi impak positif. Ini bukan sahaja memberi manfaat kepada penerima tetapi juga memperkukuhkan rasa komuniti dan saling menyokong antara satu sama lain.

Melalui aplikasi praktikal ini, hibah membantu meningkatkan kesejahteraan sosial dan mempromosikan sikap saling menghormati dalam masyarakat. Ketika golongan kritikal seperti individu tidak berkahwin atau mereka yang mempunyai anak OKU merancang pengagihan harta mereka, hibah menawarkan mereka peluang untuk melibatkan diri secara aktif dalam proses tersebut, sekaligus mengukuhkan ikatan kekeluargaan dan sosial. Dalam konteks ini, hibah berfungsi sebagai alat untuk menyokong nilai-nilai sosial yang lebih luas. Dengan memanfaatkan hibah, golongan kritikal dapat merancang harta mereka dengan lebih berkesan dan memberikan sumbangan yang bermakna kepada masyarakat Islam.

v. Memperkuatkan hubungan keluarga

Hibah berfungsi sebagai instrumen penting dalam memperkukuh hubungan antara ahli keluarga. Dengan membolehkan individu merancang dan mengagihkan harta mereka secara adil, hibah meningkatkan rasa keadilan dan saling menghormati dalam keluarga. Sebagai contoh, seorang bapa yang mempunyai anak perempuan boleh menggunakan hibah untuk memberikan harta kepada anaknya secara langsung, memastikan hak mereka terjamin dan mengukuhkan ikatan kekeluargaan (Rahman, 2022).

Apabila harta diagihkan melalui hibah, anak perempuan merasa dihargai dan diiktiraf, yang seterusnya memperkuat hubungan mereka. Pengetahuan bahawa harta akan digunakan untuk kepentingan orang

tersayang memberikan ketenangan jiwa kepada pemberi dan meningkatkan rasa tanggungjawab dalam keluarga (Salim, 2023).

Hibah juga mencipta platform untuk komunikasi yang lebih baik dalam keluarga. Dengan membincangkan niat dan kehendak mereka secara terbuka, ahli keluarga dapat menghindari salah faham yang mungkin timbul selepas kematian. Proses ini membina kepercayaan dan menghormati antara ahli keluarga (Yusuf, 2022). Kesedaran tentang pengagihan harta juga menciptakan ruang untuk dialog yang konstruktif, meningkatkan keharmonian dalam keluarga.

Lebih penting lagi, hibah membantu mencipta legasi positif dalam keluarga. Apabila individu memberi perhatian kepada cara harta mereka diagihkan, ia mencerminkan nilai-nilai dan tradisi yang ingin mereka pertahankan. Ini memastikan bahawa nilai-nilai tersebut diteruskan kepada generasi akan datang, yang selaras dengan prinsip amal jariah dalam Islam (Karim, 2023).

Oleh itu, hibah bukan sahaja berfungsi sebagai alat praktikal untuk perancangan harta tetapi juga sebagai cara untuk memperkukuh hubungan kekeluargaan. Dengan memastikan pengagihan yang adil dan memberi ruang untuk komunikasi yang terbuka, hibah menyokong keharmonian dan kesejahteraan dalam keluarga.

vi Penyelesaian terhadap kekangan yang wujud dalam sistem faraid

Hibah memberikan alternatif yang berkesan bagi beberapa aspek dalam sistem faraid, terutamanya bagi golongan kritikal yang mungkin tidak mendapat pengiktirafan sewajarnya dalam pembahagian harta. Dalam keadaan tertentu di mana faraid tidak dapat memenuhi keperluan khusus, hibah membolehkan pengagihan yang lebih fleksibel dan sesuai dengan keadaan individu.

Sebagai contoh, seorang bapa yang mempunyai anak orang kurang upaya (OKU) boleh menggunakan hibah untuk memastikan anaknya mendapat sokongan kewangan dan penjagaan yang diperlukan tanpa mengira pembahagian yang ditetapkan oleh faraid (Yusuf, 2022). Dalam situasi ini, hibah membolehkan bapa tersebut menetapkan syarat atau tujuan tertentu bagi penggunaan harta, seperti untuk pendidikan atau perubatan anaknya, yang tidak dapat dicapai melalui pembahagian faraid.

Selain itu, hibah juga membolehkan individu yang tidak berkahwin atau yang mempunyai anak perempuan sahaja merancang pengagihan harta dengan lebih adil. Dengan hibah, mereka dapat memberikan harta kepada individu atau institusi yang mereka pilih, seperti rakan rapat atau badan amal, yang mungkin tidak termasuk dalam senarai penerima faraid. Ini menunjukkan bahawa hibah tidak hanya melengkapkan sistem perancangan harta yang sedia ada, tetapi juga memperbaikinya dengan memastikan keadilan serta memenuhi keper luan khusus golongan kritikal.

Secara ringkas, hibah berfungsi sebagai alternatif yang berkesan untuk menangani aspek terhad dalam sistem faraid, menyediakan pendekatan yang lebih inklusif dan responsif terhadap keperluan pelbagai golongan dalam masyarakat. Ini menjadikan hibah pilihan utama bagi mereka yang ingin memastikan harta mereka diagihkan secara adil dan sesuai dengan keperluan khusus penerima.

Bersandarkan peranan di atas, hibah berfungsi sebagai instrumen yang sangat berkesan dalam melindungi hak golongan kritikal. Dengan menyoroti pelbagai aplikasi hibah dalam konteks yang berbeza, analisis ini mengukuhkan kedudukan hibah sebagai alat perancangan harta yang memenuhi kehendak pemberi dan menjawab keperluan penerima dengan lebih tepat. Hibah menawarkan solusi yang praktikal untuk isu-isu yang mungkin tidak dapat diatasi oleh sistem faraid atau bentuk perancangan harta lain, menjadikannya pilihan utama bagi individu yang ingin memastikan pengagihan harta dilakukan dengan adil dan efektif dalam kalangan umat Islam.

5.4 Cabaran dalam Pelaksanaan Hibah kepada Golongan Kritikal

Walaupun hibah menyediakan fleksibiliti dalam perancangan harta, pelaksanaannya terhadap golongan kritikal menghadapi pelbagai cabaran yang kompleks. Namun, hibah juga menawarkan penyelesaian unik yang dapat memenuhi keperluan khas golongan ini. Antara cabaran dalam pelaksanaan hibah adalah:

i. Kekurangan kesedaran dan pemahaman dalam kalangan masyarakat

Salah satu cabaran utama adalah kekurangan kesedaran dan pemahaman mengenai peranan hibah dalam melindungi golongan kritikal tanpa menjejaskan hak waris yang sah menurut faraid. Ramai di kalangan masyarakat Islam di Malaysia tidak memahami sepenuhnya bagaimana hibah dapat digunakan sebagai alat perancangan harta yang berkesan untuk memenuhi keperluan khusus golongan ini. Sebagai contoh, melalui hibah, pasangan yang hanya mempunyai anak perempuan dapat memastikan anak-anak mereka menerima harta pusaka yang mencukupi walaupun faraid memberikan bahagian yang lebih besar kepada waris lelaki (Abdullah, 2021).

ii. Isu undang-undang dan dokumentasi hibah

Isu undang-undang juga menjadi cabaran besar dalam pelaksanaan hibah kepada golongan kritikal. Hibah yang tidak didokumentasikan dengan betul atau tidak diiktiraf oleh mahkamah berpotensi dipertikaikan oleh pihak lain, terutama jika ada waris yang merasakan hak mereka dilanggar. Namun, dengan dokumentasi yang tepat dan pematuhan kepada peraturan syariah, hibah boleh menjadi alat yang berkesan untuk memastikan hak golongan kritikal, seperti anak angkat atau individu dengan anak OKU, terjamin tanpa risiko per tikaian undang-undang (Ali, 2020).

iii. Cabaran teknikal dalam penentuan nilai dan pengurusan harta hibah

Masalah teknikal seperti penentuan nilai harta yang dihibahkan juga menjadi cabaran dalam pelaksanaan hibah kepada golongan kritikal. Sebagai contoh, dalam kes anak OKU, ibu bapa mungkin menghadapi kesukaran untuk menentukan jumlah atau jenis harta yang sesuai untuk dihibahkan bagi memastikan keperluan jangka panjang anak tersebut terjamin. Hibah memberikan fleksibiliti untuk menyesuaikan jumlah harta berdasarkan keperluan individu penerima, seperti memastikan dana yang mencukupi untuk penjagaan jangka panjang anak OKU atau untuk memastikan pasangan tanpa anak dapat menyalurkan harta mereka kepada amal jariah (Rahman, 2022).

iv. Konflik sosial dan keluarga

Cabaran lain yang sering dihadapi adalah konflik sosial dan keluarga yang timbul daripada pelaksanaan hibah kepada golongan kritikal. Waris sah yang merasa hak mereka dikurangkan mungkin mempersoalkan niat pemberi hibah, yang boleh menyebabkan ketegangan dalam hubungan keluarga. Namun, dengan perancangan yang teliti dan komunikasi yang baik, hibah dapat digunakan untuk mengelakkan konflik ini dengan memastikan semua pihak memahami niat dan keputusan pemberi hibah. Sebagai contoh, individu yang tidak berkahwin boleh menggunakan hibah untuk mengagihkan harta mereka kepada orang-orang yang mereka anggap sebagai keluarga, tanpa menimbulkan konflik dalam kalangan waris (Karim, 2023).

v. Kekangan ekonomi

Kekangan ekonomi merupakan cabaran yang signifikan dalam pelaksanaan hibah. Terdapat di kalangan umat Islam yang menghadapi masalah kewangan yang menghalang mereka daripada membuat perancangan harta dengan berkesan. Misalnya, kos pengurusan harta, seperti penilaian dan dokumentasi, boleh menjadi beban tambahan. Dalam situasi ini, mereka mungkin tidak dapat memanfaatkan sepenuhnya potensi hibah sebagai instrumen perancangan harta yang efektif (Zainuddin, 2021).

vi. Kekurangan sumber maklumat dan nasihat

Kekurangan akses kepada sumber maklumat dan nasihat yang tepat tentang hibah juga menjadi cabaran. Ramai individu dalam golongan kritikal tidak tahu di mana untuk mendapatkan panduan yang betul tentang pelaksanaan hibah, termasuk aspek hukum dan praktikalnya. Tanpa nasihat yang sesuai, mereka mungkin tidak dapat membuat keputusan yang terbaik mengenai pengagihan harta mereka. Penyediaan sumber maklumat yang lebih baik dan akses kepada nasihat profesional dalam hal perancangan harta sangat penting untuk meningkatkan pemahaman dan pelaksanaan hibah (Mohamed, 2023).

5.5 Perbandingan Hibah, Wasiat dan Faraid

Dalam perancangan harta, hibah, wasiat, dan faraid merupakan tiga instrumen utama yang sering digunakan oleh umat Islam. Ketiga-tiganya mempunyai ciri dan perbezaan yang signifikan dari segi pelaksanaan, pengagihan, dan kelebihan masing-masing.

Hibah merupakan pemindahan harta yang dilakukan oleh pemberi kepada penerima semasa pemberi masih hidup. Salah satu kelebihan utama hibah adalah pemindahan harta berlaku secara segera, memberikan pemberi kawalan penuh terhadap pengagihan harta mereka. Ini bermakna pemberi dapat memilih penerima harta dan menentukan jumlah yang dihibahkan, selagi tidak melanggar hak waris yang ditetapkan oleh faraid. Hibah juga dapat mengurangkan risiko pertikaian di kalangan waris, kerana pemindahan telah selesai sebelum kematian, menghindari masalah yang sering timbul dalam proses pembahagian harta selepas kematian (Ahmad, 2020). Selain itu, hibah menawarkan fleksibiliti dalam memenuhi keperluan khusus golongan kritikal, seperti anak angkat dan individu dengan anak OKU.

Wasiat, berbeza dengan hibah, berkuat kuasa selepas kematian pemberi. Wasiat membolehkan individu

menyatakan hasrat mereka mengenai pengagihan harta, namun tidak memberikan kawalan yang sama seperti hibah dalam pemindahan harta semasa hidup. Selain itu, wasiat hanya boleh dilaksanakan jika memenuhi syarat-syarat tertentu dan tidak boleh melebihi satu pertiga dari harta yang ditinggalkan, jika terdapat waris yang sah menurut hukum faraid (Yusuf, 2022). Oleh itu, wasiat lebih terhad dalam konteks keadilan bagi golongan kritikal yang mungkin memerlukan perhatian khusus. Proses pelaksanaan wasiat juga boleh menjadi lebih panjang dan rumit, bergantung kepada undang-undang dan prosedur yang diperlukan (Ahmad, 2020).

Faraid adalah sistem pembahagian harta yang ketat menurut undang-undang Islam. Dalam sistem ini, bahagian yang diterima oleh setiap waris ditentukan secara automatik berdasarkan hubungan mereka dengan si mati. Faraid bertujuan untuk memastikan keadilan dalam pembahagian harta kepada waris yang sah, namun ia boleh menjadi kurang fleksibel dalam memenuhi keperluan khusus golongan kritikal. Sebagai contoh, pasangan tanpa anak atau individu yang tidak berkahwin mungkin mendapati bahawa hak mereka tidak mencukupi mengikut undang-undang faraid (Rahman, 2022). Faraid juga tidak memberikan ruang bagi pemberi untuk membuat pilihan khusus mengenai pengagihan harta berdasarkan situasi tertentu.

Ketiga-tiga instrumen ini memainkan peranan penting dalam perancangan harta. Walau bagaimanapun, hibah muncul sebagai pilihan yang lebih fleksibel dan responsif, terutama bagi golongan kritikal. Dengan membolehkan pemindahan harta secara langsung semasa hayat pemberi, hibah mampu memenuhi keperluan khusus dan mengurangkan risiko pertikaian. Ini menjadikannya alat yang lebih efektif dalam konteks perancangan harta bagi individu yang memerlukan perhatian khusus. Justeru, dalam situasi yang melibatkan golongan kritikal, hibah sering kali merupakan pilihan yang lebih sesuai berbanding wasiat dan faraid.

6. Kesimpulan

Kajian ini menegaskan bahawa hibah memainkan peranan yang sangat penting sebagai instrumen perancangan harta dalam Islam, terutamanya dalam konteks golongan kritikal. Dengan keupayaannya untuk memberikan pemindahan harta secara langsung dan segera, hibah menawarkan solusi yang lebih fleksibel dan relevan berbanding dengan sistem faraid yang lebih ketat. Ini membolehkan golongan seperti anak angkat, individu dengan anak OKU, pasangan tanpa anak, dan individu yang tidak berkahwin memperoleh hak harta dengan cara yang lebih sesuai dengan keperluan dan keadaan mereka.

Namun, walaupun manfaat hibah jelas, pelaksanaannya masih menghadapi beberapa cabaran. Kurangnya kesedaran masyarakat mengenai konsep hibah, isu-isu berkaitan dokumentasi, serta kekurangan pengetahuan mengenai pengurusan harta adalah halangan yang perlu diatasi. Oleh itu, adalah penting untuk melaksanakan program pendidikan dan kempen kesedaran yang lebih meluas untuk mendidik masyarakat tentang kelebihan dan mekanisme hibah.

Di samping itu, penggubalan undang-undang yang lebih baik dan proses dokumentasi yang lebih efisien akan dapat memudahkan pelaksanaan hibah. Ini akan membantu mengukuhkan peranan hibah sebagai alat perancangan harta yang efektif dan relevan dalam memenuhi keperluan khusus golongan kritikal.

Akhirnya, untuk memastikan pengagihan harta yang adil dan berkesan dalam jangka panjang, masyarakat harus menganggap hibah sebagai pilihan yang bukan sahaja sah secara syariah, tetapi juga sebagai instrumen penting dalam perancangan harta. Dengan meningkatkan pemahaman dan penerimaan terhadap hibah, kita dapat menjadikan instrumen ini lebih berdaya saing dan berguna dalam konteks perancangan harta di kalangan umat Islam.

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Membentuk Kepimpinan dan Tingkah Laku Beretika DalamKalangan Pelajar Politeknik Kuching Sarawak

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Abstract

In the age of globalisation and increasing competition in the labour market, leadership skills and ethical behaviourare essential qualities that polytechnic graduates must possess. This study aims to assess and analyse the extent of leadership skills and ethical behaviour among Politeknik Kuching Sarawak (PKS) students and the impact of these elements on student success. A quantitative methodology was used by distributing an online questionnaire modelled on previous studies. Data was collected from 70 students who hold leadership positions in clubs or student organisations. The data was analysed using SPSS software. The results show that students generally exhibit good ethical behaviour and show positive leadership skills, but there is a need to improve leadership skillsin difficult situations. The implications of these findings emphasise the need for more structured and comprehensive leadership and ethics education at PKS to produce graduates who not only excel academically butare also able to lead ethically. This research provides valuable insight into the need to integrate leadership and ethics education into the polytechnic curriculum, which is critical to developing competent and ethical graduatesin line with the demands of the global labour market. Suggestions for future research include more in-depth studies of the effectiveness of educational interventions and the influence of external factors on leadership and ethics in students. This will help in the development of more holistic and inclusive educational strategies.

Keywords: leadership; ethical behaviour; polytechnic education; graduate development; quantitative study.

Abstrak

Dalam era globalisasi dan peningkatan persaingan dalam pasaran kerja, kemahiran kepimpinan dan tingkah laku beretika merupakan aspek penting yang harus dimiliki oleh graduan politeknik. Kajian ini bertujuan untuk menilaidan menganalisis tahap kepimpinan dan tingkah laku beretika dalam kalangan pelajar Politeknik Kuching Sarawak (PKS), serta implikasi kedua-dua elemen tersebut terhadap kejayaan pelajar. Metodologi kuantitatif digunakan melalui pengedaran soal selidik dalam talian yang diadaptasi dari kajian terdahulu dan melibatkan 70 orang pelajar yang memegang jawatan kepimpinan dalam kelab atau organisasi pelajar. Data dianalisis menggunakan perisian SPSS. Hasil kajian menunjukkan bahawa pelajar umumnya memiliki tingkah laku beretika yang baik dan menunjukkan kemahiran kepimpinan yang positif, namun terdapat keperluan untuk memperbaiki kemampuan kepimpinan dalam menghadapi situasi yang mencabar. Implikasi dari penemuan ini menekankan perlunya pendidikan kepimpinan dan etika yang lebih berstruktur dan menyeluruh di PKS untuk menghasilkan graduan yang tidak hanya cemerlang akademik tetapi juga mampu memimpin dengan beretika. Dapatan kajian menunjukkan keperluan integrasi pendidikan kepimpinan dan etika dalam kurikulum politeknik dan kepentingan membentuk graduan yang kompeten serta beretika sesuai dengan keperluan pasaran kerja global. Cadangan untukkajian masa depan termasuklah penelitian lebih mendalam mengenai keberkesanan intervensi pendidikan dan pengaruh faktor luaran terhadap kepimpinan dan etika pelajar. Ini akan membantu dalam pengembangan strategipendidikan yang lebih holistik dan inklusif.

Kata Kunci: kepimpinan; tingkah laku beretika; pendidikan politeknik; pembangunan graduan; kajian kuantitatif

1. Pengenalan

Dalam era globalisasi dan persaingan yang semakin sengit, kemampuan untuk memimpindan bertindak secara beretika adalah kritikal dalam membina kejayaan individu dan kesejahteraan masyarakat. Sekiranya seseorang mempunyai keupayaan memimpin tetapi tidakmempunyai tingkah laku beretika, organisasi yang dipimpin akan menjadi rosak. Menurut Ruslan (2020), perkara yang harus diberi penekanan ialah aspek kefahaman terhadap nilai etikadan berakhlak mulia untuk menjadikan seorang individu itu mempunyai sahsiah berkualiti danbersedia untuk menangani masalah global di masa hadapan.

Kepimpinan dan tingkah laku beretika sangat penting dalam kalangan graduan PendidikanTeknikal dan Latihan Vokasional (TVET) demi memenuhi keperluan industri masa kini. Majikan mencari graduan yang tidak hanya memiliki kemahiran teknikal tetapi turut memerlukan graduan yang mempunyai kemampuan kepimpinan dan etika yang kukuh. Kepimpinan yang efektif membolehkan graduan menguruskan pasukan dengan lebih baik, menyelesaikan konflik, dan membuat keputusan yang berlandaskan integriti, yang akhirnya meningkatkan produktiviti dan inovasi di tempat kerja.

Selain itu, tingkah laku beretika dalam kalangan graduan TVET juga penting untuk memastikan kelangsungan perniagaan yang beretika dan mampan. Kajian oleh Jones et al. (2022) menekankan bahawa tingkah laku beretika dalam organisasi mengurangkan risiko salahlaku, penipuan, dan pelanggaran peraturan. Graduan yang mempunyai asas etika yang kuat mampu menyumbang kepada budaya kerja yang jujur dan telus, yang merupakan nilai tambahkepada reputasi syarikat dan keyakinan pelanggan.

Tambahan pula, kepimpinan dan etika yang baik dalam kalangan graduan TVET memainkan peranan penting dalam pembangunan komuniti dan masyarakat. Menurut Ahmad et al. (2023), graduan TVET yang terlatih dalam kepimpinan dan etika berkemampuan untuk menjadi agen perubahan dalam komuniti mereka. Mereka boleh memimpin projek-projek kemasyarakatan, mempromosikan amalan kerja yang beretika, dan menjadi teladan bagigenerasi akan datang, sekali gus memperkukuh perpaduan dan kemakmuran masyarakat.

Integrasi kepimpinan dan tingkah laku beretika dalam pendidikan membantu melahirkanindividu yang bertanggungjawab dan beretika. Menurut Maxwell dan Beattie (2021), pemimpin yang beretika memainkan peranan penting dalam mempengaruhi keputusan dan tindakan dalam organisasi, mencipta budaya kerja yang berkualiti dan memperkukuh hubungandengan pelanggan dan pihak berkepentingan. Kajian oleh Ahmed dan Yusuf (2021) menegaskan bahawa pemimpin yang beretika memainkan peranan penting dalam membentuk persekitaran yang produktif dan harmonis. Mereka mendapati bahawa pelajar yang mempraktikkan kepimpinan beretika cenderung untuk mencipta budaya kerja yang positif dan menyumbang kepada kesejahteraan komuniti.

Kepimpinan dan tingkah laku beretika membantu graduan TVET dalam pembangunan kerjaya jangka panjang. Graduan yang mempraktikkan kepimpinan beretika mempunyai peluang yang lebih tinggi untuk mendapat kenaikan pangkat dan mencapai kejayaan kerjaya. Ini kerana majikan menghargai pekerja yang tidak hanya kompeten secara teknikal tetapi jugamampu memimpin dengan integriti dan tanggungjawab. Oleh itu, memupuk kepimpinan dan tingkah laku beretika dalam kalangan pelajar TVET adalah pelaburan penting untuk masa depan mereka dan kejayaan industri.

Justeru, Politeknik Kuching Sarawak (PKS) sebagai salah satu institusi pendidikanteknikal terkemuka, berada dalam posisi unik untuk membentuk tingkah laku beretika dan kepimpinan dalam kalangan pelajarnya. Ini adalah penting kerana pelajar politeknik bukan sahaja bakal tenaga kerja masa hadapan tetapi juga bakal pemimpin dalam pelbagai industri. Pendidikan yang menyeluruh yang merangkumi aspek etika dan kepimpinan akan memastikan

graduan bukan sahaja cemerlang dari segi teknikal tetapi juga dari segi moral dan sosial. Kajianoleh Hassan et al. (2022) menunjukkan bahawa program-program pembangunan kepimpinan yang berstruktur di politeknik mampu menghasilkan graduan yang lebih bersedia untukmemasuki pasaran kerja.

Kesimpulannya, kajian ini bertujuan untuk menekankan kepentingan kepimpinan dan tingkah laku beretika dalam pendidikan politeknik. Melalui pemahaman dan pengukuhan elemen-elemen ini, PKS dapat memainkan peranan yang signifikan dalam melahirkan graduanyang bukan sahaja mahir dalam bidang teknikal tetapi juga beretika dan berupaya memimpin.Penelitian ini akan memberikan wawasan yang berguna untuk membina strategi pendidikan yang lebih holistik dan efektif.

2. Tinjauan Literatur

2.1 Tingkah Laku Beretika

Kepentingan tingkah laku beretika dalam pendidikan telah diakui secara meluas. Menurut kajian oleh Johnson et al. (2023), tingkah laku beretika dalam kalangan pelajar bukan sahaja membantu dalam membuat keputusan yang bertanggungjawab tetapi juga memupuk hubunganyang baik dengan rakan sebaya dan tenaga pengajar. Pelajar yang mengamalkan etika yang tinggi cenderung untuk menjadi *role model* kepada rakan- rakan mereka, sekaligus mencipta persekitaran pembelajaran yang positif dan harmonis. Kajian oleh Miller dan Roberts (2022) pula menunjukkan bahawa tingkah laku beretika berkait rapat dengan peningkatan pencapaianakademik. Pelajar yang mempunyai asas etika yang kukuh lebih cenderung untuk berdisiplin dan berdedikasi dalam pembelajaran mereka. Ini membuktikan bahawa pendidikan yangmengintegrasikan nilai- nilai etika dapat menghasilkan pelajar yang tidak hanya cemerlang darisegi akademik tetapi juga mempunyai sahsiah yang baik.

Menurut Jones et al. (2023), pelajar yang dilatih untuk berfikir dan bertindak secara beretika cenderung untuk membuat keputusan yang bertanggungjawab dan menyumbangsecara positif kepada masyarakat. Kajian oleh Arce and Gentile (2021) turut menyokong pandangan ini dengan menunjukkan bahawa pelajar yang mengamalkan etika yang tinggi mempunyai pencapaian akademik dan sosial yang lebih baik. Selain itu, menurut MuhammadIqbal (2018), tingkah laku beretika dan nilai yang lahir daripada diri seseorang menjadi kayu ukur baik atau buruknya peribadi individu tersebut. Sehubungan itu, bahawa institusi pendidikan bukan sahaja bertanggungjawab untuk menyampaikan pengetahuan tetapi juga menyemai dan memupuk nilai-nilai etika yang kukuh kerana pembentukan sahsiah dan tingkahlaku beretika turut mempengaruhi nilai kognitif, afektif, dan sikap pelajar dalam interaksi mereka dengan persekitaran dan masyarakat.

2.2 Kemahiran Kepimpinan

Kepimpinan dalam kalangan pelajar juga memainkan peranan yang signifikan dalam pembangunan diri mereka. Menurut kajian oleh Chen et al. (2021), kemahiran kepimpinan yang diperoleh melalui penglibatan dalam aktiviti kokurikulum membantu meningkatkan keyakinan diri dan kemahiran komunikasi pelajar. Pelajar yang memegang peranan kepimpinan lebih berkemampuan untuk bekerja dalam pasukan dan menyelesaikan konflik dengan efektif. Kepimpinan yang berkesan memainkan peranan penting dalam membimbing pelajar menuju kejayaan akademik dan profesional. Kajian oleh Smith et al. (2022) menunjukkan bahawa kemahiran kepimpinan yang baik dapat meningkatkan keyakinan diri, kemahiran komunikasi, dan kemampuan untuk bekerja dalam pasukan. Sementara itu, kajian oleh Wong dan Koh (2020) mendapati bahawa pelajar yang terlibat dalam aktiviti kepimpinan menunjukkan prestasi yang lebih tinggi dalam pelbagai aspek kehidupan kampus, termasuk akademik dan kegiatan kokurikulum.

Kepimpinan yang mantap dalam kalangan pelajar dapat membantu mereka mengatasi cabaran dan memanfaatkan peluang dalam dunia pekerjaan yang dinamik. Kajian oleh Lee dan Park (2020) juga menunjukkan bahawa penglibatan dalam aktiviti kepimpinan mempunyai kesan positif terhadap prestasi akademik pelajar. Pelajar yang terlibat dalam aktiviti kepimpinan menunjukkan peningkatan dalam kemahiran pengurusan masa dan keupayaan untuk mengimbangi komitmen akademik dan kokurikulum. Ini menunjukkan bahawa kemahiran kepimpinan bukan sahaja penting untuk pembangunan peribadi tetapi juga memberikesan positif kepada pencapaian akademik.

3. Objektif Kajian

Objektif kajian ini adalah untuk:

i. Menilai tingkah laku beretika dalam kalangan pelajar PKS
ii. Menilai tahap kepimpinan dalam kalangan pelajar PKS
iii. Mengenalpasti faktor-faktor yang mempengaruhi pembentukan kepimpinan dan tingkah laku beretika dalam kalangan pelajar PKS

4. Persoalan Kajian

i. Apakah faktor-faktor yang mempengaruhi pembentukan kepimpinan dan tingkah laku beretika dalam kalangan pelajar di Politeknik Kuching Sarawak?

5. Metodologi Kajian

5.1 Populasi dan Kaedah Persampelan

Dalam penyelidikan ini, persampelan bertujuan digunakan dengan mengambil kira duakriteria yang utama. Pertama, penyelidik memilih responden yang mempunyai pengalamandalam memegang jawatan kepimpinan dalam kelab atau organisasi pelajar. Ini bertujuan untuk memastikan bahawa peserta memiliki pemahaman yang mendalam tentang dinamikakepimpinan dalam konteks pelajar. Kedua, responden dipilih berdasarkan keterlibatan aktif dalam program-program pembangunan sahsiah atau kepimpinan yang dianjurkan oleh politeknik. Hal ini memastikan bahawa peserta tidak hanya memahami tetapi juga terlibat dalam inisiatif yang bertujuan untuk memupuk dan meningkatkan kemahiran kepimpinan dan tingkah laku beretika dalam kalangan pelajar politeknik. Dengan menggabungkan kriteria ini, sampel kajian yang terdiri daripada 70 orang pelajar dianggap mencukupi untuk mewakili populasi pelajar yang terlibat secara aktif dalam kelab atau persatuan di Politeknik Kuching Sarawak. Teknik persampelan bertujuan digunakan bagi membolehkan penyelidik memilih peserta yang paling relevan dan berinformasi bagi membantu mencapai objektif kajian dengan lebih berkesan. Persampelan bertujuan (purposive sampling) adalah kaedah persampelan yang membolehkan penyelidik memilih responden berdasarkan kriteria tertentu yang relevan dengan tujuan kajian. Hal ini memastikan bahawa mereka mempunyai pengalaman langsung dalam bidang kepimpinan, sesuai dengan fokus kajian. Jumlah 70 orang juga adalah memadai kerana ia mewakili sebahagian signifikan daripada populasi sasaran yang relevan, membolehkan analisis statistik yang boleh dipercayai bagi mengukur kemahiran kepimpinan dan tingkah laku beretika pelajar. Responden dipilih kerana mereka dianggap sebagai yang paling sesuaidan berinformasi untuk memberikan data yang berkualiti dan mendalam tentang fenomena yang sedang dikaji (Campbell, Greenwood, Prior, Shearer, Walkem, Young, & Bywaters, 2020)

5.2 Instrumen Kajian

Kajian ini menggunakan pendekatan kuantitatif yang menggunakan borang soal selidik secara dalam talian (*Google Form*) dan menggunakan skala Likert 4 (Skala 1 : Sangat Tidak Setuju, Skala 2 : Tidak Setuju, Skala 3 : Setuju, Skala 4 : Sangat Setuju) sebagai instrumen untukpengumpulan data. Soal selidik bagi kajian ini adalah hasil adaptasi daripada kajian terdahulu iaitu *Tingkah Laku Beretika dan Keupayaan Kepimpinan Dalam Kalangan Mahasiswa Tahun Akhir Porogram Kerja Sosial* oleh Nazihah Kamarudin, fauziah Ibrahim dan Nur Saadah Mohamad Aun (2019). Borang soal selidik terbahagi kepada tiga bahagian iaitu bahagian A melibatkan maklumat demografi responden, bahagian B item bagi mengukutr tingkah laku beretika dalam kalangan pelajar PKS dan bahagian C pula item bagimengukut tahap kepimpinan dalam kalangan pelajar PKS.

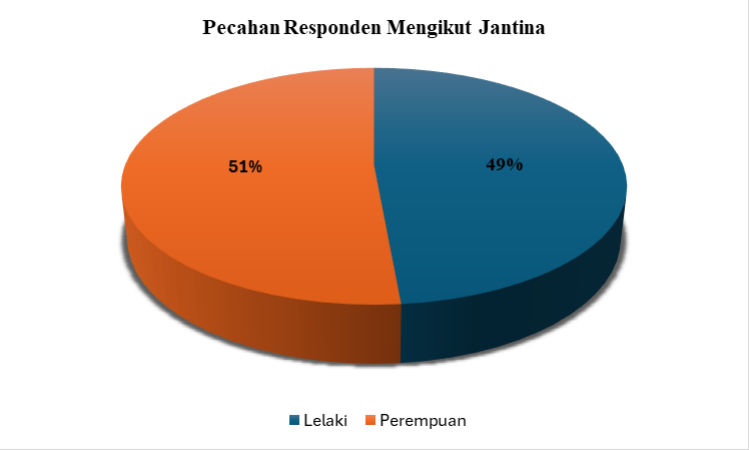
5.3 Prosedur menjalankan kajian

Prosedur menjalankan kajian diperingkat awal ialah dengan mengemukakan permohonan menjalankan kajian kepada pihak institusi. Permohonan dibuat dengan mengisiborang yang telah disediakan oleh pihak Unit Penyelidikan, Inovasi dan Komersialan(UPIK) institusi. Setelah mendapat kelulusan, borang soal selidik diedar kepada responden melalui *Google Form*. Data yang diperoleh dianalisa menggunakan aplikasi SPSS versi 22 (2013). Semua aspek metodologi ini telah mematuhi pertimbangan etika, termasuk mendapatkan persetujuan daripada semua responden sebelum pengumpulan data dan memastikan kerahsiaan data yang disediakan oleh responden. Responden juga dimaklumkan bahawa mereka bebas untuk tidak menjawab soal selidik tanpa sebarang kesan negatif.

6. Dapatan Kajian dan Perbincangan

6.1 Demografi Responden

Rajah 1 memaparkan taburan demografi responden yang terlibat dalam kajian ini. Seramai 70 orang responden telah mengambil bahagian, terdiri daripada 34 orang (51%) perempuan dan 36 orang (49%) lelaki.



Rajah 1. Taburan responden mengikut jantina

6.2 Tahap Tingkah Laku Beretika Dalam Kalangan Pelajar PKS

Hasil kajian menunjukkan bahawa pelajar PKS umumnya menunjukkan tingkah laku beretika yang positif. Item B7 berkaitan dengan penghargaan terhadap bantuan orang lain, mencatat skor min tertinggi 3.84 dengan sisihan piawai 0.366, menandakan konsistensi tingkahlaku ini dalam kalangan pelajar. Item B5 dan B3 masing-masing berkaitan dengan penerimaanteguran (skor min 3.74) dan penerimaan tugas dan tanggungjawab (skor min 3.70), mencerminkan sikap terbuka dan rasa tanggungjawab yang tinggi dalam kalangan pelajar, membentuk asas yang kukuh untuk persekitaran akademik dan sosial yang positif.

Walau bagaimanapun, terdapat tingkah laku negatif yang perlu diberi perhatian. Skor min yang rendah untuk item B8 dan B10 masing-masing merujuk kepada aduan tentang tugasan (1.87) dan sikap sombong (1.60), menunjukkan wujudnya segelintir pelajar yang mempamerkan tingkah laku negatif. Sisihan piawai yang tinggi untuk kedua-dua item ini menunjukkan variasi yang ketara dalam kalangan pelajar dan hal ini membawa kepada keperluan untuk melakukan langkah intervensi melalui program kesedaran etika dan bimbingan berterusan untuk memastikan semua pelajar mencapai standard tingkah laku beretika yang tinggi.

Penemuan ini selaras dengan kajian-kajian terkini, termasuk kajian oleh Greenberg danBaron (2018) yang menunjukkan bahawa pelajar yang terlibat dalam program pendidikan etikamenunjukkan peningkatan dalam tingkah laku beretika. Rest et al. (2020) juga mendapati bahawa integrasi pendidikan etika dalam kurikulum akademik dapat mengukuhkan kesedaranetika dan tingkah laku positif dalam kalangan pelajar.

Jadual 1: Tingkah laku beretika pelajar PKS

Item	Skor Min	Sisihan Piawai
B1 Saya boleh menyiapkan kerja dalam tempoh masa yang ditetap kan.	3.48	.558
B2 Saya tidak mengambil mudah dalam menyelesaikan sesuatu per kara.	3.57	.526
B3 Saya menerima tugas dan tanggungjawab yang diamanahkan.	3.70	.520
B4 Saya seorang yang menepati masa.	3.37	.640
B5 Saya menerima teguran secara baik.	3.74	.529
B6 Saya berkongsi kejayaan bersama dengan orang lain.	3.68	.497
B7 Saya menghargai bantuan dan pertolongan orang lain.	3.84	.366
B8 Saya sering merungut tentang tugasan yang diberikan kepada s aya.	1.87	1.03
B9 Saya sanggup bekerja lebih masa tanpa mengharapkan ganjaran .	3.28	.725
B10 Saya seorang yang sombong.	1.60	1.01

1.1 Tahap Kepimpinan Dalam Kalangan Pelajar PKS

Hasil kajian juga menunjukkan bahawa pelajar PKS memiliki kemahiran kepimpinan yangbaik. Item-item seperti C6, C14, C15, dan C16 yang berkaitan dengan keupayaan membina hubungan, keyakinan menyelesaikan tugas, dan memberi motivasi mencatat skor min tinggi sekitar 3.50, menunjukkan kepercayaan diri dan kemahiran interpersonal yang baik. Ini menandakan pelajar mampu bekerjasama dan menguruskan hubungan dengan rakan sekerja serta mencapai matlamat kumpulan secara efektif.

Namun, terdapat aspek kepimpinan yang memerlukan penambahbaikan, terutama dalam menghadapi situasi kepimpinan yang mencabar seperti yang ditunjukkan oleh skor minlebih rendah dalam item C1 dan C11. Variasi dalam kemahiran kepimpinan yang diperlihatkanoleh sisihan piawai yang tinggi menandakan keperluan untuk penyediaan latihan dan bimbingan yang lebih berstruktur untuk meningkatkan kemampuan pelajar dalam mengambil inisiatif dan memotivasikan ahli kumpulan.

Penemuan ini mengesahkan pentingnya pengalaman praktikal dan latihan berstruktur dalam mengembangkan kemahiran kepimpinan seperti yang dinyatakan dalam kajian oleh Northouse (2016) dan Kouzes dan Posner (2017) yang menekankan keperluan untuk kepimpinan efektif merangkumi kemahiran interpersonal dan kebolehan mengurus konflik dengan berkesan.

Jadual 2: Tahap kepimpinan pelajar PKS

Item	Skor Min	Sisihan Piawai
C1 Saya berupaya untuk mengambil alih sesuatu kumpulan sekiranya kumpulan tersebut tidak menunjukkan prestasi yang baik.	3.25	.715
C2 Saya berupaya untuk mengubah tingkah laku ahli kumpulan jika mereka bertingkah laku negatif.	3.21	.678
C3 Saya berupaya untuk mengubah sesuatu perkara di dalam kumpulan walaupun saya bukan ketua kumpulan.	3.18	.687
C4 Saya berupaya untuk mengagihkan tugas kepada semua ahli kumpulan secara sama rata.	3.45	.606
C5 Saya berupaya untuk mengenalpasti ahli kumpulan yang bersesuaian untuk sayaberikan tugasan yang spesifik.	3.38	.572
C6 Saya berupaya untuk mewujudkan hubungan yang baik dengan individu bekerja dengan saya.	3.51	.503
C7 Saya berupaya untuk menguruskan hubungan dengan semua ahli dalam kumpulan saya.	3.48	.583
C8 Saya berupaya untuk mengenalpasti kekuatan dan kelemahan saya.	3.42	.649
C9 Saya berupaya untuk menghasilkan sesuatu dengan baik berdasarkan kepada situasi yang sedang saya hadapi.	3.38	.643
C10 Saya berupaya untuk membantu ahli kumpulan mencapai matlamat Berdasarkan kepada pengalaman dan kompetensi yang saya miliki.	3.44	.528
C11 Saya yakin saya boleh memberi motivasi kepada ahli kumpulan saya	3.25	.735
C12 Saya yakin dengan kebolehan saya memilih ahli kumpulan untuk membina satu kumpulan yang efektif dan efisien.	3.35	.614
C13 Saya yakin saya boleh berkomunikasi dengan baik dengan orang lain tentang sesuatu perkara.	3.45	.556
C14 Saya percaya dengan kebolehan saya menyelesaikan sesuatu tugasan.	3.50	.607
C15 Sebagai seorang ketua, saya berpegang kepada kepercayaan dan nilai saya	3.50	.583
C16 Saya berupaya untuk memberi motivasi kepada ahli kumpulan dan menyakinkan mereka apabila memulakan sesuatu projek baharu.	3.50	.607
C17 Saya berupaya untuk memotivasikan ahli kumpulan supaya mereka lebih bersemangat melakukan tugas mereka.	3.48	.607
C18 Saya berupaya untuk membuatkan individu yang bekerja dengan saya menghargai saya.	3.32	.675
C19 Saya yakin saya boleh mendapatkan persetujuan dariapda ahli kumpulan saya	3.42	.579
C20 Saya berupaya untuk mengetuai kumpulan dengan persetujuan ahli kumpulan yang lain	3.35	.702

1.2 Faktor Mempengaruhi Pembentukan Kepimpinan Dan Tingkah Laku Beretika Dalam Kalangan Pelajar

Berikut adalah faktor-faktor yang mempengaruhi pembentukan kepimpinan dan tingkah laku beretika dalam kalangan pelajar di Politeknik Kuching Sarawak (PKS):

a) **Penglibatan dalam Aktiviti Kokurikulum dan Jawatan Kepimpinan**

Pelajar yang memegang jawatan dalam kelab atau organisasi pelajar menunjukkan kemahiran kepimpinan yang lebih baik. Aktiviti kokurikulum membantu membina keyakinan diri, kemahiran komunikasi, dan kemampuan menyelesaikan konflik, yang semuanya penting dalam kepimpinan yang berkesan. Dapatan ini turut disokong oleh kajian oleh Chen et al. (2021) yang menunjukkan bahawa kemahiran kepimpinan yang diperoleh melalui penglibatan dalam aktiviti kokurikulum membantu meningkatkan keyakinan diri dan kemahiran komunikasi pelajar. Pelajar yang terlibat dalam kepimpinan lebih berkemampuan untuk bekerja dalam pasukan dan menyelesaikan konflik dengan efektif.

b) **Pendidikan Berstruktur Mengenai Kepimpinan dan Etika**

Program pembangunan kepimpinan dan etika yang terstruktur di institusi seperti PKS memainkan peranan penting dalam membentuk graduan yang bukan sahaja cemerlang secara teknikal tetapi juga beretika. Penemuan kajian menunjukkan keperluan untuk pendidikan yang lebih sistematik dalam kedua-dua aspek ini bagi melahirkan pemimpin yang beretika dan bertanggungjawab. Hal ini dibuktikan juga melalui penulisan oleh Hassan et al. (2022), Northouse (2016) dan Kouzes dan Posner (2017) yang menegaskan bahawa program-program pembangunan kepimpinan yang berstruktur di politeknik mampu menghasilkan graduan yang lebih bersedia untuk memasuki pasaran kerja, dengan penekanan terhadap etika dan kemahiran interpersonal serta kebolehan mengurus konflik dengan baik.

c) **Pengaruh Sosial dan Budaya Akademik**

Tingkah laku beretika dalam kalangan pelajar juga dipengaruhi oleh persekitaran sosial mereka, termasuk hubungan dengan rakan sebaya dan tenaga pengajar. Pelajar yang mengamalkan etika yang tinggi cenderung untuk menjadi *role model* kepada rakan mereka, mencipta persekitaran pembelajaran yang positif. Kajian oleh Johnson et al. (2023) menegaskan bahawa tingkah laku beretika dalam kalangan pelajar membantu dalam membuat keputusan yang bertanggungjawab serta memupuk hubungan yang baik dengan rakan sebaya dan tenaga pengajar. Manakala Miller dan Roberts (2022) pula mendapati bahawa pelajar yang mempunyai asas etika yang kukuh lebih cenderung untuk berdisiplin dan berdedikasi dalam pembelajaran mereka.

d) **Pengalaman dan Pendedahan kepada Situasi Kepimpinan yang Mencabar**

Walaupun pelajar umumnya menunjukkan kemahiran kepimpinan yang baik, kajian mendapati terdapat kekurangan dalam menangani situasi yang mencabar. Ini menunjukkan bahawa pengalaman langsung dalam situasi kepimpinan yang mencabar adalah faktor penting dalam pembangunan kemahiran kepimpinan (Wong & Koh, 2020).

Faktor-faktor ini menekankan pentingnya pengalaman praktikal, pendidikan berstruktur, dan pengaruh sosial dalam membentuk kepimpinan dan tingkah laku beretika pelajar di PKS.

7. Kesimpulan

Kajian ini telah memberikan pemahaman yang mendalam tentang kepentingan kepimpinandan tingkah laku beretika dalam kalangan pelajar Politeknik Kuching Sarawak (PKS). Hasil penemuan menunjukkan bahawa walaupun pelajar PKS umumnya menunjukkan tingkah laku beretika yang positif dan kemahiran kepimpinan yang baik. Namun demikian, masih terdapat ruang untuk penambahbaikan, terutamanya dalam aspek mengambil alih kepimpinan dalam situasi yang mencabar dan keupayaan untuk memotivasikan anggota kumpulan secara efektif.Program-program pembangunan kepimpinan dan etika yang lebih sistematik dan berkesan adalah penting untuk menguatkan lagi elemen-elemen ini dalam kalangan pelajar.

Selain itu, terdapat beberapa batasan yang perlu diakui dalam kajian ini. Pertama, kajian ini bergantung kepada data kuantitatif yang mungkin tidak sepenuhnya menggambarkanpersepsi dan pengalaman individu. Kedua, sampel yang digunakan mungkin tidak mencerminkan keseluruhan populasi pelajar PKS, yang mana membatasi generalisasi dapatankajian. Oleh itu, penelitian lanjutan dengan metodologi yang lebih inklusif dan

menyeluruh perlu dilakukan dalam kajian pada masa hadapan.

Dari segi aplikasi praktikal pula, peningkatan dalam pendidikan kepimpinan dan etika dapat membantu dalam pembentukan budaya kerja yang positif dan produktif, yang bukan sahaja memperkukuhkan kapasiti individu dalam menghadapi cabaran global masa kini, tetapijuga melahirkan pemimpin-pemimpin masa depan yang beretika dan bertanggungjawab. Institusi pendidikan seperti PKS mempunyai peranan penting dalam menyediakan pelajar dengan kemahiran yang diperlukan untuk memenuhi keperluan industri dan masyarakat secarakeseluruhan.

Untuk kajian masa depan, adalah dicadangkan untuk melakukan penilaian yang lebih mendalam terhadap program-program pembangunan kepimpinan dan etika yang sedia ada untuk mengenal pasti kekuatan dan kelemahan dalam struktur dan pelaksanaannya. Kajian lanjutan juga boleh diarahkan kepada pengaruh faktor-faktor luar seperti teknologi dan keadaanekonomi terhadap pembentukan kepimpinan dan etika dalam kalangan pelajar. Ini akan membantu dalam mengembangkan strategi yang lebih holistik dan inklusif untuk pembangunan pelajar di masa hadapan.

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Tahap Kesediaan Pensyarah Dalam Pembangunan Kerangka Berpandukan Data Bagi Penilaian Kenaikan Pangkat di Kolej Komuniti Kota Marudu

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Abstrak

Kajian ini bertujuan untuk menilai kesediaan dan persepsi pensyarah terhadap pembangunan kerangka Sistem Sokongan Keputusan (DSS) bagi proses kenaikan pangkat di kolej komuniti, khususnya di Kolej Komuniti Kota Marudu. Dengan peningkatan bilangan kolej komuniti di Malaysia, pengurusan sumber manusia, terutamanya dalam prosedur kenaikan pangkat staf akademik, menjadi satu cabaran yang ketara. Keputusan kenaikan pangkat yang hanya bergantung pada dokumentasi mencetuskan keperluan untuk sistem yang lebih objektif dan telus. Kerangka DSS dicadangkan sebagai penyelesaian untuk mengatasi cabaran ini dengan memastikan penilaian yang lebih adil, konsisten, dan telus. Melalui pendekatan kuantitatif dengan penggunaan soal selidik berskala likert, kajian ini mengumpul data mengenai pandangan pensyarah terhadap sistem penilaian sedia ada dan potensi DSS. Hasil kajian menunjukkan bahawa pensyarah menyambut baik pelaksanaan DSS dengan penilaian purata antara 4.05 hingga 4.27, yang diklasifikasikan sebagai "Tinggi". Integrasi teknologi DSS dilihat mampu mempercepatkan proses penilaian kenaikan pangkat dan meningkatkan keadilan serta konsistensi. Selain itu, responden menekankan kepentingan penggabungan sumber data tambahan seperti penilaian prestasi dan ulasan rakan sebaya untuk meningkatkan ketepatan dan kebolehpercayaan penilaian. Walau bagaimanapun, kajian ini mendapati tahap kepuasan terhadap proses penilaian kenaikan pangkat sedia ada hanya pada tahap sederhana dengan nilai purata 3.05, menandakan terdapat ruang untuk penambahbaikan. Kesimpulannya, kajian ini menegaskan bahawa pembangunan kerangka DSS adalah penting untuk meningkatkan keberkesanan dan kecekapan proses kenaikan pangkat di kolej komuniti.

Kata kunci: - DSS, kenaikan pangkat, kolej komuniti

1. Pengenalan

Kolej komuniti memainkan peranan penting dalam menyediakan pendidikan yang mudah diakses dan kos efektif kepada ramai pelajar di Malaysia. Namun, dengan peningkatan jumlah kolej komuniti di negara ini, pengurusan sumber manusia menjadi satu cabaran yang ketara. Salah satu isu utama ialah prosedur kenaikan pangkat staf akademik. Keputusan kenaikan pangkat hanya bergantung kepada dokumentasi yang dikemukakan, walaupun terdapat fasa temuduga oleh panel pakar. Pendekatan ini memberikan masa yang terhad untuk menilai, terutama apabila terdapat jumlah permohonan kenaikan pangkat yang banyak. Bagi mengatasi halangan ini, pembangunan sistem penilaian berdasarkan Sistem Sokongan Keputusan (DSS) untuk kenaikan pangkat dapat mengatasi cabaran tersebut.

Membentuk rangka kerja pelaksanaan untuk sistem berasaskan DSS ini adalah penting bagi memastikan kejayaannya dalam proses kenaikan pangkat. Rangka kerja ini perlu merangkumi elemen-elemen asas sistem penilaian penarafan, termasuk kriteria untuk menilai calon dan pemberian berat yang sesuai kepada setiap kriteria. Pendekatan ini menjamin asas yang lebih objektif dan berasaskan data, sekali gus mengurangkan kemungkinan ketidaktepatan dalam proses penilaian. Transformasi ini akhirnya akan meningkatkan semangat dan motivasi staf akademik, seterusnya meningkatkan kepuasan kerja, produktiviti, dan pencapaian keseluruhan institusi.

Objektif utama kajian ini dijalankan adalah bagi menilai tahap kesediaan pensyarah terhadap cadangan pembangunan kerangka DSS. Selain itu, kajian ini juga bertujuan untuk menilai persepsi pensyarah terhadap kaedah sedia ada dalam proses kenaikan pangkat. Implementasi kerangka DSS ini dapat menyakinkan pensyarah di kolej komuniti bahawa kemajuan kerjaya mereka dinilai berdasarkan kriteria yang telus dan adil, yang berpotensi meningkatkan motivasi, kepuasan kerja, dan perkembangan profesional. Persekitaran sebegini membentuk budaya kecemerlangan dan peningkatan berterusan, menggalakkan kakitangan untuk cemerlang dalam peranan mereka dan menyumbang kepada misi institusi. Kajian ini memberikan dapatan awal tentang bagaimana teknologi boleh dimanfaatkan untuk memperbaiki proses organisasi dan membuat keputusan. Ia menambah pengetahuan dalam pendekatan berasaskan data dalam amalan pengurusan sumber manusia, serta menyediakan pelan tindakan untuk institusi lain dalam mengaplikasikan perkembangan teknologi yang serupa.

2. Kajian Literatur

Penemuan penyelidikan daripada pelbagai kajian dalam kalangan pensyarah politeknik dan kolej komuniti menonjolkan pemahaman yang mendalam tentang dinamika antara proses kenaikan pangkat, kepuasan kerja, dan produktiviti, serta memberikan pandangan yang pentingh tentang bagaimana amalan organisasi mempengaruhi hasil pekerja. Chong dan Lenny (2016) bersama Nor Azida et al. (2015) menekankan aspek penting dalam kehidupan organisasi di institusi akademik, menyatakan bahawa tahap kepuasan terhadap proses kenaikan pangkat dalam kalangan pensyarah kolej komuniti hanya berada pada tahap sederhana. Penemuan ini penting kerana ia menunjukkan terdapat ruang penambahbaikan dalam proses kenaikan pangkat, sebagai aspek penting dalam pembangunan kerjaya dan pengiktirafan, secara semula jadi mempengaruhi persepsi pensyarah terhadap peluang perkembangan profesional mereka. Penyelidikan oleh Reduan et al. (2020) dan Saufiyudin Omar et al. (2020) menunjukkan hubungan positif antara kepuasan kerja, komitmen kerja, dan prestasi. Ini mencadangkan bahawa apabila pensyarah berasa puas dengan kerja mereka, termasuk proses kenaikan pangkat, mereka lebih cenderung untuk komited kepada institusi dan menunjukkan prestasi yang lebih baik dalam tugas mereka. Ini merupakan pandangan penting bagi pentadbir yang ingin meningkatkan keberkesanan dan motivasi dalam organisasi mereka. Menyokong hal ini, Razinah Sikul et al. (2015) mendapati bahawa pengiktirafan dan kenaikan pangkat mempunyai hubungan yang ketara dengan kepuasan kerja dan prestasi. Ia mengukuhkan tingkah laku positif dan pencapaian yang membawa kepada prestasi tinggi, mewujudkan kitaran motivasi dan penglibatan yang memberi manfaat kepada individu dan institusi. Firdaus dan Abu Yazid (2020) dalam kajian mereka menunjukkan bahawa kepuasan kerja mempunyai hubungan yang signifikan dengan tekanan kerja, seterusnya boleh memberi kesan buruk kepada organisasi. Berdasarkan fakta ini, jika kepuasan kerja, yang dipengaruhi oleh proses kenaikan pangkat, tidak diuruskan dengan berkesan, ia boleh menyebabkan peningkatan tekanan dalam kalangan pekerja, yang seterusnya memberi kesan negatif terhadap kesihatan dan produktiviti keseluruhan organisasi.

Pelaksanaan Sistem Sokongan Keputusan (DSS) dalam sesebuah organisasi merupakan perubahan teknologi yang signifikan, yang memberi kesan bukan sahaja kepada infrastruktur teknikal tetapi juga budaya organisasi, proses, dan cara membuat keputusan seperti yang diketengahkan oleh KF Curley dan LL Gremillion (1983). Reka bentuk dan pelaksanaan DSS mencerminkan usaha yang mampan ke arah perubahan teknologi dalam organisasi. Kajian oleh S.C. Palvia dan N.L. Chervany (1995) menyatakan bahawa cara proses perubahan ini dikendalikan adalah penting bagi kejayaan atau kegagalan DSS. Ini menekankan kepentingan bukan sahaja memberi tumpuan kepada aspek teknikal DSS tetapi juga dinamik organisasi, termasuk kepimpinan, komunikasi, latihan pengguna, dan kesediaan keseluruhan organisasi untuk menerima perubahan. McCoy dan Rosenbaum (2019) turut menekankan potensi DSS dan teknologi digital untuk meningkatkan pembuatan keputusan institusi. Namun, mereka juga menekankan keperluan untuk mempertimbangkan perspektif sosioteknikal. Pendekatan ini menyokong bahawa kejayaan pelaksanaan teknologi dalam organisasi memerlukan pemahaman tentang interaksi antara faktor sosial dan teknikal. Pelaksanaan sistem baharu perlu diikuti dengan integrasi sistem ke dalam organisasi dengan cara yang menghormati dan meningkatkan peranan, hubungan, dan proses yang mentakrifkan organisasi tersebut. B. Williamson (2016) menyokong pandangan ini, dengan mencadangkan bahawa memberi perhatian kepada dimensi sosioteknikal dalam pelaksanaan DSS boleh membawa kepada integrasi teknologi yang lebih berkesan dan mampan dalam proses pembuatan keputusan. Ini melibatkan pertimbangan bagaimana alat teknologi selaras dengan keperluan manusia, budaya organisasi, dan persekitaran kerja sedia ada. Ia juga melibatkan penglibatan pihak berkepentingan dalam seluruh organisasi untuk memastikan sistem direka dan dilaksanakan berdasarkan keperluan sebenar serta mendapat sokongan yang luas.

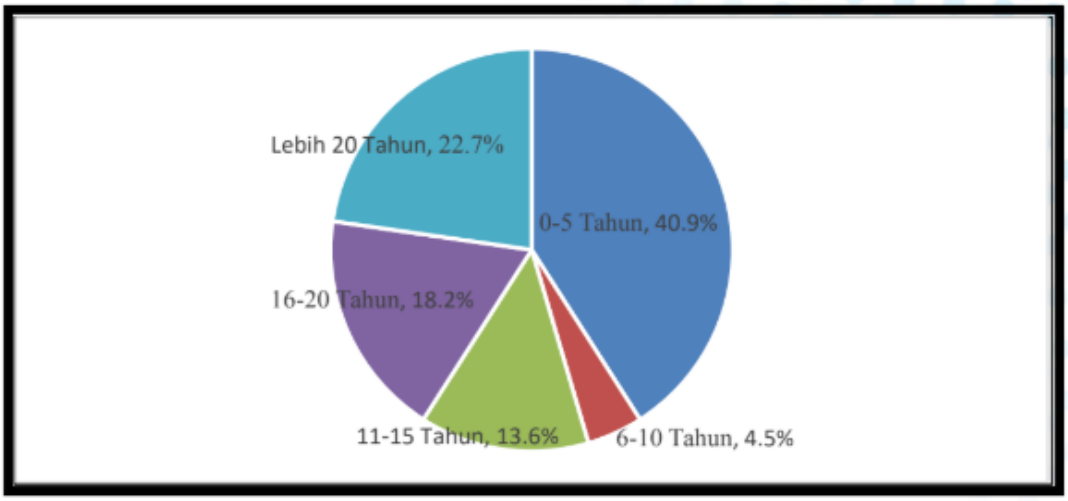
3. Metodologi

Kajian ini menggunakan pendekatan penyelidikan kuantitatif yang mana responden dikehendaki menjawab soal selidik yang diedarkan secara dalam talian dengan skala likert dari 1 hingga 5. Soal selidik terbahagi kepada dua(2) bahagian iaitu maklumat demografi responden dan penilaian tahap kesediaan pensyarah. Soalan soal selidik meliputi pandangan pensyarah terhadap sistem sedia ada bagi proses kenaikan pangkat, keperluan pembangunan DSS dalam proses kenaikan pangkat, dan kepentingan integrasi data dalam pembangunan DSS. Analisis deskriptif telah dijalankan ke atas maklum balas pensyarah yang diterima.

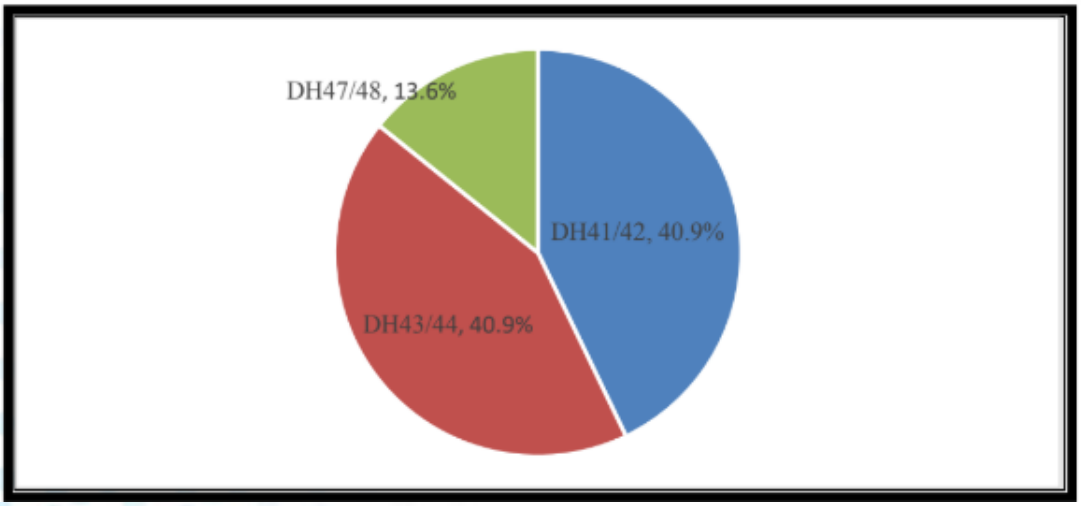
4. Dapatan Kajian

Rajah 1 menunjukkan taburan tempoh perkhidmatan pensyarah yang telah memberikan maklum balas dalam soal selidik yang telah diedarkan. Majoriti responden merupakan pensyarah yang berkerja sebagai

Pegawai Pendidikan Pengajian Tinggi (PPPT) selama lima(5) tahun atau kurang iaitu sebanyak 40.9%, manakala 22.7% pensyarah merupakan PPPT yang berpengalaman lebih daripada 20 tahun. Rajah 2 pula menunjukkan gred semasa PPPT di Kolej Komuniti Kota Marudu(KKKMS). 40.9% PPPT merupakan dalam kalangan pensyarah bergred DH41/42, 40.9% pula daripada kalangan pensyarah bergred DH43/44, dan 18.2% merupakan pensyarah bergred DH47/48.



Rajah 1 : Taburan Peratusan Pengalaman Berkerja Sebagai PPPT



Rajah 2 : Gred Semasa PPPT

Jadual 1 menunjukkan interpretasi kajian soal selidik yang telah dilaksanakan berdasarkan hasil analisis daripada maklum balas responden. Maklum balas menunjukkan, tahap kepercayaan pensyarah terhadap sistem penilaian kenaikan pangkat yang digunakan pada masa ini pada tahap sederhana iaitu nilai purata 3.05. Dalam pada itu, secara umumnya pensyarah di Kolej Komuniti Kota Marudu berpendapat bahawa pembangunan kerangka DSS dalam proses penilaian kenaikan pangkat adalah diperlukan dan penting berdasarkan hasil analisis yang menunjukkan nilai purata jawapan responden pada tahap tinggi iaitu 4.23.

Dapatan juga menunjukkan bahawa responden bersetuju bahawa pendekatan terstruktur dan sistematik dalam pembuatan keputusan untuk proses kenaikan pangkat adalah perlu, dengan nilai purata 4.18. Ini menggambarkan kepentingan prosedur yang jelas dan sistematik dalam memastikan bahawa setiap calon dinilai secara adil dan berdasarkan merit. Penilaian mengenai keupayaan DSS untuk mempercepatkan proses penilaian menunjukkan nilai purata 4.14, yang diinterpretasikan sebagai tinggi. Responden melihat DSS sebagai satu alat yang mampu mempercepatkan proses penilaian kenaikan pangkat, sekali gus mengurangkan beban kerja serta masa yang diperlukan untuk membuat keputusan. Responden memberikan penilaian tinggi terhadap keupayaan DSS untuk memastikan keadilan dalam proses kenaikan pangkat, dengan nilai purata
4.09. Ini menunjukkan bahawa pensyarah percaya bahawa DSS mampu memberikan keputusan yang lebih

adil yang akan meningkatkan keyakinan mereka terhadap sistem tersebut.

Penilaian mengenai kecekapan DSS dalam mengenal pasti calon yang sesuai untuk kenaikan pangkat juga mendapat nilai purata 4.14. Ini menunjukkan bahawa responden percaya DSS mampu membantu dalam mengenal pasti calon yang layak dengan lebih cepat dan tepat berbanding kaedah tradisional. Responden memberikan nilai purata 4.14 terhadap kepentingan beralih daripada kaedah tradisional kepada pendekatan yang lebih telus dan objektif. Ini menandakan keperluan mendesak untuk memperkenalkan DSS yang lebih telus, adil, dan objektif dalam proses penilaian kenaikan pangkat. Penilaian mengenai nilai kepentingan teknologi dalam meningkatkan proses organisasi seperti DSS mencatatkan nilai purata 4.23. Nilai ini menunjukkan bahawa responden menghargai kepentingan penggunaan teknologi dalam meningkatkan kecekapan dan keberkesanan proses penilaian kenaikan pangkat.

Penilaian terhadap keupayaan DSS untuk mewujudkan konsistensi dan keseragaman dalam penilaian kenaikan pangkat adalah pada tahap tinggi dengan nilai purata 4.09. DSS dilihat sebagai satu alat yang dapat memastikan semua calon dinilai berdasarkan kriteria yang sama, seterusnya mengurangkan cabaran konsistensi dalam proses penilaian. Responden memberikan nilai purata 4.05 terhadap keupayaan DSS dalam membezakan calon berdasarkan kelayakan dan pencapaian mereka. Pensyarah menunjukkan keyakinan yang tinggi terhadap keupayaan DSS untuk menilai setiap calon secara adil berdasarkan kriteria yang ditetapkan.

Salah satu dapatan utama kajian ini adalah kepentingan penggabungan sumber data tambahan seperti penilaian prestasi dan ulasan rakan sebaya ke dalam DSS, yang mendapat nilai purata 4.23. Responden percaya bahawa penggabungan data tambahan ini dapat meningkatkan ketepatan penilaian DSS. Penilaian mengenai keupayaan DSS untuk menggabungkan pelbagai jenis data secara efektif dalam proses penilaian mendapat nilai purata 4.09, menandakan keyakinan yang tinggi terhadap keupayaan teknologi ini untuk mengurus data yang pelbagai bagi memastikan penilaian yang lebih holistik. Akhir sekali, kajian menunjukkan bahawa responden sangat menyokong keperluan untuk memperhalusi dan mengemaskini kerangka DSS berdasarkan maklum balas dan keperluan yang berkembang, dengan nilai purata 4.23. Data ini mempamerkan keperluan kerangka DSS yang ingin dibangunkan perlu terus ditambah baik agar kekal relevan dan berkesan dalam jangka masa panjang.

Jadual 1: Interpretasi Dapatan Kajian

Soalan	**Nilai Purata (*Mean*)**	**Interpretasi**
Sejauh mana anda percaya bahawa proses penilaian kenaikan pangkat sedia ada bagi kolej komuniti di Sabah adalah berkesan?	3.05	Sederhana
Pada pandangan anda, seberapa pentingkah untuk memperkenalkan kerangka DSS bagi penilaian kenaikan pangkat di kolej komuniti?	4.23	Tinggi
Adakah anda setuju bahawa pendekatan terstruktur dan sistematik terhadap pembuatan keputusan adalah perlu untuk proses kenaikan pangkat?	4.18	Tinggi
Pada pandangan anda, sejauh manakah kerangka DSS dapat mempercepat proses penilaian untuk proses kenaikan pangkat?	4.14	Tinggi
Seberapa yakinnya anda terhadap kemampuan kerangka DSS untuk memastikan keadilan dalam proses kenaikan pangkat?	4.09	Tinggi
Adakah anda percaya bahawa kerangka DSS dapat membantu mengenal pasti calon yang sesuai untuk kenaikan pangkat dengan lebih cekap daripada proses sedia ada?	4.14	Tinggi
Pada pandangan anda, seberapa pentingkah untuk beralih dari kaedah tradisional, subjektif ke pendekatan yang lebih telus dan objektif dalam penilaian kenaikan pangkat?	4.14	Tinggi
Sejauh mana anda percaya bahawa kerangka DSS dapat mengatasi kerumitan dan cabaran yang berkaitan dengan proses kenaikan pangkat sedia ada?	4.09	Tinggi
Apakah nilai kepentingan yang anda letakkan pada pelaksanaan penyelesaian berasaskan teknologi, seperti kerangka DSS, dalam meningkatkan proses organisasi?	4.23	Tinggi
Adakah anda bersetuju bahawa kerangka DSS dapat menyumbang kepada proses kenaikan pangkat yang lebih konsisten dan seragam di seluruh kolej komuniti?	4.09	Tinggi
Sejauh mana anda percaya bahawa kerangka kerja DSS dapat membezakan calon berdasarkan kelayakan dan pencapaian mereka dengan efektif?	4.05	Tinggi
Seberapa yakinkah anda dengan kebolehpercayaan hasil yang dihasilkan oleh kerangka kerja DSS dalam proses kenaikan pangkat?	4.05	Tinggi

Adakah anda bersetuju bahawa kerangka kerja DSS menyediakan penilaian yang adil dan tidak berat sebelah terhadap calon untuk kenaikan pangkat?	4.05	Tinggi
Pada pandangan anda, adakah kerangka kerja DSS selaras dengan prinsip keadilan dan ketelusan dalam proses kenaikan pangkat?	4.09	Tinggi
Sejauh mana anda melihat kerangka kerja DSS sebagai peningkatan berbanding dengan kaedah tradisional dalam menilai calon kenaikan pangkat?	4.09	Tinggi
Adakah anda percaya bahawa kerangka kerja DSS secara tepat mengukur kelayakan dan pencapaian yang pelbagai dari calon untuk kenaikan pangkat?	4.05	Tinggi
Pada pandangan anda, seberapa pentingkah keperluan untuk mengintegrasikan sumber data tambahan, seperti penilaian prestasi dan ulasan rakan sebaya ke dalam kerangka kerja DSS untuk penilaian kenaikan pangkat?	4.23	Tinggi
Sejauh mana anda percaya bahawa penggabungan sumber data tambahan dapat meningkatkan ketepatan dan kebolehpercayaan kerangka kerja DSS dalam menilai calon?	4.27	Tinggi
Seberapa yakinkah anda dengan kemampuan kerangka kerja DSS untuk menggabungkan pelbagai jenis data secara efektif ke dalam proses penilaian?	4.09	Tinggi
Adakah anda setuju bahawa penggabungan sumber data tambahan dapat menyediakan penilaian yang lebih holistik dan bernuansa (mendalam) terhadap kelayakan dan pencapaian calon?	4.18	Tinggi
Pada pandangan anda, sejauh manakah kerangka kerja DSS menggabungkan pelbagai jenis data untuk memastikan penilaian yang adil dan objektif terhadap calon untuk kenaikan pangkat?	4.14	Tinggi
Seberapa yakinkah anda dengan kemampuan kerangka kerja DSS untuk menyesuaikan dan menggabungkan sumber data baharu sebagaimana yang diperlukan pada masa hadapan?	4.09	Tinggi
Pada pandangan anda, seberapa pentingkah untuk terus memperhalusi dan mengemaskini kerangka kerja DSS berdasarkan maklum balas dan keperluan yang berkembang dalam proses kenaikan pangkat?	4.23	Tinggi

5. Rumusan

Berdasarkan hasil kajian ini, didapati bahawa kebanyakan responden memberikan penilaian yang tinggi terhadap potensi kerangka Sistem Sokongan Keputusan (DSS) dalam memperbaiki proses kenaikan pangkat di kolej komuniti khususnya di Kolej Komuniti Kota Marudu. Penilaian terhadap soalan-soalan berkaitan keberkesanan dan keadilan kerangka DSS, serta potensi untuk meningkatkan ketelusan dan objektiviti dalam proses penilaian kenaikan pangkat, menunjukkan nilai purata yang tinggi, kebanyakannya berada di antara 4.05 hingga 4.27, yang boleh ditafsirkan sebagai "Tinggi". Responden juga bersetuju bahawa integrasi penyelesaian berasaskan teknologi seperti DSS dapat mempercepat dan mempermudah proses penilaian kenaikan pangkat, serta meningkatkan konsistensi dan keadilan dalam menilai pencapaian calon. Selain itu, kebanyakan responden menekankan kepentingan penggabungan sumber data tambahan, seperti penilaian prestasi dan ulasan rakan sebaya, yang dilihat dapat meningkatkan ketepatan dan kebolehpercayaan penilaian DSS. Namun, penilaian mengenai keberkesanan proses penilaian kenaikan pangkat sedia ada di kolej komuniti hanya mendapat nilai purata 3.05, yang menunjukkan tahap kepuasan sederhana. Ini menunjukkan bahawa terdapat ruang untuk penambahbaikan dalam proses kenaikan pangkat yang sedang dilaksanakan, dan ini mengukuhkan lagi keperluan untuk memperkenalkan kerangka DSS yang lebih terstruktur dan objektif. Secara keseluruhan, dapatan kajian ini menunjukkan bahawa responden menyambut baik pelaksanaan kerangka DSS dan melihatnya sebagai satu langkah positif yang mampu meningkatkan ketelusan, keadilan, dan kecekapan dalam proses penilaian kenaikan pangkat di kolej komuniti.

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An Analysis of Code Switching and Code Mixing in Hospitality Jargon Used by Hotel Operation Students of Politeknik Negeri Bali

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Abstract

Recently there has been a concern regarding the code switching and code mixing of English and Indonesian in hospitality jargon used by the Hotel Operation students of Politeknik Negeri Bali, particularly detected in their internship reports and final project reports. This has raised a question on why they mix the languages, mainly as it appears in the written form which must adhere to language rules. This article aims at analyzing the types and the meanings of code switching and code mixing cases of the hospitality jargon used by the hospitality students of Politeknik Negeri Bali as well as unveiling what motivates them in conducting the language integration. The study employs document analysis and questionnaires to provide balanced analysis of the issue. The data are gathered from five (5) students' weekly internship reports and from an open-ended questionnaire distributed to one of the Hotel Operation students in Politeknik Negeri Bali who has taken the internship program in hotel and to an HR staff of a five-star hotel in Bali to get a perspective and conformity from the industry. Results are presented descriptively. The finding suggests that blending English and Indonesian in the hospitality industry may be necessary to communicate more efficiently and build cultural awareness. Further discussion about this topic will not only benefit hospitality practitioners, but also contribute to better language teaching and learning.

Keywords: code switching, code mixing, hospitality, jargon.

1. Introduction

The discussion on code switching and code mixing has long been conducted by researchers and linguists who are concerned with language integration, particularly among Indonesians who learn English as a foreign language. Switching from Indonesian to English or mixing the elements of the two languages has become a common phenomenon in the society. Although switching and mixing languages can be found anywhere in day to day interactions, there has been a concern regarding the code switching and code mixing of En glish and Indonesian in hospitality jargon used by the Hotel Operation students of Politeknik Negeri Bali. The cases of code switching and code mixing are particularly detected in their internship reports and final project reports. This has raised a question on why they mix the languages, as it appears in the written form which must adhere to language rules.

It is not surprising that code switching and code mixing are found among Hospitality students as they are very familiar with bilingual situation both as English learners in formal education environment and as hospitality practitioners in professional working environment especially in a hotel. Deuchar (2020) argues that language use norms are evolving, and the increased tendency of young people to code-switch suggests that it is becoming more widespread and accepted, particularly in informal settings. In addition, many theorists and linguists have long believed that code switching and code mixing occur as a result of the intensive contact between two or more languages in a bilingual situation which is known as bilingualism (Bell, 1983). Code switching and code mixing in essence involves the process of switching or shifting from one language to another language (Poplack, 1980; Grosjean, 1982; Musyken, 2000; Wardhaugh, 2006; Gardner, 2009; Bhatia & Ritchie, 2013). While code switching is widely understood as alternating two languages or more in a short discourse, code mixing involves blending different linguistic elements, such as morphemes, words, modifiers, phrases, clauses, and sentences, mainly from two distinct grammatical systems within a single sentence (Bhatia & Ritchie, 2004).

Code switching are divided into three types or categories in terms of grammatical aspects, tag switching, intersentential switching, and intrasentential switching (Poplack, 1980; Hoffman, 1991; Appel & Musyken, 2006). Tag switching is code-switching that occurs with independent elements within a statement or question; it typically appears at the beginning or end of the statement or question (Fanani & Ma'u, 2018). The example of this type of switching is "You're going to the event, *kan*?" (*You're going to the event, aren't you?*). Intersentential switching occurs when there is an alternation of two or more languages within a short discourse or conversation, meaning that a different language is used after a sentence is uttered in certain language (Appel & Musyken, 2006), for instance "I won't be able to come. Kamu bisa menggantikan saya, kah?" (*I won't be able to come. Could you go instead?*). The last type is intrasentential switching is shifting from one language to another language within a single utterance or sentence, for example "Tamu itu tadi telepon order in room dining" (*The guest called to order in room dining service*).

As code mixing is defined as blending linguistic elements of two languages or more into one sentence, an apparent characteristic of code mixing is intrasentential switching (Fanani & Ma'u, 2018). Code mixing falls to three categories, including insertion, alternation, and congruent lexicalization (Musyken, 2000; Kim, 2006). As in the data gathered in the study code mixing practices are far greater in number than code switching, this study leans more on code mixing analysis and the possible reasons behind the practices. Beatty-Martinez, et.al. (2020) states that the decision to code-switch is likely influenced by practical and interactional factors and the patterns are also influenced by one's level of bilingual proficiency although code switching may serves various discourse functions. Samsi (2016) in his research about the use of code switching and code mixing in tourism exemplifies three different influencing factors including social, cultural, and individual factors which is in line with Hudson's theory (1980). Meanwhile, Bhatia and Ritchie (2004) in Kim (2006) suggest a number of factors that trigger code switching and code mixing, such as with whom (participants: their backgrounds and relationships), about what (topic, content), and when and where a speech act occurs, bilinguals make their language choice.

Code switching and code mixing practised by hospitality students are related to hospitality jargon. According to Hornby (1989) as cited in Pravitasari (2021), jargon is a specific language variety used by particular social groups in a limited context. It is further suggested that jargon might be musical, mechanical, culinary, scientific, and technological or many other things and it might concern to an area of study, a business, a sport, a creative activity or all profession (Pravitasari, 2021). Jargon appears in the form of abbreviation, acronym, word, and phrase (Halligan, 2004). It is just natural that hospitality students are familiar with hospitality or hotel jargon such as "check in", "check out", "occupancy rate", "turn-down service", "housekeeping", "welcome drink", and "PMS" because these are what they hear and say almost every day. This study, therefore, discuss the practice of code switching and code mixing in relation to hospitality jargon.

The fact that there is still a great number of studies and research articles regarding code switching and code mixing in the multilingual environment shows that these language phenomena are still if not more relevant. Ameliza & Ambalegin (2020) conclude that the member of WhatsApp group Putera Batam University used all the types of code switching categorized by Poplack and using Grosjean's theory they agreed that there were three reasons of using the code switching and mixing namely to fill a linguistic nee d for lexical item, to continue the last language used (triggering) and to specify speaker involvement. Yim and Clement (2021) argues that code switching is related to bicultural identity, in which a more detailed classification of biculturals is valuable, as variations in cultural identification among biculturals are associated with notable differences in their comfort with code-switching, preference for code-switching, attitudes toward code-switching, and multicultural perspectives. Hafid and Margana (2022) explored the practice of code switching in nultilingual classrooms and argue that code switching will encourage students to be bilinguals and that code switching can support the language minority. Similarly, Agustina and Widagsa (2024) found six different functions of code-switching in the classroom context which include quotation, addressee specification, interjection, reiteration, message qualification, and personalization or objectification. Their study on the practice of code switching by lecturer in English speaking class also shows that the lecturers' reasons for code switching are related to helping the students comprehend their explanations and materials more effectively.

2. Methodology

The study used descriptive qualitative approach to obtain a deeper analysis. According to Richie and Lewis (2003), qualitative research seeks to understand human behavior from the participant's perspective, enabling comprehensive insights into social phenomena. This is in line with the purpose of this study, which attempts to understand the practice of code switching and code mixing conducted by the Hotel Operation students in Politeknik Negeri Bali and for what reasons. The respondents include five students of the Hotel Operation Study Program Politeknik Negeri Bali who are doing their internship in a hotel and also one hospitality practitioner who work in the HR department of a hotel in Bali. Five (5) weekly internship reports were used as the main source of data, supported by the results of a questionnaire listing eight open-ended questions that were responded by one of the students and the practitioner. The data were then analyzed descriptively.

3. Result and Discussion

3.1 The Practice of Code Mixing and Code Switching

The students of the Hotel Operation study program spend their whole internship semester in the industry. Given the fact that they receive English lessons at campus, it is not uncommon and natural that they practise code mixing, as reflected through the sentences they write on their weekly report. Table 1 demonstrates the examples of code mixing found in the students' reports.

Table 1. Code mixing and cose switching in students' weekly reports

NO	CATEGORY	EXAMPLE
1	Insertion	***Preparing buffet*** *(mengatur meja, kursi,* ***table cloth, inner, cutleries****, dan* ***candle****)*
2	Congruent Lexicalization	*Menyajikan minuman ke tamu,* ***clear up*** *dan* ***closing***
3	Insertion	*Mengambil* ***napkin*** *ke* ***laundry***
4	Congruent Lexicalization	***Clear up table*** *dan mengelap meja*
5	Insertion	*Melakukan* ***taking order***
6	Insertion	*Belajar menggunakan* ***Agylisis***
7	Insertion	*Belajar membuat* ***bill***
8	Congruent Lexicalization	*Membuat* ***bill*** *dan belajar* ***close bill***
9	Insertion	*Mempersiapkan bahan bahan* ***amuse bouche***
10	Insertion	*Mencetak* ***dipping****, memotong daging, sayur, nanas, belimbing wuluh, membuat cemcem, menggoreng keripik* ***taco***
11	Insertion	*Melakukan* ***platting*** *rujak,* ***tart, dipping,*** *dan* ***taco***
12	Insertion	*Menyiapkan* ***amenities, towel, sheet, linen, duvet*** *dan* ***mineral water***
13	Congruent Lexicalization	*Melakukan* ***striping soil*** *dan sampah*
14	Congruent Lexicalization	***Me-refill*** *air,* ***tea, coffee, sugar, bathroom amenities,*** *tisu* ***bathroom***
15	Congruent Lexicalization	*Melakukan* ***making bed*** *dengan senior*
16	Congruent Lexicalization	*Melakukan* ***dusting*** *di area kamar dan* ***balcony*** *menggunakan* ***vacuum***
17	Insertion	*Mengambil* ***trolley*** *dan* ***linen*** *di* ***office***
18	Insertion	*Mengambil* ***uniform*** *kotor*
19	Insertion	*Mengambil* ***soil*** *di* ***pantry*** *bersama senior*
20	Congruent Lexicalization	*Melakukan* ***striping*** *bersama senior*
21	Congruent Lexicalization	***Set up linen*** *dan* ***uniform*** *bersama senior*
22	Insertion	*Mempelajari tata cara absensi dengan menggunakan* ***handkey***
23	Insertion	*Melakukan tata cara* ***grooming*** *yang sesuai standar yang telah ditentukan oleh hotel*
24	Insertion	*Mendengarkan himbauan yang dilakukan pada saat* ***emergency***
25	Insertion	*Melakukan* ***tour*** *di seputaran hotel untuk pengenalan ruangan dan fasilitas yang bisa digunakan oleh karyawan*
26	Insertion	*Memaparkan materi seputaran dengan* ***houseekeeping***
27	Insertion	*Mempelajari cara menggunakan mesin* ***presser***
28	Insertion	*Menghitung jumlah* ***hand towel*** *yang sudah dilipat*
29	Insertion	*Melakukan* ***folding towel***
30	Insertion	*Menyiapkan* ***hanger*** *dan* ***stand hanger***
31	Insertion	*Menyiapkan* ***uniform presser*** *(penggembusan) baju tamu*
32	Insertion	*Menggantung* ***uniform kitchen*** *dan* ***uniform security***
33	Insertion	*Melipat* ***hand towel, bath towel, bath sheets***
34	Insertion	*Melakukan* ***roling*** */ penyetrikaan pada* ***sheet, duvet cover,*** *dan* ***pillow case***
35	Insertion	*Melipat dan menghitung* ***pillow case***
36	Insertion	*Memasukkan* ***table cloth*** *dan* ***napkin*** *ke dalam mesin* ***flat work***
37	Insertion	*Memilah dan mencatatat jumlah* ***napkin***
38	Insertion	*Mempelajari kode-kode* ***uniform***
39	Insertion	*Melakukan penggantungan* ***uniform*** *sesuai dengan kodenya dan nomor* ***uniform***
40	Insertion	*Mengambil* ***prepare*** *ke* ***laundry linen***

41	Insertion	*Melakukan **briefing***
42	Insertion	*Memberi **departure tag** pada **luggage** tamu*
43	Insertion	*Melakukan **record departure guest luggage***
44	Congruent Lexicalization	*Menyiapkan **amenities** untuk tamu yang akan **check-in***
45	Insertion	*Belajar mengendarai **buggy***
46	Insertion	*Membantu menaikkan barang bawaan tamu ke **buggy***
47	Insertion	*Mencocokkan nama tamu dengan **room number** pada **system***
48	Insertion	*Mencatat **guest luggage** yang sudah dikirim ke kamar oleh **bellman***
49	Insertion	*Membuat **request record** untuk hari besok*
50	Insertion	*Membuka **system** opera pada komputer*
51	Insertion	*Memberikan **welcome drink** kepada tamu*
52	Congruent Lexicalization	*Meminta **passport** tamu untuk **di scan***

From 52 cases of code mixing, 41 cases or 78,85% belong to insertion and the rest are the examples of congruent lexicalization. Meanwhile, alternation is absent in the data. As for the insertion, the students simply insert English terms in the form of words of phrases in a single Indonesian sentence. Among the examples are the followings.

a. Belajar membuat **bill**.

b. Melakukan tata cara **grooming** yang sesuai standar yang telah ditentukan oleh hotel.

c. Mengambil **uniform** kotor.

d. Memberikan **welcome drink** kepada tamu.

The words *bill*, *grooming*, *uniform*, and *welcome drink* are very much used in the hotel industry. Bill refers to a note stating an amount of money or charges a guest needs to pay, which is commonly translated to *tagihan* in Indonesian. Grooming means the care of a body and its physical appearance and can roughly be translated into *penampilan diri*. Uniform refers to the outfit worn by the hotel staff which is *seragam* in Indonesian. Welcome drink is a beverage usually offered to welcome a guest in a hotel and is usually made as one of the hotel's signature drink. It is roughly translated into *minuman selamat datang*.

The cases of congruent lexicalization are used when the sentence structure is maintained while incorporating English verbs. It is particularly apparent when the students combines an English verb with an Indonesian prefix.

a. **Clear up table** dan mengelap meja

b. **Me-refill** air, tea, coffee, sugar, bathroom amenities, tisu bathroom

c. Menyiapkan amenities untuk tamu yang akan **check-in**

d. Meminta passport tamu untuk **di scan**

The sentence in (a) include two clauses in English and Indonesian, allowing the two parts to be syntactically equal. Examples (b) and (d) show how the Indonesian affixes are used together with English verbs to maintain the Indonesian sentence structure. Meanwhile, sentence (c) shows how the grammatical structure of the verb is maintained while incorporating an English verb (*will check in*).

The results from the questionnaire show that the respondents, consisting of one student and one HR staff, frequently use code switching and code mixing in professional setting when they communicate directly with their colleagues or clients. The examples of the cases include the followings.

NO	CATEGORY	EXAMPLE
1	Insertion	***Town hall*** *akan dilaksanakan siang hari.*
2	Congruent lexicalization	*Saya sedang* ***meeting*** *di* ***executive board room*** *untuk HACCP audit.*
3	Alternation	*Maaf bapak, untuk rib eye steak-nya lagi kosong untuk hari ini,* ***but we have sirloin and tenderloin steaks available***
4	Intersentential switching	*Untuk pesanan makanannya sudah semua ya kak?* ***Alright then, enjoy and have a good day!***
5	Congruent lexicalization	*Saya lagi* ***polish chinaware*** *di* ***pantry***
6	Congruent lexicalization	*Saya nanti harus* ***sending fruit amenities*** *ke kamar*
7	Congruent lexicalization	*Tolong* ***set up breakfast*** *di* ***table 67*** *ya*

From the seven examples, congruent lexicalization dominates with 4 cases or more than 50% cases, while the rest vary. In example number 2, the continuous verb in Indonesian is combined with an English present participle (*sedang meeting*) which allows the structure to be intact. This also occurs in example 5, 6, and 7, and those examples illustrates how the respondents can fluidly combine the Indonesian and English linguistic elements while maintaining the whole sentence structure intact. Example 4 which is an extract of a spoken discourse shows a case of intersentential switching in which the respondent shift from Indonesian to English within a short discourse, allowing a professional and also friendly manner. Alternation is reflected in example 3, where the respondent switch languages within a sentence, from one clause to another, while the structure of the compound sentence remains intact (indicated by the use of coordinate connector "but").

3.2. The Possible Reasons Motivating the Students for Code Mixing and Code Switching

According to Hudson (1980) as cited in Samsi (2016), there are three factors that can affect someone to practice code mixing and code switching. The first is social factor which includes participants, topic, situation, place, and setting. The second is cultural factor in which the speaker and the addressee come from different regions and have different languages. The last is individual factor which may be caused by limited vocabulary or because the speaker wants to show proficiency in English. In the cases that code mixing and code switching of hospitality jargon occur in the written weekly reports, the social factor especially participants, topic and setting may contribute significantly, as the students have been experienced being a trainee in the hospitali ty industry. They have been exposed to hospitality jargon used extensively in a hotel setting by their colleagues and superiors which they consider normal to use and it is difficult for them to find the appropriate translation in Indonesian. This is also related to the individual factor where the students feel that they have implemented the language they learn by incorporating it in their reports.

As from the questionnaire results, the three factors are indicated to be the reasons for code switching and code mixing. The student feels the necessity to integrate the languages to obtain a more effective communication with the guests because he cannot find the proper Indonesian translation for the terms. The words are already familiar to him and he feels strange if the words are translated into Indonesian. This is validated by the response from the HR staff who typically code switch and code mix English and Indonesian when communicating with expatriates and Indonesian colleagues at the same time, both through direct or spoken communication and through written correspondence such as an email.

Similarly, Bhatia and Ritchie (2004) as cited in Kim (2006) suggest that there are at least four influencing factors for practising code switching and code mixing which include 1) participant roles and relationships, 2) situational factors, 3) message-intrinsic factors, and 4) language attitude, dominance, and security. In the case of the student respondent, he positions himself as waiter who is ready to serve the guest professionally, for example by saying "*Maaf Bapak, untuk rib eye steak-nya lagi kosong untuk hari ini, but we have sirloin and tenderloin steaks available*". He shows to the client that he is a professional hotelier who is familiar with hotel jargon. The same thing goes to the HR staff who is very much aware of her vital role in the hotel who need to maintain good relations and effective communication with her colleagues, superiors, and clients, both foreign and Indonesian. When communicating with both foreign and Indonesian colleagues or clients, code switching and code mixing in hospitality jargon becomes an effective communication strategy to build mutual intelligibility.

Language attitude means that when code switching and code mixing are considered positive, it is likely that the students practise them more to the extent that code switching and code mixing are in line with bilingual proficiency. However, this is still debatable because other theorists argue that code switching and code mixing

are a sign of the lack of bilingual proficiency and interference. The reasons and motivations for code switching and code mixing, though, can be personal and individual although there are some contributing factors that generally trigger the cases. What is also critical when talking about this language phenomenon is whether the outcomes are prone to be positive or negative and when they tend to be negative, those who are concerned need to think of what measures to be taken.

4. Conclusion

The results of the study show that code switching and code mixing appear in all the weekly reports of the students, with insertion and congruent lexicalization dominating the cases. Besides, the data from the questionnaires also reveal that the variations of code switching and code mixing are even greater in spoken utterances. The practices of code switching and code mixing by the hospitality students are very much related to hotel jargon which is not surprising since the students are exposed to hotel-related vocabulary during their day to day communications at work, in a professional setting. There are several possible factors that contribute to the cases of code switching and code mixing done by the students, including social factor, cultural factor, and individual factor. The phenomenon is common and natural among hospitality students who are doing their internships and also among hospitality practitioners, and can be seen positive or negative depending on the outcomes. It is positive when it can be employed as an effective communication strategy that build mutual intelligibility, but it can be negative when it is considered diminishing comprehension between speakers or violating grammar rules as such in an academic writing like a report. Deeper investigations on the practice of code switching and code mixing among hospitality students are needed, particularly in regards with the written form, to understand the latest trend of this phenomenon and to be able to decide to what extent code switching and code mixing are allowed in an academic writing.

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POLITEKNIK KOTA KINABALU

PENGLIBATAN PELAJAR DALAM LATIHAN AMALI DI BENGKEL DAN MAKMAL TERHADAP PEMAHAMAN TEORI DALAM KALANGAN PELAJAR JABATAN KEJURUTERAAN MEKANIKAL, POLITEKNIK KOTA KINABALU

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Abstrak

Pendekatan pembelajaran yang terlalu berfokus pada teori tanpa sokongan latihan amali mungkin tidak mencukupi dalam mengukuhkan pemahaman pelajar bidang kejuruteraan. Menurut kajian-kajian terdahulu latihan amali memainkan peranan penting dalam meningkatkan minat, motivasi dan pemahaman pelajar terhadap konsep teori. Oleh yang demikian, kajian kuantitatif perlu dilaksanakan bagi memberikan penjelasan yang lebih mendalam mengenai hubungan antara pengalaman praktikal dan penguasaan teori dalam kalangan pelajar. Objektif kajian ini adalah untuk mengenal pasti kesan atau pengaruh latihan amali di bengkel dan makmal terhadap pencapaian dalam pemahaman subjek teori dalam kalangan pelajar Jabatan Kejuruteraan Mekanikal, Politeknik Kota Kinabalu. Oleh itu, sample kajian ini adalah terdiri daripada 118 orang pelajar yang sedang mengikuti pengajian di Jabatan Kejuruteraan Mekanikal, Politeknik Kota Kinabalu. Bagi memperolehi data kajian, kaedah pensampelan secara rawak dengan menggunakan borang google form telah diedarkan kepada respondan. Data dianalisa menggunakan Statistical Package for Social Science (SPSS). Kaedah analisa berbentuk deskriptif seperti kekerapan, peratusan dan min digunakan bagi menjawab objektif kajian. Berdasarkan analisis yang dijalankan didapati purata min 4.*337* telah diperolehi menunjukkan bahawa majoriti pelajar bersetuju latihan amali memberi kesan positif terhadap pemahaman dan minat pelajar dalam pembelajaran teori. Bagi meningkatkan lagi minat dan pemahaman pembelajaran teori dan amali dalam kalangan pelajar beberapa cadangan perlu diambil tindakan. Antaranya adalah menambah baik kemudahan peralatan dan mesin yang usang dengan mesin yang baharu atau mempunyai teknologi terkini. Selain daripada itu, kemudahan peralatan dan mesin yang terdapat di bengkel dan makmal hendaklah mencukupi mengikut jumlah pelajar. Disamping itu, peralatan dan mesin yang digunakan hendaklah diselenggara agar dapat berfungsi secara optimum.

Kata kunci: amali, bengkel, peralatan, mesin

1. Pengenalan

Senario hari ini mendapati berlaku banyak perubahan pesat dalam kehidupan bekerja, masyarakat, teknologi maklumat, kejuruteraan dan lain-lain. Untuk membina kepakaran dalam satu bidang secara berterusan, seseorang perlu dapat menggunakan pengetahuan teori mereka dalam kerja sebenar. Oleh yang demikian, menurut Katajavuori et al. (2006), adalah penting untuk memupuk pembelajaran pelajar dan integrasi pengetahuan teori dalam amalan semasa pendidikan tinggi untuk memberi lebih perhatian kepada pengetahuan praktikal dalam bahagian teori kurikulum. Kajian oleh Katajavouri et al. (2006) mengesahkan bahawa pengetahuan praktikal adalah kontekstual. Oleh itu, adalah penting untuk memahami hubungan antara teori dan amalan untuk menggunakan pengetahuan teori di tempat kerja. Dapatan kajian tersebut menyimpulkan bahawa adalah penting untuk memastikan pelajar dapat mengenali keperluan untuk komponen teori tertentu dan menunjukkan bagaimana komponen teori ini boleh digunakan secara praktikal (Van Ryneveld et al., 2020).

Dalam bidang kejuruteraan mekanikal, pemahaman teori yang mendalam dan kemahiran praktikal yang kukuh adalah kritikal untuk memastikan pelajar dapat mengaplikasikan pengetahuan mereka secara berkesan dalam situasi sebenar. Walaupun pembelajaran teori memberikan asas pengetahuan yang penting, terdapat kebimbangan bahawa pendekatan pembelajaran yang terlalu berfokus pada teori tanpa sokongan latihan amali mungkin tidak mencukupi untuk mengukuhkan pemahaman pelajar. Kajian-kajian terdahulu telah menunjukkan bahawa latihan amali boleh memainkan peranan penting dalam meningkatkan minat, motivasi, dan pemahaman pelajar terhadap konsep teori (Van Ryneveld et al., 2020). Namun, sejauh manakah latihan amali di bengkel dan makmal benar-benar memberi kesan terhadap pencapaian pelajar dalam pemahaman subjek teori dalam kejuruteraan mekanikal masih memerlukan kajian lanjut. Oleh itu, objektif kajian ini adalah bagi mengenal pasti kesan latihan amali di bengkel dan makmal terhadap pencapaian dalam pemahaman subjek teori dalam kalangan pelajar bidang kejuruteraan mekanikal. Kajian ini penting kerana dapat memberikan penjelasan yang lebih mendalam mengenai hubungan antara pengalaman praktikal dan penguasaan teori dalam kalangan pelajar.

2. Sorotan Kajian

Dalam landskap pendidikan kontemporari, terdapat pengiktirafan yang semakin meningkat terhadap impak transformatif yang boleh dilakukan oleh pengalaman praktikal apabila disepadukan ke dalam kerangka pembelajaran tradisional (Fantinelli et al., 2024). Ini kerana menurut Van Ryneveld et al. (2020) pengalaman praktikal mempunyai kesan positif terhadap pengetahuan teori. Implikasi praktikal untuk institusi pendidikan dapat menangani jurang antara dunia kerja teori dan praktikal, supaya institusi pendidikan boleh merekabentuk dan menyesuaikan kurikulum dengan lebih baik, memastikan pelajar dilengkapi dengan kemahiran insaniah asas yang diperlukan untuk membuat pilihan. Ini bermakna institusi pengajian tinggi mesti melabur secara berterusan dalam latihan sumber manusia yang kompeten dan berkelayakan untuk dunia pekerjaan hari ini. Oleh itu, pengalaman praktikal adalah salah satu teras dan elemen utama pendidikan yang menjurus ke arah membantu pelajar menguasai teori dengan amalan (Msuya, 2022). Selain itu, faedah bagi pelajar yang menjalani latihan praktikal berasaskan lapangan ialah mereka dapat mengimbangi kekurangan pengetahuan (merujuk kepada teori) apabila bekerja (Marijani et al., 2023). Selain itu, kekurangan refleksi kritis terhadap pengalaman pembelajaran yang berkaitan boleh menghalang proses membangunkan pemahaman dan generalisasi dari pengalaman praktikal (Radović et al., 2021).

3. Metodologi Kajian

Kajian ini merupakan kajian kuantitatif berbentuk tinjauan. Responden kajian ini adalah terdiri dari pelajar Jabatan Kejuruteraan Mekanikal, Politeknik Kota Kinabalu, Sabah. Sampel kajian adalah sebanyak 118 pelajar dari tiga program. Instrumen yang digunakan untuk mendapatkan data adalah soal selidik menggunakan *Google form*. Data yang diperoleh akan dianalisis secara deskriptif untuk mendapatkan nilai skor min. Nilai skor min akan di terjemah kepada nilai tahap seperti yang dicadangkan oleh Ngadiman et al. (2019) seperti berikut: 1.00 – 1.99 (Lemah), 2.00 – 2.99 (Rendah), 3.00 – 3.99 (Sederhana) dan 4.00 – 5.00 (Tinggi). Item soal selidik dibahagikan kepada tiga iaitu a) latar belakang responden, b) penglibatan pelajar dalam latihan amali di bengkel, dan c) kesan penglibatan pelajar dalam latihan amali terhadap pembelajaran teori.

4. Hasil Kajian

a). Latar Belakang Responden

Jadual 1: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	92	78.0
	Perempuan	26	22.0
Program	DEM	27	22.9
	DKM	62	52.5
	DTP	29	24.6
Semester	1.00	10	8.5
	2.00	28	23.7
	3.00	7	5.9
	4.00	37	31.4
	5.00	9	7.6
	6.00	27	22.9
HPNM	2.00 - 2.99	26	22.0
	3.00 - 3.33	39	33.1

3.43 - 3.67	26	22.0
3.68 - 4.00	17	14.4
Semester 1 (Tiada HPNM)	10	8.5

Responden kajian ini adalah merupakan pelajar Jabatan Kejuruteraan Mekanikal di Politeknik Kota Kinabalu, Sabah. Jadual 1 menunjukkan responden seramai 118 orang pelajar yang terdiri daripada pelajar lelaki (78%) dan perempuan (22%). Sebilangan besar pelajar mengikuti program Diploma Kejuruteraan Mekanikal (DKM) 52.5%, diikuti oleh Diploma Kejuruteraan Mekanikal (Pembuatan) (DTP) 24.6% dan Diploma Kejuruteraan Mekatronik (DEM) 22.9%. Dari segi semester, kebanyakan pelajar berada di semester 4 (31.4%) dan semester 2 (23.7%), dengan bilangan pelajar yang hampir sama di semester 1 (8.5%) dan 5 (7.6%). Untuk Himpunan Purata Nilaian Mata (HPNM), peratusan terbesar pelajar mempunyai HPNM antara 3.00 hingga 3.33 (33.1%), diikuti oleh mereka yang mempunyai HPNM antara 2.00 hingga 2.99 dan 3.43 hingga 3.67 (masing-masing 22%), dan hanya 14.4% pelajar yang mempunyai HPNM antara 3.68 hingga 4.00.

b). Penglibatan Pelajar Dalam Latihan Amali Di Bengkel

Jadual 2: Tahap Penglibatan Pelajar Dalam Latihan Amali Di Bengkel

No	Item	Skor Min	S.P	Tahap
1	Melibatkan diri secara aktif dalam setiap aktiviti bengkel	4.407	0.798	Tinggi
2	Latihan amali yang dijalankan adalah berkualiti	4.280	0.895	Tinggi
3	Bimbingan yang diberikan oleh pensyarah semasa latihan amali adalah memuaskan	4.271	0.921	Tinggi
4	Kemudahan fasiliti latihan amali adalah memuaskan	3.831	1.096	Sederhana
	Purata	*4.197*		*Tinggi*

Jadual 2 menunjukkan tahap penglibatan pelajar dalam latihan amali di bengkel. Berdasarkan nilai skor min, majoriti responden bersetuju bahawa mereka melibatkan diri secara aktif dalam setiap aktiviti bengkel (skor min 4.407). Pelajar juga bersetuju latihan amali yang dijalankan adalah berkualiti (skor min 4.280). Selain itu, pelajar juga bersetuju bahawa bimbingan yang diberikan oleh pensyarah semasa latihan amali dinilai memuaskan (skor min 4.271). Walau bagaimanapun, pelajar menunjukkan kemudahan fasiliti latihan amali hanya mencapai tahap sederhana dengan skor min 3.831. Secara keseluruhannya, purata skor min adalah 4.197, yang menunjukkan tahap penglibatan pelajar dalam latihan amali di bengkel adalah tinggi.

c). Kesan Penglibatan Pelajar Dalam Latihan Amali Terhadap Pembelajaran Teori

Jadual 3: Analisis Kesan Penglibatan Pelajar Dalam Latihan Amali Terhadap Pembelajaran Teori

No	Item	Skor Min	S.P	Kesan
1	Melalui latihan amali, saya dapat melihat dan mengalami secara langsung bagaimana konsep teori diterapkan dalam situasi sebenar.	4.373[3]	0.885	Tinggi
2	Melalui latihan amali, saya dapat memperkuat pemahaman saya tentang teori yang dipelajari di kelas.	4.347	0.890	Tinggi

3	Saya lebih cenderung untuk mengingat dan memahami maklumat yang saya terlibat secara langsung dalam latihan amali.	4.280	0.951	Tinggi
4	Melalui latihan amali, saya berhadapan dengan masalah sebenar yang perlu diselesaikan yang juga berguna dalam menjawab soalan teori.	4.322	0.895	Tinggi
5	Pengalaman praktikal meningkatkan minat dan motivasi saya terhadap subjek tersebut.	4.407[1]	0.899	Tinggi
6	Setelah mengikuti latihan amali, saya bersemangat untuk belajar dan memahami teori.	4.297	0.899	Tinggi
7	Latihan amali membantu saya menghubungkan teori dengan amalan sebenar, supaya saya dapat melihat perkaitan dan aplikasi sebenar apa yang saya pelajari dalam teori.	4.314	0.912	Tinggi
8	Pengalaman praktikal mengukuhkan ingatan pembelajaran saya, menjadikannya lebih mudah diingati semasa menjawab soalan teori.	4.331	0.878	Tinggi
9	Latihan amali memberikan konteks sebenar di mana teori diaplikasikan.	4.398[2]	0.859	Tinggi
10	Maklum balas dalam latihan amali sangat penting untuk membetulkan kesilapan memahami aspek teori yang mungkin belum dikuasai sepenuhnya.	4.322	0.876	Tinggi
11	Melalui latihan amali, saya boleh membincangkan teori, bertukar idea, dan belajar dari perspektif yang berbeza, yang boleh memperkayakan pemahaman saya tentang teori.	4.322	0.886	Tinggi
	Purata	*4.337*		*Tinggi*

Nota: [1,2,3]Tiga item yang memperoleh min tertinggi

Jadual 3 menunjukkan kesan penglibatan pelajar dalam latihan amali terhadap pembelajaran teori. Berdasarkan skor min majoriti responden bersetuju bahawa latihan amali di bengkel memberikan kesan positif terhadap pembelajaran teori mereka. Ini dijelaskan apabila majoriti responden sangat bersetuju terhadap 11 item kajian. Walaubagaimanapun tiga kesan utama (skor min tertinggi) yang perlu dijelaskan disini. Kesan paling utama ialah pelajar memperoleh pengalaman praktikal semasa latihan amali dapat meningkatkan minat dan motivasi mereka terhadap subjek (skor min 4.407). Apabila pelajar terlibat secara aktif dalam latihan amali, mereka lebih berkemungkinan untuk merasa teruja dan berminat dengan subjek yang dipelajari. Selain itu, latihan amali juga memberikan konteks sebenar di mana teori diaplikasikan (skor min 4.398). Latihan amali membolehkan pelajar melihat nilai praktikal dan kegunaan pengetahuan teori mereka. Justeru, dengan memahami konteks sebenar juga membantu dalam pengukuhan konsep dan pemahaman pelajar. Manakala kesan seterusnya ialah melalui latihan amali, pelajar dapat melihat dan mengalami secara langsung bagaimana konsep teori diterapkan dalam situasi sebenar, (skor min 4.373). Secara keseluruhannya, kesemua item menunjukkan bahawa latihan amali mempunyai kesan positif yang tinggi terhadap pemahaman dan minat pelajar dalam pembelajaran teori.

5. Kesimpulan

Secara keseluruhannya, kajian ini mendapati bahawa latihan amali di bengkel dan makmal akan dapat meningkatkan pencapaian dan pemahaman subjek-subjek teori dalam bidang kejuruteraan mekanikal. Pernyataan ini disokong melalui dapatan hasil kajian yang menunjukkan kesan penglibatan pelajar dalam latihan amali terhadap pembelajaran teori adalah berada pada tahap tinggi iaitu purata skor min 4.*337*. Maka dengan ini dapat

disimpulkan bahawa latihan amali di bengkel dan makmal memberikan kesan yang positif terhadap pembelajaran teori para pelajar. Secara tidak langsung, ia dapat membantu para pelajar lebih memahami dan mengukuhkan lagi pemahaman mereka terhadap subjek teori tersebut. Ini dapat dibuktikan dengan dapatan kajian yang menunjukkan lebih 50% pencapaian HPNM responden melebih gred 3.00. Namun begitu, beberapa cadangan perlu diambil perhatian oleh pihak yang terlibat. Antara cadangan tersebut adalah menaiktaraf fasiliti amali dan bangkel terutamanya peralatan dan mesin yang digunakan. Ini kerana, dapatan kajian menunjukkan responden kurang berpuashati terhadap kemudahan fasiliti amali yang mereka gunakan telah menunjukkan skor min berada pada tahap sederhana iaitu 3.831. Terdapat kemudahan seperti peralatan atau mesin yang digunakan adalah usang dan tidak mesra pengguna. Selain daripada itu, pihak terlibat juga perlu manambah peralatan dan mesin agar sesi amali dapat dijalankan dengan lebih berkesan. Jumlah peralatan dan mesin yang sedia ada tidak dapat menampung jumlah pelajar dalam satu-satu masa. Pelajar terpaksa bergilir atau menjalankan kerja-kerja amali atau bengkel secara berkumpulan. Cadangan seterusnya adalah menyediakan penyelenggaraan mesin atau peralatan bengkel dan makmal yang lebih teratur agar lebih bersedia untuk digunakan dan berada pada tahap yang optimum semasa digunakan oleh pelajar.

Rujukan

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Development and Validation of Peer Support for University Scale in China using Exploratory and Confirmatory Factor Analysis

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Abstract

Peer support is crucial in the health care system. However, the implications of peer support have been reported to be unsatisfactory in the university context. This study aims to develop and validate an instrument that examines the effectiveness of peer support. A suitable theory is the Social Identity Theory, proposed by psychologists Tajfel and Turner in the 1970s, which examines how people define themselves in social groupings. The framework of the Peer Support Scale, developed by Kuo et al. (2007), was employed to develop and validate this instrument to gain a better understanding of this matter. This cross-sectional study collected 394 valid responses for the pilot study. 192 participants were subjected to exploratory factor analysis (EFA) using SPSS, and 202 data were subjected to confirmatory factor analysis (CFA) using AMOS. Findings from the experts suggested one item be deleted and four items moved from the physical support dimension to the emotional support dimension. Subsequently, the results of the EFA concluded that all the remaining items fell only into one construct with higher loading factors. Still, to fulfil discriminant validity, construct validity, and convergent validity of the CFA, eight items were eliminated before the actual study. Despite the recognized importance of peer support in healthcare, its effectiveness in university settings is lacking, prompting the need for a comprehensive evaluation tool.

Keywords: Peer support, Confirmatory factor analysis, Exploratory factor analysis, healthcare

1.0 Introduction

Peer support, while extensively acknowledged for its role in healthcare—improving hope, engagement, quality of life, self-confidence, and reducing system burdens—also has broad implications across fields such as forensic services, addiction, and mental health. In higher education, where students face significant stress from academic demands and personal transitions, peer support is particularly crucial. It not only aids "at-risk" students but has evolved into a critical tool for enhancing teaching and learning experiences. Studies have consistently shown that peer support benefits students academically and socially, particularly those with special needs. Moreover, peer support has been demonstrated to reduce depression symptoms and improve mental health, as seen among Hong Kong students and during the COVID-19 pandemic.

In technical and vocational education, students encounter a unique set of challenges, including complex curricula, industry-focused skills development, and the pressure of meeting both academic and industrial expectations. These transitions—whether entering work placements, internships, or moving towards graduation—often generate stress and anxiety, which can undermine students' academic performance and overall well-being. Peer support becomes particularly important in these contexts, as it fosters a sense of belonging and contributes to mental well-being by providing both emotional and practical support. Social Identity Theory is particularly relevant here because it explains how individuals enhance their self -esteem and sense of self-worth through group identification. In the context of education, when students feel part of a supportive peer group, they are more likely to experience positive self-concepts, which can boost resilience in the face of academic and industrial pressures. By forming social bonds with peers, students not only receive practical and emotional support but also strengthen their motivation and engagement in learning. Thus, Social Identity Theory provides a theoretical foundation for understanding how peer support mechanisms enhance student outcomes, making it an essential lens for evaluating the impact of peer support in technical education settings. Measuring this impact, tools like the Peer Support Scale emphasize the physical, academic, and emotional dimensions of support that directly align with the theory's principles. Therefore, the objective of the study is to explain how to develop and validate the instrument intended to gauge peer support construct.

2.0 Methodology

To develop a valid and reliable instrument for measuring the Peer Support Scale construct, a cross-sectional research design was utilized. The study focused on lecturers teaching in China universities

(Shijiazhuang city) as the target population. Data collection occurred in two phases: a pilot study and a field study. In both phases, the stratified random sampling method was employed to select participants, with 180 respondents in the pilot phase and 358 respondents in the field phase. Data were gathered using a structured questionnaire. The PSS measurement tool was adapted from Kuo et al. (2007) with 17 items, resulting in a construct with eight items measured on a six-point Likert scale.

Before conducting the Confirmatory Factor Analysis (CFA), an Exploratory Factor Analysis (EFA) was carried out (Nasir, Mohamad, Ghani, & Afthanorhan, 2020). EFA is particularly useful for identifying relationships among the peer support items, reducing them into a smaller set of factors without losing significant information (Duntemen, 1989). By refining instruments developed by earlier researchers, the items were adjusted to align with the goals of this study. The EFA procedure is recommended when adapting previously developed instruments, as it helps ensure their relevance to current research. Some items may no longer be suitable for contemporary studies, necessitating adjustments. As part of this process, the internal reliability of the existing instrument was reassessed, along with a recalculation of Cronbach's Alpha to confirm reliability (Baistaman, Awang, Afthanorhan, & Abdul Rahim, 2020). The internal consistency of the items helps verify the strength of the construct being measured (Rahlin, Awang, Afthanorhan, & Aimran, 2019).

3.0 Research Findings and Discussion

2.1 Exploratory Factor Analysis on Peer Support Construct

An exploratory factor analysis (EFA) was conducted on pilot research data to identify the underlying characteristics of academic, emotional, and physical support, following criteria from Awang (2015) and Bahkia et al. (2019). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy exceeded .50, and Bartlett's Test of Sphericity yielded significant results ($p<.001$). Using principal component analysis with Kaiser Normalization and Varimax rotation, one factor emerged from the 16 -item Peer Support questionnaire, accounting for 79.7% of the variance with an eigenvalue of 12.8. All items had factor loadings greater than .4, and the single factor, named Peer Support, showed a high-reliability score (Cronbach's Alpha = .983) and a KMO value of .943, confirming the appropriateness of the sample for factor analysis.

2.2 Confirmatory Factor Analysis on Peer Support Construct

The data obtained were analyzed using the AMOS 24 application to conduct Confirmatory Factor Analysis (CFA) to validate the measurement models of latent constructs for (1) unidimensionality, (2) validity, and (3) reliability (Aimran, Ahmad, Afthanorhan, & Awang, 2017). CFA tests were employed for each factor to assess their compatibility. The primary criterion for assessing compatibility was the loading factor value, which should ideally be $\geq.50$, <1.00, and positive. Additionally, three validity criteria were proposed for fit assessment: Fitness Index, Convergent Validity, and Construct Validity.

Table 1. The results of exploratory factor analysis loading for peer support construct

Item	Description	1
	Factor 1: Peer Support	
34	For the good of a specific individual, classmates will offer suggestions.	.934
30	Classmates who perform well academically are willing to assist students who need help.	.922
28	If there is a conflict between classmates, other classmates help smooth things out.	.919
38	Classmates encourage each other.	.912
31	When a classmate encounters difficulty with assignments, other classmates offer suggestions.	.909
33	Classmates respect the different opinions of other classmates.	.908
35	Classmates are concerned with each other's needs.	.907
37	Classmates listen to each other's troubles and problems.	.906
27	When a classmate is lonely and needs company, other classmates are willing to keep her company.	.896
26	When a classmate is sick, other classmates accompany them to get medical help.	.893
25	When a classmate encounters difficulty, other classmates take the initiative to help.	.884
39	Classmates have someone to share feelings with.	.876
29	Classmates discuss assignments with each other.	.871
36	Classmates trust each other and do not lie.	.870
40	There is deep friendship among classmates.	.849
32	Classmates share notes and references.	.823
	Eigenvalues	12.754
	In Explained Variance Percentage	79.712
	Kaiser-Meyer-Olkin = .943	
	Bartlett's Test of Sphericity Approx. Chi-Square = 4599.155, *df* = 120, Sig. = .000	
	Percentage of Total Variance = 79.712%	
	Cronbach's Alpha	.983
	The Cronbach's Alpha value for the 16 items is .983.	

i. . Fitness Index

The Chi-square test (X2) and the RMSEA index were used to evaluate model fit, in which case Chi-Square values must be approximately <3.0 (Bentler, 1990), while RMSEA values less than .05 indicate good fit, and between .05 and .08 are considered an acceptable fit (Byrne, 2001; Kline, 2015). In addition, the Comparative Fit Index (CFI), and TLI were used, where values greater than .95 indicate a good fit and greater than .90 an acceptable fit (Awang, Lim, & Zainudin, 2018). The fitness index does not achieve the required level even though all factor loadings are above .6. Then the research examined the Modification Index (MI) to look for redundant items. After deleting item PS1, PS2, PS3, PS5, PS6, PS7, PS9, PS15, only eight items remained. The findings show that the CFA analysis did meet the criteria of RMSEA = 0.079, Chi-Square/df (2.269), while CFI and TLI values did reach ≥.90, as indicated in Figure 1.

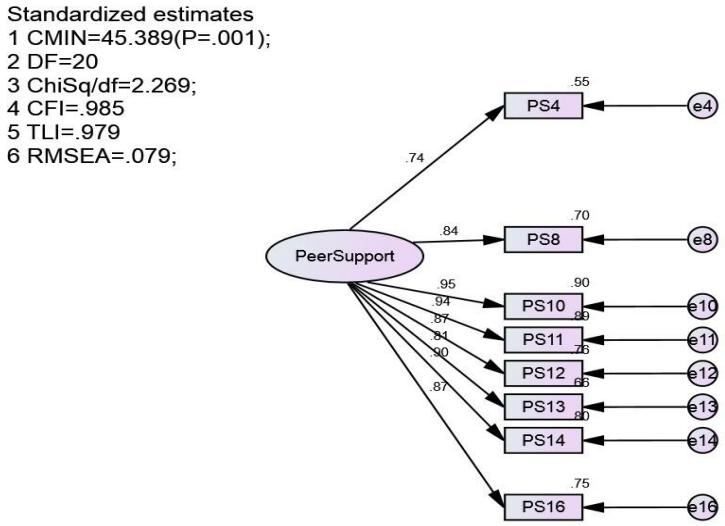

Fig. 1. CFA result of peer support

ii. Convergent Validity

Convergent validity pertains to a collection of indicators intended to gauge a specific construct (Awang et al., 2018). Brown (2006) elaborated on convergent validity as the degree of correlation among items designed to represent a singular underlying construct. Validating the convergent validity of a construct involves calculating the Average Variance Extracted (AVE). Kline (2005) suggests that an AVE value of at least .50 indicates adequacy, while Fornell and Larcker (1981) propose a threshold of ≥.5 for meeting the requirements of convergent validity measurement. The results demonstrate that the Confirmatory Factor Analysis (CFA) conducted on peer support successfully fulfils the criterion of AVE≥.5 (with a value of .75). Consequently, it is reasonable to conclude that the model has attained convergent validity.

iii. Composite Reliability

The structural equation model's dependability is estimated using composite reliability (Awang et al., 2018). Good reliability is indicated by composite reliability estimates of 0.7 or above, while an acceptable value falls between 0.6 and 0.7 (Hair, Black, Babin, & Anderson, 2014). According to the analysis, the peer support construct's composite reliability (CR=.96) was higher than the required minimum score of .6. Reliability in composites is achieved.

iv. Construct Validity

Construct validity refers to the degree to which a test accurately measures the intended concept. It is pivotal to establish the overall validity of a method. With only one construct at hand, all fitness indexes, including absolute fit (RMSEA), incremental fit (CFI and TLI), and parsimonious fit (Chisq/df), are essential to evaluate whether the model meets the criteria (see Figure 1). Thus, achieving construct validity is imperative. As suggested by Awang et al. (2018), commonly used indicators include the root mean of approximation (RMSEA), the comparative fit index (CFI), and the normed Chi-Square (X^2)/df. The scale developed fulfils all three categories of fitness indices: (1) the RMSEA value is below .08 (.079), establishing the absolute fit index; (2) the scale meets the incremental fit index criteria, with a CFI value of .985, surpassing the recommended threshold of .90; (3) the parsimonious fitness, measured by Chisq/df, yields a value of 2.269, lower than the 3.0 threshold suggested by Bentler (1990). Consequently, this study substantiates the construct validity of the scale developed.

v. Discriminant Validity

Discriminant validity of the survey was also established to ensure that no redundant constructs occurred in the model. A redundant construct occurs when any pair of constructs in the model are highly correlated. In assessing the discriminant validity, the discriminant validity index summary was developed. The diagonal value (.87) (square root of AVE) is higher than in its row and column (Zainudin, 2012).

vi. Normality Assessment

Following the achievement of the measurement model's goodness-of-fit, the data was examined for normality using the following criteria: skewness and kurtosis. If all the item values for skewness do not deviate from normality (Asnawi. Awang, Afthanorhan, Mohamad, & Karim., 2019), skewness values falling between -1.5 and 1.5 are considered acceptable, which infers that their distribution does not depart from normality (Asnawi et al., 2019). As a result, the data distribution in the scale met the requirement of normality distribution.

4.0 Summary

The study aimed to create and validate the Peer Support Scale for measuring peer support among university students. After experts suggested removing one item, the EFA identified one factor encompassing all 16 items. The CFA confirmed the scale's validity after eliminating eight items, meeting all criteria for validity. The scale developed was found to be a reliable tool for assessing peer support. The study recommends using the scale in various contexts, such as in China and suggests future research to explore factors like self-efficacy, learning environment, material format, economics, and ethnicity to further strengthen the tool.

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The Utilization of Artificial Intelligence (AI) Tools in Learning and Assessment Among Higher Learning Students in Kota Kinabalu Institutes

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Abstract

Over the past two decades, the education system, particularly in higher learning, has undergone significant transformations driven by technological advancements. This study explores the utilization of Artificial Intelligence (AI) tools, such as ChatGPT, QuillBot, and Perplexity, in learning and assessment among higher learning students in Kota Kinabalu. The research employs a survey methodology, targeting students from various academic backgrounds. The findings reveal that AI tools are widely used for academic tasks like research, writing, and exam preparation, with notable benefits in enhancing learning efficiency. However, challenges such as over-reliance on technology and reduced critical thinking skills were identified. These insights suggest a need for balanced AI integration in education to maximize benefits while addressing potential drawbacks.

Keywords: Technological Advancements, Artificial Intelligence, Higher Learning

1.0 Introduction

The rapid advancements in artificial intelligence (AI) technologies have been among the most influential factors affecting various sectors, including higher education. These advancements hold significant potential to further enhance the ways in which students learn and are assessed in higher education institutions (Amdan et al., 2024). The growing integration of AI tools in educational practices has become a p rominent topic of interest. This literature review aims to synthesize existing research on the application of AI tools in higher education, with a specific focus on their role in enhancing learning and assessment for students in Kota Kinabalu's higher learning institutions. More precisely, this review seeks to examine how AI tools can improve the student learning experience, enhance assessment outcomes, and explore the challenges or considerations related to their used. Through this assessment, the review provides a comprehensive understanding of the current state of AI adoption in higher education institutions in Kota Kinabalu.

Artificial intelligence (AI) tools have the potential to significantly transform the landscape of higher education by enabling personalized learning experiences, real-time feedback, and adaptive assessment methods. These tools can analyse student data to identify learning patterns and deliver tailored content, thereby enhancing learning outcomes and increasing student engagement (Chang et al., 2022). Common AI tools currently utilized in higher education include:

i. Adaptive learning platforms that modify content based on student performance
ii. Virtual tutors and chatbots offering instant support and guidance
iii. AI-powered writing assistants that assist with content drafting and structuring
iv. Plagiarism detection software to ensure academic integrity
v. AI-powered assessment tools that facilitate accurate and efficient grading (Kumar & Raman, 2022)

The integration of AI in higher education has the potential to lead to more engaged students, improved learning outcomes, and more efficient assessment processes. However, successful implementation requires careful planning at the faculty level, including providing training to instructors and ensuring that students receive the necessary support to use these tools effectively and ethically.

While AI tools offer numerous advantages in educational settings, their rapid integration has raised concerns regarding their potential overuse, ethical implications, and the impact on students' critical thinking and problem-solving abilities. These issues are particularly pressing in higher education, where academic integrity and independent thinking are highly valued. This paper aims to investigate both the benefits and challenges of AI tool usage in learning and assessment, focusing on students from higher education institutions

in Kota Kinabalu. The paper is organized as follows: the literature review explores existing research on AI tools in education, the methodology outlines the survey design, data analysis discusses the survey findings, and the conclusion addresses the broader implications and potential future directions for AI in education.

2.0 Literature Review

2.1 Use Of AI-tools in Learning

Over the past two decades, the education system, particularly in higher learning, has undergone significant transformations, driven by technological advancements. As educators, it is crucial to recognize and adapt to the rapidly evolving educational landscape to maintain our relevance and effectiveness. This adaptation ensures that teaching and learning processes remain uninterrupted. The introduction and widespread use of Artificial Intelligence (AI) tools such as ChatGPT, QuillBot, and Perplexity among students have sparked discussions about their benefits and drawbacks (Chen et al., 2020) This paper explores the utilization of these AI tools in the learning and assessment processes, highlighting how they assist students with their academic tasks. By examining these aspects, educators can better understand and prepare for the ongoing and future trends in education. (Abbas et al., 2023)

Artificial intelligence (AI) tools have the potential to significantly enhance student learning within higher education institutions. For example, adaptive learning platforms analyze student data to create individualized learning paths, recommend relevant resources, and provide tailored content that aligns with each learner's unique style and abilities (Chang et al., 2022). This personalized approach fosters greater student engagement, leading to improved retention of course material. Another AI-driven tool that supports student learning is the use of virtual tutors and chatbots. These AI-powered assistants offer real-time feedback, answer questions, and guide students through complex concepts, providing essential support beyond the classroom. The availability of virtual tutors supplements the work of human instructors by offering constant responses and assistance.

Additionally, AI-powered writing assistants play a valuable role in the learning process by helping students draft, structure, and revise their written work. These tools suggest improvements in grammar, style, and clarity, enabling students to focus more on developing ideas and engaging in critical thinking. While these AI assistants are not intended to replace students' efforts, they can provide meaningful enhancements to writing skills, ultimately allowing students to produce higher-quality work.

In terms of AI applications for assessment, several tools have gained prominence for their ability to streamline grading and feedback processes. For instance, platforms like Gradescope use AI algorithms to grade assignments and exams with high accuracy, reducing the workload for educators. Similarly, Turnitin is widely used for plagiarism detection, ensuring academic integrity by comparing student submissions against vast databases. Another example is the AI-powered adaptive testing platforms like Questionmark, which adjusts the difficulty of test items based on a student's responses, providing a more personalized assessment experience. These tools exemplify how AI can enhance the accuracy, efficiency, and fairness of assessment practices in higher education.

2.2 Use of AI Tools in Assessment

AI tools play a crucial role in enhancing assessment procedures within higher education (Owan et al., 2023). For instance, plagiarism detection software promotes academic integrity by identifying unoriginal content through comparison with a vast database of online sources, including web pages, books, and previously submitted assignments (Lievens, 2023). These tools not only help maintain fairness and honesty in the assessment process but also encourage students to develop independent ideas and properly cite their sources.

Moreover, AI-powered assessment tools can improve grading accuracy and efficiency. These tools analyze student responses by comparing them to required answers, identifying patterns, and providing detailed feedback. AI grading systems also reduce the potential for human bias or error (Wang et al., 2023).

Additionally, AI tools facilitate the use of adaptive assessments, where test items are selected based on a student's performance. This approach enables a more precise evaluation of students' knowledge and skills, while also highlighting areas where additional support is needed. Adaptive assessments can reduce testing time by focusing on questions relevant to each student's ability, making the process more efficient and engaging.

3.0 Problems Statements

While AI tools in learning and assessment offer substantial potential, they also present a range of challenges and considerations. One major concern is the possibility of misuse by students, such as relying on AI writing assistants to complete assignments or uploading personal data to AI systems without consent. Such misuse may compromise the learning process and lead to inaccurate assessments of students' knowledge and skills. Therefore, institutions of higher education must establish clear guidelines and policies on the use of AI tools in academic settings. These policies should explicitly outline what is permissible, as well as the consequences for any misuse of AI technologies. Furthermore, educators should provide guidance to students on the responsible and ethical use of AI tools, with an emphasis on maintaining academic integrity and fostering genuine learning (Eager & Brunton, 2023).

Another significant challenge is the potential for bias or inaccurate decisions made by AI systems. Institutions must exercise caution in selecting AI tools, ensuring they are both unbiased and accurate, and that they align with the learning objectives of the institution (Farrelly & Baker, 2023). Testing these tools on diverse learner populations is essential to identify and mitigate any biases in the outcomes, and algorithms should be periodically reviewed to address emerging biases. Additionally, the integration of AI tools in higher education requires significant investment in infrastructure, faculty training, and student support. Institutions need to ensure they have the necessary resources and expertise to effectively incorporate AI into their learning and assessment practices. This may involve professional development for faculty, technical support for students, and financial investment in procuring and maintaining AI tools (Shi & Xuwei, 2023).

The potential for improving educational outcomes through the use of AI tools in learning and assessment is particularly promising for the students at higher learning institutions in Kota Kinabalu. These tools offer personalized learning experiences by providing real-time feedback and adapting to the needs of individual students. Additionally, AI tools can enhance academic integrity during assessments, streamline gradin g processes, and enable adaptive assessments. However, the challenges and considerations associated with AI, such as the potential for misuse, necessitate that institutions implement clear guidelines and policy frameworks to ensure responsible use (Denecke et al., 2023).

By thoughtfully evaluating and integrating AI tools, higher education institutions in Kota Kinabalu can create more engaging, effective, and equitable learning experiences for their students. As AI technologies continue to advance, it is crucial for these institutions to remain at the forefront of innovation, exploring new ways to incorporate AI into their learning and assessment practices (Qureshi, 2023).

This not only prepares students for the demands of the 21st-century workforce but also contributes to the ongoing development of AI-based solutions in education. Continuous refinement of AI tools in learning and assessment will allow higher education institutions to remain relevant, effective, and responsive to the needs of students, stakeholders, and the broader community (Keshishi & Hack, 2023).

4.0 Research Objectives

The following are the research objectives:

i. To identify the most used AI tools and their specific applications
ii. To evaluate the impact of AI tools on student learning outcomes
iii. Analyzing the benefits and drawbacks of AI tools.

5.0 Research Methodology

This chapter provides a detailed description of the methods used to conduct the research on the usage of Artificial Intelligence (AI) among students in higher education institutions in Kota Kinabalu.

To better understand the use of AI among students, a literature review was conducted. The purpose was to explore the challenges, opportunities, and current adoption rates of AI in education, which led to the formulation of the problem statement and research objectives.

The survey was designed to collect both quantitative and qualitative data on students' use of AI tools in academic tasks. The questionnaire was divided into sections covering demographic information, frequency of AI tool usage, specific applications of these tools, and perceived benefits and drawbacks. Likert scale questions were used to gauge student satisfaction and the impact of AI tools on their learning outcomes. To ensure a diverse sample, convenience sampling was employed, targeting 50 students from various academic disciplines and institutions. The selection process aimed to represent a broad range of experiences by including participants from both public and private higher learning institutions, ensuring varied perspectives on the use of AI tools.

To gather primary data, a survey was designed using Google Forms. The survey was distributed to 50 students from various institutions of higher learning in Kota Kinabalu. The target group included students from different academic disciplines to ensure a diverse range of responses. The selection of participants was based on convenience sampling, aiming to provide a snapshot of AI use among the student population. The survey was designed to take approximately 10–15 minutes to complete, ensuring that the questions were concise and focused on the research objectives.

Table and figure were used to present the results clearly and effectively. These visuals highlighted key findings, such as the percentage of students who frequently use AI tools, the most common challenges they face, and the perceived benefits of integrating AI into their academic work.

6.0 Data Analysis and Discussion

In this analysis, we're looking at feedback from 50 people at the Institute of Higher Learning in Kota Kinabalu. Our respondents come from a mix of backgrounds, including both engineering and non-engineering fields. They're studying at different levels, from diplomas to degrees, and they're enrolled in both public and private institutions. This varied group helps us get a well-rounded view of student experiences and perspectives, offering insights into how different factors might influence their education.

6.1 Respondent Demography

Respondent Demography	
Item	**Response**
Institute of Higher Learning	
Government	42
Non-government	8
Gender	
Male	29
Female	21
Course Program	
Engineering	24
Non-engineering	26

6.2 Analysis Objective 1

Which AI tools do you use most frequently for academic purposes		
Tools	**No of Students**	**Percentage (%)**
ChatGPT	44	88
QuillBot	26	52
Perplexity	9	18
Grammarly	21	42
Turnitin	10	20
POE	1	2
Google	1	2

The analysis reveals that ChatGPT stands out as the most popular AI tool, with an overwhelming 88% of students using it regularly. Other tools, such as QuillBot and Grammarly, follow, being used by 52% and 42% of students, respectively. Tools like Turnitin, which is often used to check for plagiarism, are somewhat less commonly used, with 20% of students relying on it. Interestingly, niche tools like Perplexity and even Google are barely used for academic purposes, with just 2% of students reporting their use.

The dominance of ChatGPT as the most frequently used tool suggests that students prefer AI tools that provide quick and comprehensive responses to a wide range of queries. This highlights the importance of general-purpose AI tools in academic settings, where versatility is valued. However, the lower usage of specialized tools like Turnitin indicates that students may not prioritize plagiarism detection unless explicitly required by instructors

For which academic activities do you primarily use these AI tools?		
Tools	**No of Students**	**Percentage (%)**
Writing and editing essays	34	69.4
Conducting research and gathering information	36	73.5
Checking for plagiarism	19	38.8
Improving grammar and style	31	63.3
Studying and exam preparation	35	71.4
Designing Template Presentation	15	30.6
Video Editing	5	10.2
Other	1	2

In terms of what students use these tools for, the data shows that the primary applications include conducting research and gathering information (73.5%) and writing or editing essays (69.4%). These tools are also instrumental for studying and preparing for exams, as reported by 71.4% of the students. While tools help with improving grammar and style (63.3%), they are less commonly used for more specialized tasks like designing presentations or editing videos. The lower usage for tasks like video editing or designing presentations points to the limited scope of AI in more creative or technical fields, suggesting areas for future development.

How often do you integrate multiple AI tools to complete a single academic task?		
Scales	**No of Students**	**Percentage (%)**
Always	7	14
Frequent	20	40
Often	18	36
Sometimes	3	6
Never	2	4

When asked about integrating multiple AI tools, nearly 40% of students frequently use more than one tool to complete a task, while another 36% report doing so often.

How satisfied are you with the performance of the AI tools you use in your academic work?		
Scales	**No of Students**	**Percentage (%)**
Very satisfied	12	24
Satisfied	25	50
Neutral	12	24
Dissatisfied	0	0
Very Dissatisfied	1	2

Overall, satisfaction levels are high, with half of the students feeling satisfied and 24% feeling very satisfied with the performance of these tools. A small number of students (2%) expressed dissatisfaction. The small proportion of dissatisfied users indicates that some students may encounter limitations or frustrations, possibly due to tool inaccuracy or complexity.

6.3 Analysis Objective 2

How frequently do you use AI tools (e.g., ChatGPT, QuillBot, Perplexity) to assist with your academic tasks?		
Frequency	**No of Students**	**Percentage (%)**
Daily	8	16
Weekly	28	56
Monthly	9	18
Rarely	5	10
Never	0	0

Figure 6

The second objective examined how frequently students use AI tools and their perceived impact on learning outcomes. The data indicates that AI tools have become a routine part of academic life for many students, with 56% using them on a weekly basis, while 16% use them daily. Only a small minority, around 10%, report rarely using these tools.

To what extent do you feel that AI tools have improved your understanding of course materials?		
Scales	No of Students	Percentage (%)
Significantly improved	12	24
Much improved	27	54
Improved	9	18
No change	1	2
Significantly decreased	1	2

Figure 7

When it comes to enhancing understanding of course materials, the impact of AI tools is quite clear. More than half of the students (54%) reported that AI tools have significantly improved their understanding of academic concepts, and 24% noted even more dramatic improvements. Very few students felt that AI tools hindered their comprehension, with only 2% reporting no change or a decrease.

Have AI tools helped you improve your grades or academic performance?		
Scales	**No of Students**	**Percentage (%)**
Yes	37	74
No	12	24
Maybe	1	2

Figure 8

The benefits of AI tools are also reflected in students' academic performance, as 74% of respondents believe these tools have positively influenced their grades.

In which specific areas of your studies do you find AI tools most beneficial?		
Areas	**No of Students**	**Percentage (%)**
Research and information gathering	30	60
Writing and editing assignments	6	12
Understanding complex concepts	11	22
Exam preparation	2	4
Other	1	2

Figure 9

The primary area where AI tools prove to be most beneficial is research and information gathering, with 60% of students highlighting this as their primary use case. Writing and editing assignments and understanding complex concepts are also areas where AI tools offer notable support, though to a lesser extent than research.

6.4 Analysis Objective 3

What benefits have you experienced from using AI tools in your academic work?		
Scales	**No of Students**	**Percentage (%)**
Improved efficiency	28	56
Enhanced understanding	30	60
Better quality of work	30	60
Increased creativity	22	44
Other	0	0

Figure 10

The final objective looked at both the advantages and disadvantages of using AI tools in educational settings. In terms of benefits, 60% of students reported that AI tools have significantly enhanced their understanding of academic content, while 56% credited the tools for improving their overall efficiency in

completing tasks. Better quality work and increased creativity were also cited as major advantages, with 60% and 44% of students noting these benefits, respectively.

What drawbacks have you encountered while using AI tools?		
Drawbacks	**No of Students**	**Percentage (%)**
Over-reliance on technology	20	40.8
Reduced critical thinking skills	31	63.3
Academic dishonesty concerns	23	46.9
Inaccurate or misleading information	20	40.8

Figure 11

One of the most commonly reported issues is the over-reliance on technology, which 40.8% of students admitted to. Even more concerning is the impact on critical thinking skills, with 63.3% of students reporting a reduction in their ability to think critically. Additionally, concerns about academic dishonesty (46.9%) and the spread of inaccurate or misleading information (40.8%) are also significant issues for students.

Do you believe that AI tools help in developing your critical thinking and problem-solving skills?		
Scales	**No of Students**	**Percentage (%)**
Strongly agree	8	16
Agree	12	24
Neutral	25	50
Disagree	4	8
Strongly Disagree	1	2

Figure 12

Despite these concerns, half of the students remain neutral on whether AI tools help develop critical thinking and problem-solving skills. Only 16% strongly believe that these tools are beneficial in this regard.

How do you perceive the overall impact of AI tools on the quality of education you are receiving?		
Scales	**No of Students**	**Percentage (%)**
Very positive	8	16
Positive	19	38
Neutral	22	44
Negative	0	0
Very Negative	1	2

Figure 13

Nevertheless, when considering the overall impact of AI tools on the quality of education, the majority of students (38%) maintain a positive outlook, while 44% remain neutral. Very few perceive the impact as negative, with only 2% expressing dissatisfaction.

7. Conclusion

The analysis reveals that ChatGPT, QuillBot, and Grammarly are the most used tools for various academic purposes, mainly research, essay writing, and studying. Satisfaction levels are generally high, with 74% reporting a positive experience integrating multiple tools.

AI tools are frequently used in academic tasks, and most students feel these tools have improved their understanding of course materials and academic performance. The majority of the benefits are in research and information gathering, with 74% believing AI tools positively impact their grades.

While AI tools bring notable benefits in terms of efficiency, understanding, and quality of work, there are significant concerns regarding reduced critical thinking and academic dishonesty. Although many students are neutral on whether AI tools improve problem-solving skills, a positive impact on education quality is generally perceived.

The development of AI tools for education should focus on addressing current limitations, such as reducing over-reliance on AI for academic tasks and enhancing students' critical thinking skills. Future work could explore the integration of AI with other educational technologies, such as virtual reality, to create more

immersive learning experiences. Additionally, researchers and educators must address the ethical challenges posed by AI tools, including concerns about academic dishonesty and the potential for bias in AI -generated content. Institutions should consider developing frameworks that promote the responsible use of AI while fostering innovation in teaching and learning practices.

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The Impact of School Infrastructure on Learning among Rural Areas in Sabah, Malaysia.

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Abstract

In rural Sabah, Malaysia, the deficiency in school infrastructure significantly impedes students' learning experiences, reflecting broader socioeconomic disparities. This study investigates the complex relationship between school infrastructure and learning results in rural settings, taking into account the additional obstacles of geographical isolation and limited resources. It aims to contribute to education reform discourse by conducting a thorough analysis of infrastructure, quantifying its impact, and proposing interventions tailored to rural Sabah's distinct needs. The scarcity of classrooms, outdated facilities, and inadequate resources create overcrowded and outdated learning environments, hindering both teaching and learning. Furthermore, unequal resource distribution exacerbates educational inequities, leaving rural children behind their urban counterparts. Beyond academics, limited infrastructure affects students' entire development and well-being, demanding comprehensive measures. Through surveys, assessments, and interviews, this research aims to identify challenges and propose evidence-based strategies to enhance educational environments and academic achievements in rural Sabah, advocating for equitable resource allocation and policy implementation.

Keywords: Rural Education, School Infrastructure, Learning Experiences

1.0 Introduction

Education is very crucial in one person's life and also in the overall development of society. In Sabah, Malaysia, poor educational infrastructure found in their rural areas inhibits the ability of students to learn. Poor educational infrastructure in the rural areas of Sabah is a persisting issue. The state of the school's infrastructure is the focus of the following research, which aimed to investigate how it impacts students' ability to learn tough topics in harsh environments. Generally, it is well recognized that rural schools are often isolated and lack enough funding. This study is supposed to have a great addition to the existing debate in the reformation of school infrastructures. For this to happen, analysis will cover the school infrastructure in rural Sabah. This current study is an attempt to measure the effect of poor infrastructure on the learning experiences with a view to devising solutions that are region-focused. The study looked at how students are adversely affected through classrooms that are out of touch and due to the lack of resources by Amdan, Janius & Kasdiah (2024). Another effect that hampered teaching efforts is the uninviting and highly populated learning environments. This affects the teachers' capability of teaching and the pupils' learning. The unequal allocation of resources at large is now making discrepancies in education, which are slightly lagging from a rural setting against those contrasted to kids originating from metropolitan areas. It affects infrastructure, which in turn affects the development and well-being of children besides affecting their academic performance. Questionnaires and examinations were also used to find information on the problems experienced by rural schools in Sabah. The use of such information will favor learning environments and academic achievements that are evidence based. It can reduce the differences between rural and urban pupils in Sabah through the implementation of an equitable resource allocation and effective policy.

1.1 Problem Statement

Unequal Infrastructure, Unequal Opportunities: Inadequacy of classrooms, antiquated facilities, and resources within the rural setting in Sabah, Malaysia, result in overcrowded and unattractive learning environments. This will further limit teaching and learning, exacerbate socioeconomic inequities and trap rural students in a cycle of disadvantage compared with their urban counterparts.

Beyond Buildings: The Multifaceted Effect of School Infrastructure in Rural Sabah: The poor school infrastructure of rural Sabah affects not just the academic performance of the students. Overcrowded classrooms and outdated amenities are not conducive to a comfortable learning environment. Too many students in a room make it hard for instructors to deliver individual attention, which hinders learning. Without contemporary tables,

seats, ventilation, and digital learning tools, kids struggle to engage with their courses. A comprehensive solution is needed to solve this difficult issue, which, together with unfair resource distribution, harms students' development and well-being.

Need for Evidence-Based Interventions: It is commonly known that poor infrastructure is scalding rural education. However, the solutions obtained currently may not be tailored accordingly to Sabah. The current research seeks to identify the levels of infrastructure and learning outcomes in rural Sabah. The study will, hence, measure the impact and collect data through surveys, appraisals, and interviews in informing the design of evidence-based interventions to improve education and student accomplishment.

1.2 Research Objectives

i. Identify the Effect of Inadequate Infrastructure on Learning

ii. Identify rural Sabah school challenges

iii. Identify the design Sabah-specific evidence-based interventions

2.0 Literature Review

A well-built infrastructure in education is part and parcel of the successful imparting or teaching and learning activities. On the deficit side, this is more evident in a rural setup. Literature continually exhibits that insufficient school infrastructure characterized by overcrowded classrooms, outdated facilities, and limited resources adversely affects student learning and overall development. (World Bank, 2020; UNESCO, 2018). Factors that result in this create a poor learning environment, jeopardizing effective teaching and student participation, thereby widening the education gap between the rural and urban areas. (Ganimian & Murnane, 2016). In the rural area of Sabah, Malaysia, there exist geographical remoteness, restricted availability of educational resources, and socio-economic inequalities, all of which further compound existing deficiencies in infrastructure and have summed up to a large gap in education. (Rashid, 2017).

Some research highlights that the state of school facilities, learning materials, and the adequacy of classroom space are critical factors with substantial effects on education outcomes. (Duflo, 2011; Earthman, 2002). In rural Sabah, a lack of classrooms and inappropriate infrastructure inhibits the efficient execution of the curriculum and at the same time jeopardizes children's health and safety, hence decreasing their academic achievement and general well-being. (Fadly, 2019). Moreover, these challenges are made much more difficult by the unequal distribution of resources to education, which puts children living in rural areas at a disadvantage in comparison to their peers living in metropolitan areas. (Liu, Ys, 2020).

This underlines the need for culturally norm-referenced, empirically-supported interventions in rural Sabah. It is evident that, in many instances, standardized methods tend to be ineffective against problems relevant to educational settings in rural areas. (Kirk & Winthrop, 2015). Instead, such success can only be attained if these interventions are tailored in respect to the specific setting, including the local requirements and conditions. (Morris & Choi, 2020). Enhanced quality of education has been perceived as a tight measure by increasing teachers' in-service training and professional development in rural areas. (Hattie, 2009). If there was community involvement in the decision-making process, it would probably result in more long-lasting and environmentally-friendly improvements in school infrastructure. (Bruns, Filmer & Patrinos, 2011).

This study aims to contribute to the extant literature by providing a measurement for the extent to which a lack of infrastructure in rural Sabah contributes to educational attainments, while also highlighting some characteristics of the issues that delineate it from elsewhere. The data concerning the subject under study will be extensively gathered through questionnaires and assessments from educators, administrators, and interviews. This will be used to guide the development of the treatment by Amdan, Janius, Jasman & Kasdiah (2024). These would be initiatives not only to overcome the infrastructural deficiencies prevalent at present but also to seek an enhancement of the general learning environment and academic achievements for rural students in Sabah. This research work would further ensure that there is equal distribution of resources and proper implementation of policies aimed at closing the education gap between rural and urban Malaysia.

This paper, seeks to offer an insight into the challenge's rural schools in Sabah face by underlining the interrelationship between school infrastructure and resource distribution on educational outcomes. This therefore shows how important it is to have specific fact-based approaches toward the actualization of equal educational opportunities and raising of education standards for all students, irrespective of geographical location.

3.0. Methodology

Semi-structured interviews are suggested for this qualitative research in finding solutions to issues encountered with the infrastructure. Five rural Sabah school administrators and teachers will be interviewed. Such a methodology would provide the opportunity for a flexible exploration regarding realties of these institutions and the specific problems they face. The interview will be based on a set of open-ended questions prepared in advance, covering the most important themes. These questions will range f rom how teaching and learning are influenced by a lack of resources to whether they are affected or not by geographical isolation. The format of the interview, on the other hand, gives the real opportunity to the participants to express themselves and their experiences, and through this, surprises may emanate that were not anticipated. Analysis of the transcribed interviews will therefore lead to recurring themes that help the research learn about the requirements of rural Sabah schools. This qualitative data acquired with the help of evaluation infrastructure shortfalls in order to offer a comprehensive picture of rural schooling in Sabah.

4.0 Finding and Analysis

4.1 Challenges:

Infrastructural matters: This factor was mentioned by all three participants as a major challenge. For Respondent 1, this meant the old structure of the building, unavailability of light because it was irregular, and lack of water. Respondent 2 mentioned malfunctioning fans as making the students feel uncomfortable and distracted. This situation has a direct implication on the physical learning environment, where the comfort and concentration for students are at lower levels. Bad lighting and ventilation, combined with irregular power supplies, make it difficult for both students and teachers to focus on educational activities. Further, such challenges often demoralize students from attending school regularly, creating a vicious cycle of low attendance and low performance.

Transportation Issues: Teachers indicated problems of the students concerning transportation, especially during the rainy season. The village dormitory was needed because students lived very far away with no transportation, Respondent 3 said. Respondent 2 described students walking far and families struggling to buy bicycles. Nevertheless, in so far as rural areas are concerned, schoolchildren in Sabah are facing increasing problems in pursuing education due to clearly inadequate transport infrastructure. Absenteeism and reduced participation in school activities further arise from poor access roads and extreme weather conditions. The high cost of transportation disproportionately burdens B40 students, who have been forced to cough up their money for long, tiring journeys that affect the quality of learning altogether.

Geographical constraints: The school were noted in the interviews. A previous flood ruined instructional materials, Respondent 3 said. Respondent 2 confirmed tall buildings can flood. It is geographical isolation added to environmental hazards, such as flooding, that heightens the challenges in Sabah's rural education. The floods cause damage to property, but they also delay the process of education since these classrooms become unsafe or too hazardous for use. It is these kinds of recurrent environmental events that call for stringent infrastructure planning and disaster preparedness in protecting the school community and its resources.

Digital Divide: Other challenges were related to access to technology. On the same point, although Respondent 1 appreciated the changing technology, he indicated that power supply problems affected the availability of the internet. A number of students, Respondent 2 pointed out, lacked ICT knowledge, stressing the need for its improvement. The latter reflects a more significant digital gap between rural and urban areas due to more substantial socio-economic differences. Moreover, the instability of access to both the internet and computers puts students in rural areas at a disadvantageous position compared to their peers, particularly when it comes to online learning opportunities. This gap is even further widened through the impact of power cuts and inefficient infrastructure on the implementation of modern educative technologies and the provision of important ICT skills for students in the future.

4.2 Positive Aspects:

Community Cooperation: Community support was very strong. Respondent 1 elaborated on how the parents and the local representatives constructed and financed the construction of the school's cottages. Respondent 2, on the other hand, said that parents cooperated well with NGOs, as the latter provided medical care, welfare, and 3R activities in order to raise environmental consciousness. The PIBG and NGOs have become very important in ensuring student safety and infrastructure maintenance, said Respondent 3. S trong community involvement is usually regarded as one of the major enablers of rural school sustainability. Parents' and organizations' active involvement mean a lot in maintenance work for the school and developing ownership and responsibility towards the school itself. Such collaboration efforts promote student well-being

by the multiple health, welfare, and environmental programs that extend beyond academic education and contribute to the full development of a child.

Teaching Dedication: Teachers worked hard despite obstacles. When the technology failed, Respondent 1 used donated computers and focused on reading. Respondent 2 showed her dedication by asking the children to sit on the floor to work on their homework as the tables and chairs were few in number. Respondent 3 testifies that instructors travel through difficult commutes and river crossing accidents but never compromise on students' security. Therefore, in this context, the resilience and dedication of the teachers stand out to be the biggest facilitator of minimizing such infrastructural and logistical conditions affecting students' education. Many such challenges being faced by the teachers include a lack of resources or un safe travel conditions; teachers do much more than their professional duties to ensure that learning is happening. Their adaptability regarding those aspects-whether it involves teaching without proper furniture or in dangerous conditions-speaks volumes with regards to their commitment towards students' education and safety, factors that are enablers of rural school success.

Better Facilities: The new school building has greatly improved learning. Respondent 3 thanked the new classrooms, furnishings, and tables and chairs for improving student performance. Respondent 2 noted the new building's functional fans and confirmed this favourable influence. A decent infrastructure, whereby there are functional classrooms and proper furnishings available, directly impacts education quality. Better physical conditions guarantee better performance and better engagement by students, as these conditions are more comfortable and stimulating for learning. Also, simple amenities such as fans in hot classrooms are very instrumental in helping them engage their brains in schoolwork, hence the success of that particular school.

Academic Performance: The school excels academically despite challenges. Respondent 3 noted their strong district ranking despite weak infrastructure. The dedicated teachers, the supportive community, and recent infrastructure improvements, he said, contributed to this success. Academic success, within this plethora of infrastructural and logistical setbacks, stands as a testimony to the resilience of both the staff and the students. Certainly, it has been community involvement, the dedication of teachers, and, lately, a sprucing up of school facilities that has aided the school in retaining its academic standing. This success speaks not only to the efficiency of such collaborative efforts but also to the promise of rural schools with proper help and support.

These interviews thus validate the premise that rural education challenges indeed warrant a multi-faceted approach. Community support, dedicated teachers, and targeted infrastructure and digital divide remedies are all required to achieve student success. (Janius, N, 2024). This means geographical constraints unique to rural schools may necessitate innovative remedies like mobile classrooms or community learning centers. This combination can therefore provide a more holistic framework by which to meet the needs of rural education in Sabah, for increased student equity.

5.0 Discussion

The results of the study spell out the deep impact of poor school infrastructure on rural-student educational outcomes within Sabah, Malaysia. Indeed, the data reveal that, much as documented by extant literature, the provision of adequate classrooms, facilities that are not obsolete, and resources that are not limited will significantly improve learning experiences among students. (Agarwal et al., 2021). Such shortcomings are further deepened by geographical isolation and socioeconomic inequality that creates a cycle of educational unfairness, therefore, putting children from rural areas at a considerable disadvantage compared to their urban classmates. (Gordon & Louis, 2018).

Some of the key insights one would take away from the research are the multifaceted characters of the issues rural schools in Sabah are up against. Inadequacies in infrastructure thwart not only students' doing well in their academic fields but also affect their general development and well-being. Among some of the factors that most dented students' interest in studying and increased absenteeism, which affects educational achievement negatively, are overcrowded and uncomfortable learning environments. (Smith & Reimer, 2020). It also showed, from the interviews, how problems of transit and the digital divide accumulate to further put rural students at a disadvantage compared with their metropolitan area peers when it comes to educational options. (Bryk & Schneider, 2020).

The findings suggest interventions that are really tailored to and based on local realities. This is indeed what has been happening: standard models of education reform seem to fail on the specific issues rural schools face. (Bates & Plog, 2017). In its place, interventions must be designed in full awareness of the local context, fully aware of the constraints that geography and the community being targeted will have. From this study, it is concluded that education quality is going to be enhanced by raising professional development and training opportunities for teachers in the rural areas. (Lumby & Foskett, 2016). It can further provide more sustainable

facility renovations in schools, through robust community involvement and can further foster a learning - friendly environment for kids. (Booth & Ainscow, 2011).

The research also opens up possibilities for community collaboration in reducing some of the challenges experienced in the schools located in the rural setting. Community involvement in construction and maintenance has been found to be quite helpful during the entire process of establishing a learning-friendly environment. (Robinson & Timperley, 2017). For instance, construction and financing of school cottages by local parents and representatives underline the important role that community assistance may play in bridging infrastructural gaps. (Stoll & Louis, 2007). Moreover, it underlines the problems even more with the dedication of instructors, despite the conditions. If anything has to be held dear in this world, it will be that devoted educators make sure of the success of the students at all costs. (Leithwood et al., 2010).

These findings thus fit nicely within the broader discourse of educational equity, wherein equal distribution of resources and equal treatment in policy implementation will ultimately close that very gap between rural and urban schools. (Creemers & Kyriakides, 2015). Moreover, policies that give assistance to the development of interventions targeted at the particular requirements of rural Sabah should be called for. This involves fair resource distribution to develop the school's physical infrastructure and bring overall improvement to the learning environment. (Harris & Goodall, 2008).

6.0 Conclusion

In conclusion, this paper gives an overview of issues facing rural schools in Sabah and presents the importance of individual intervention to assist educational achievement. The findings of this research provide useful insights into developing effective measures to attain educational equity. Such insights are offered through the highlighting of the interconnection among school infrastructure, allocation of resources, and educational outcomes. It is of interest that further research investigate new approache s to addressing issues specific to rural education. In this way, every child will have access to quality education regardless of where one happens to be.

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Kesan Pengajaran Berbantukan Video terhadap Pemahaman Pelajar dalam Topik *"Apply the technique of Integration"*

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Abstrak

Pembelajaran dan pengajaran berbantukan video didapati mampu meningkatkan kemahiran visualisasi pelajar disemua peringkat umur. Penggunaan video pembelajaran juga banyak membantu pelajar dalam meningkatkan pengetahuan dan pemahaman sesuatu topik dengan lebih mendalam. Walau bagaimanapun, pengajaran berbantukan video dalam topik *"Apply the technique of Integration"* khususnya masih kurang sedangkan terdapat beberapa masalah yang dialami oleh pelajar kerana kesukaran menjawab pada topik ini. Tambahan pula, penguasaan pelajar dalam topik ini sangat lemah dan ini terbukti apabila ramai pelajar tidak menjawab soalan berkaitan topik ini semasa peperiksaan akhir. Oleh itu, kajian ini bertujuan untuk melihat kesan pengajaran berbantukan video terhadap pemahaman pelajar dalam topik "Apply the technique of Integration". Sampel kajian adalah terdiri daripada 59 orang pelajar semester 2 di Politeknik Kota Kinabalu yang mengambil kursus Engineering Mathematics 2. Dalam topik ini, pelajar perlu membuat pembentangan dan menerangkan konsep pengiraan luas di bawah graf dan isipadu janaan. Oleh yang demikian, daripada hasil kajian menunjukkan analisa pencapaian pelajar melalui rubrik pembentangan tersebut mendapati peningkatan yang sangat baik dalam pencapaian markah pelajar. Kajian ini mendapati bahawa pengajaran berbantukan video membuktikan kesan yang positif dalam meningkatkan pemahaman pelajar dalam topik "Apply the technique of Integration" dalam kursus Engineering Mathematics 2. Implikasi kajian ini adalah pentingnya pengintegrasian teknologi dalam proses pengajaran dan pembelajaran untuk meningkatkan kesan pengajaran dan pemahaman pelajar dalam mata pelajaran yang kompleks khususnya Matematik.

Kata kunci :- pengajaran berbantukan video, pemahaman pelajar, integration

1. Pengenalan

Penggunaan teknologi dalam pendidikan semakin hari semakin meluas, dengan pelbagai kaedah inovatif diperkenalkan untuk meningkatkan proses pembelajaran. Salah satu kaedah yang semakin mendapat perhatian ialah pengajaran berbantukan video. Dalam konteks topik matematik yang kompleks seperti "Apply the technique of Integration," penggunaan video pembelajaran dapat membantu memecahkan konsep-konsep sukar dan menjadikannya lebih mudah difahami oleh pelajar. Kajian menunjukkan bahawa penggunaan video dalam pengajaran dapat meningkatkan kefahaman dan minat pelajar kerana visualisasi yang jelas dan langkah demi langkah yang teratur (Ismail, 2020). Video pembelajaran menyediakan keupayaan untuk diulang tayang, membolehkan pelajar belajar mengikut kadar mereka sendiri, seterusnya meningkatkan pemahaman mereka terhadap topik yang diajar (Ahmad, 2018).

Kajian mengenai kesan pengajaran berbantukan video terhadap pemahaman pelajar dalam topik "Apply the technique of Integration" adalah penting untuk menentukan keberkesanan pendekatan ini. Dalam era digital yang serba canggih ini, adalah penting untuk mengkaji dan memahami bagaimana media seperti video dapat digunakan secara optimum dalam bilik kuliah. Selain daripada memberikan pemahaman teori, video pembelajaran juga boleh menunjukkan aplikasi praktikal teknik integrasi dalam situasi sebenar, yang mampu meningkatkan minat dan motivasi pelajar (Rahman A. , 2019). Oleh itu, kajian ini bertujuan untuk menilai sejauh mana penggunaan video dalam pengajaran dapat membantu pelajar memahami konsep integrasi dengan lebih baik, serta mengenal pasti faktor-faktor yang menyumbang kepada keberkesanan kaedah ini.

Kajian tindakan ini dijalankan disebabkan keprihatinan penulis terhadap prestasi pencapaian pelajar yang mengambil kursus DBM20023-*Engineering Mathematics 2*. Statistik lulus gagal bagi semester lepas iaitu sesi 1: 2023/2024 menunjukkan seramai 48 orang pelajar telah gagal daripada sejumlah 170 orang pelajar dengan peratus kegagalan adalah sebanyak 28.2%. Selain daripada itu, kegagalan pelajar memahami dan men gusai topik "Apply the technique of Integration" juga antara penyebab kegagalan yang mana topik ini merupakan soalan terakhir dalam kertas peperiksaan akhir. Melihat kepada topik yang diuji ianya bukanlah suatu topik yang berat, namun kegagalan pelajar memahami dan menguasai topik ini membuatkan penulis merasakan sesuatu tindakan perlu dilaksanakan agar pencapaian pelajar meningkat semasa penilaian *Presentation* 2 dan seterusnya mampu menjawab soalan peperiksaan akhir dengan baik. Justeru itu, pengajaran berbantukan video dilaksanakan bagi meningkatkan pemahaman pelajar.

2. Objektif kajian

Kajian ini dijalankan adalah untuk melihat kesan pengajaran berbantukan video terhadap pemahaman pelajar dalam tajuk "Apply the technique of Integration" melalui penilaian sumatif dalam Presentation 2.

3. Sorotan Kajian

Penggunaan video dalam pembelajaran telah mendapat perhatian yang meluas dalam kajian pendidikan, di mana pelbagai kajian telah menunjukkan kesan positif terhadap pencapaian dan pemahaman pelajar. (Mayer, 2009) menyatakan bahawa video pembelajaran dapat meningkatkan kefahaman pelajar melalui visualisasi yang jelas dan interaktif, yang membantu pelajar memahami konsep-konsep abstrak dengan lebih baik. Menurut kajian oleh Wang et al. (2014), penggunaan video dalam pembelajaran matematik menunjukkan peningkatan yang signifikan dalam pencapaian pelajar, terutama dalam topik-topik yang memerlukan pemahaman konsep mendalam.

Kajian oleh (Kay, 2012) mendapati bahawa video pembelajaran dapat meningkatkan minat dan motivasi pelajar, memberikan pengalaman pembelajaran yang lebih menarik dan menyeronokkan. Ini selaras dengan penemuan Giannakos (2013), yang mendapati bahawa pelajar yang menggunakan video pembelajaran lebih cenderung untuk terlibat secara aktif dalam proses pembelajaran dan menunjukkan peningkatan dalam prestasi akademik mereka. Selain itu, Guo, Kim, dan Rubin (2014) menekankan bahawa video membolehkan pelajar mengawal kadar pembelajaran mereka sendiri, dengan fleksibiliti untuk menghentikan, mengulang, dan mempercepatkan video mengikut keperluan mereka.

Namun begitu, terdapat cabaran dalam penggunaan video pembelajaran yang perlu diambil kira. Kajian oleh Zhang et al. (2006) mendapati bahawa kualiti video dan kandungan yang disampaikan memainkan peranan penting dalam keberkesanan pembelajaran. Video yang tidak disunting dengan baik atau mengandungi maklumat yang terlalu padat boleh mengurangkan tumpuan dan minat pelajar. Oleh itu, adalah penting untuk memastikan video yang digunakan dalam pengajaran adalah berkualiti tinggi dan direka dengan baik untuk memenuhi keperluan pembelajaran pelajar (Merkt et al., 2011).

Pengajaran berbantukan video telah menjadi salah satu kaedah yang semakin popular dalam membantu pelajar memahami konsep-konsep matematik yang abstrak seperti teknik integrasi. Kajian oleh Ali et al. (2021) menunjukkan bahawa penggunaan video interaktif dalam pengajaran matematik dapat meningkatkan minat dan motivasi pelajar, sekali gus memudahkan pemahaman terhadap topik yang kompleks. Penggunaan elemen visual dan animasi dalam video membolehkan pelajar melihat bagaimana konsep integrasi diterapkan dalam situasi kehidupan sebenar, yang seterusnya membantu mereka mengaitkan teori dengan aplikasi praktikal (Rahman et al., 2022).

Akhirnya, keberkesanan video pembelajaran juga bergantung kepada cara ia diintegrasikan dalam kurikulum. Tennyson dan Breuer (2002) mencadangkan bahawa video pembelajaran harus digunakan sebagai sebahagian daripada strategi pengajaran yang lebih besar, bukannya sebagai alat pembelajaran yang berdiri sendiri. Penggunaan video perlu disokong dengan aktiviti-aktiviti pembelajaran lain seperti perbincangan kelas dan latihan amali untuk memastikan pemahaman yang menyeluruh dan mendalam. Selain itu, kajian terbaru oleh Ismail et al. (2023) mendapati bahawa pelajar yang belajar melalui pengajaran berbantukan video menunjukkan peningkatan signifikan dalam pencapaian akademik mereka, terutamanya dalam topik yang memerlukan pemahaman mendalam seperti integrasi. Ini kerana video dapat diulang tayang berkali-kali, membolehkan pelajar belajar mengikut kadar mereka sendiri dan menambah kefahaman terhadap konsep yang sukar. Hasil kajian ini selari dengan pandangan Abdul (2020), yang menyatakan bahawa pendekatan pengajaran berbantukan video tidak hanya meningkatkan pemahaman pelajar, tetapi juga memperbaiki kemahiran penyelesaian masalah dalam matematik. Secara keseluruhannya, literatur menunjukkan bahawa video pembelajaran mempunyai potensi besar untuk meningkatkan pemahaman dan pencapaian pelajar dengan syarat ia digunakan dengan cara yang betul dan berkesan.

4. Metodologi kajian

Kajian yang dijalankan ini adalah berbentuk kuantitatif. Bilangan sampel adalah terdiri daripada 59 orang pelajar kejuruteraan yang mengambil kursus Engineering Mathematics 2 (DBM20023). Kaedah pemilihan sampel adalah berpandukan persampelan bertujuan dan data yang dikaji adalah hasil daripada pencapaian sebenar pelajar berdasarkan rubrik pemarkahan "Application of ideas" dalam Presentation 2 seperti yang ditunjukkan dalam Jadual 1. Data yang diperolehi ini dianalisis menggunakan perisian *Microsoft Excel* dan analisis yang digunakan adalah analisis deskriptif untuk mendapatkan peratusan.

Jadual 1: Rubric Presentation

CRITERIA	Very Good	Good	Fair	Weak	Weightage
	4 marks	3 marks	2 marks	1 mark	
APPLICATION OF IDEAS	Comply all these points in presentation: Clear explanation of mathematical ideas. Use correct mathematics formula in solving mathematical problems. Use correct calculation steps. Correct usage of diagram /graph.	Comply any 3 of these points in presentation: Clear explanation of mathematical ideas. Use correct mathematics formula in solving mathematical problems. Use correct calculation steps. Correct usage of diagram /graph.	Comply any 2 of these points in presentation: Clear explanation of mathematical ideas. Use correct mathematics formula in solving mathematical problems. Use correct calculation steps. Correct usage of diagram /graph.	Comply any 1 of these points in presentation: Clear explanation of mathematical ideas. Use correct mathematics formula in solving mathematical problems. Use correct calculation steps. Correct usage of diagram /graph.	30%

5.0 Hasil kajian

5.1 Latar belakang responden

Jadual 2 di bawah menunjukkan maklumat responden yang terlibat dalam kajian ini. Mereka terdiri daripada 88.3% pelajar lelaki dan 11.7% pelajar perempuan. Majoriti pelajar terdiri dari program Diploma Kejuruteraan Elektrik & Elektronik (DEE) (48.3%), diikuti Diploma Kejuruteraan Mekatronik (DEM) (43.3%), Diploma Kejuruteraan Elektronik (Komputer)(DTK) (5.0%) dan Diploma Kejuruteraan Mekanikal (DKM) (3.3%).

Jadual 2: Latar Belakang Responden

Item		n	%
Jantina	Lelaki	53	88.3
	Perempuan	7	11.7
Program	DEE	29	48.3
	DTK	3	5.0
	DKM	2	3.3
	DEM	26	43.3

5.2 Hasil analisis

Hasil analisis dalam Jadual 3 menunjukkan peratus pencapaian pelajar bagi kriteria "Application of Ideas" yang dinilai dalam penilaian *Presentation 2* menunjukkan penguasaan yang tinggi di kalangan pelajar dalam beberapa aspek penting. Pada kriteria pertama, "Clear explanation of mathematical ideas," majoriti pelajar (91.5%) telah menunjukkan penguasaan yang sangat baik melalui skor 4. Ini menunjukkan keberkesanan pengajaran berbantukan video dalam membantu pelajar memahami dan menjelaskan idea matematik den gan baik.

Jadual 3 : Peratus Pencapaian Pelajar Berbantukan Video Pengajaran

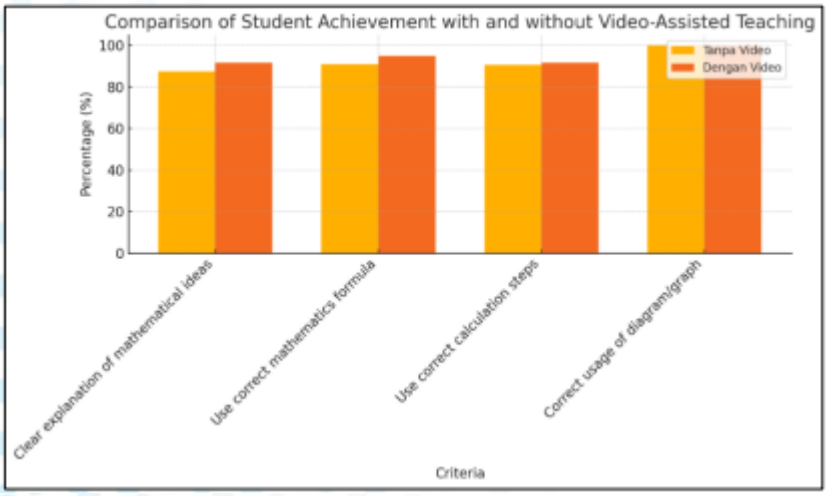
Bil	Kriteria	Peratus Pencapaian (%)	Skor Markah	Tahap
		Application Of Ideas		
1	Clear explanation of mathematical ideas.	91.5	4	Sangat Baik
		5.1	3	Baik
		3.4	2	Sederhana

2	Use correct mathematics formula in solving mathematical problems	94.9 5.1	4 3	Sangat Baik Baik
3	Use correct calculation steps	91.5 8.5	4 3	Sangat Baik Baik
4	Correct usage of diagram /graph.	100	4	Sangat Baik

Sementara itu, kriteria kedua yang melibatkan *"Use correct mathematics formula in solving mathematical problems,"* juga mencatatkan skor yang tinggi dengan 94.9% pelajar mencapai tahap sangat baik. Ini membuktikan kemampuan pelajar dalam menerapkan pengetahuan matematik secara praktikal dalam penyelesaian masalah. Bagi kriteria *"Use correct calculation steps,"* 91.5% pelajar masih menunjukkan hasil yang sangat baik. Akhir sekali, penggunaan diagram atau graf menunjukkan hasil yang sempurna dengan 100% pelajar mencapai skot sangat baik, menunjukkan kebolehan mereka dalam menggunakan formula yang tepat dalam soalan yang diberikan. Dalam jadual 4 pula menunjukkan peratus pencapaian pelajar dalam penilaian *Presentation 1* yang mana proses pembelajaran adalah seperti kaedah pengajaran terus.

Jadual 4: Peratus Pencapaian Pelajar Tanpa Berbantukan Video Pengajaran

Bil	Kriteria	Peratus Pencapaian (%)	Skor Markah	Tahap
	Application Of Ideas			
1	Clear explanation of mathematical ideas.	87.5	4	Sangat Baik
		7.0	3	Baik
		5.5	2	Sederhana
2	Use correct mathematics formula in solving mathematical problems	91.0	4	Sangat Baik
		9.0	3	Baik
3	Use correct calculation steps	90.5	4	Sangat Baik
		9.5	3	Baik
4	Correct usage of diagram /graph.	100	4	Sangat Baik



Rajah 1: Perbandingan Pencapaian Pelajar Dengan dan Tanpa pengajaran Berbantukan Video

Berdasarkan Rajah 1 yang membandingkan pencapaian pelajar dengan dan tanpa pengajaran berbantukan video, terdapat peningkatan yang jelas dalam prestasi pelajar apabila video digunakan sebagai alat bantuan pengajaran. Pertama, dalam aspek penjelasan idea matematik, peratus pencapaian pelajar yang dibantu dengan video adalah 91.5%, sedikit lebih tinggi berbanding 87.5% bagi pelajar tanpa bantuan video. Ini menunjukkan bahawa video berperanan dalam membantu pelajar memahami konsep matematik dengan lebih baik. Kedua, penggunaan formula matematik yang betul memperlihatkan peningkatan yang ketara, di mana pelajar dengan video mencatatkan 94.9%, berbanding 91.0% tanpa video. Ini menunjukkan bahawa pelajar yang dibantu dengan video lebih cenderung menggunakan formula matematik dengan tepat.

Seterusnya, dalam aspek langkah pengiraan yang betul, pelajar dengan video mencatatkan 91.5%, berbanding 90.5% bagi pelajar tanpa video. Walaupun perbezaan ini kecil, ia tetap menunjukkan impak positif dari penggunaan video dalam membantu pelajar mengikuti langkah pengiraan yang betul. Akhir sekali, untuk penggunaan diagram/graf yang betul, kedua-dua kumpulan pelajar mencapai tahap maksimum 100%. Ini menunjukkan bahawa sama ada dengan atau tanpa bantuan video, pelajar dapat menggunakan diagram atau graf dengan tepat.

6.0 Kesimpulan

Secara kesimpulannya, hasil analisis dalam Jadual 3 menunjukkan pendekatan pengajaran berbantukan video adalah sangat berkesan. Penggunaan video yang menjelaskan teknik dan langkah demi langkah penyelesaian dapat membantu pelajar memahami konsep dengan lebih jelas. Berdasarkan kepada data perbandingan, secara rumusannya analisis menunjukkan bahawa pengajaran berbantukan video memberikan kesan dan membantu meningkatkan pemahaman pelajar dalam hampir semua aspek pembelajaran matematik, terutamanya dalam penerangan idea dan penggunaan formula yang betul. Pembelajaran berbantukan video juga membolehkan pelajar untuk menonton kandungan pembelajaran berulangkali dan ini dapat meningkatkan pemahaman dan kebolehan pelajar untuk menggunkan formula matematik dengan betul. Video pembelajaran yang menarik sedikit sebanyak dapat membantu pelajar tidak hanya memahami tetapi juga mempraktikkan konsep dengan lebih efektif.

Rentetan daripada hasil kajian yang diperolehi, terdapat beberapa penambahbaikan yang boleh dilakukan. Pertama, memperkayakan bahan video pengajaran dengan animasi interaktif dan simulasi untuk konsep kompleks. Kedua, menyediakan sesi tutorial video interaktif yang memungkinkan pelajar berinteraksi langsung dengan pengajar. Ketiga, mengintegrasikan sistem maklum balas segera seperti kuiz dalam video pembelajaran untuk pembetulan konsep secara real-time. Akhir sekali, mendorong latihan kolaboratif melalui projek kumpulan dan forum dalam talian untuk memperkuat kemahiran komunikasi dan kerjasama. Cadangan- cadangan ini bertujuan untuk membuat pembelajaran matematik lebih menarik dan efektif serta membantu pelajar menguasai kemahiran yang diperlukan untuk kejayaan mereka di masa depan.

Rujukan

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POLITEKNIK KOTA KINABALU

The Use of AI-Tools Among The Educators in Unitar International University and Politeknik Kota Kinabalu

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Abstract

Artificial Intelligence (AI) tools are widely used among the educators for teaching and learning in higher learning to increase the effectiveness in learning outcome. There are a lot of AI tools that are being invented such Chat-GPT, Perplexity, Logo AI, and many more. Some of these tools are free to use and some need to be subscribed to, but due to a lot of existing AI tools nowadays, these tools are easy to access for everyone. As educators, AI tools can help in enhancing lesson planning and give an idea in using a new teaching aid, due there is unlimited information that can be accessed by the educator through this tool. Our result will highlight the benefits of using AI tools for the educators, such increase the efficiency of the teaching, improving the accuracy of the information given, and enhancing the student's engagement in the classroom. This research will be conducted to identify how the educator utilizes these tools to help them facilitate their task. This research was conducted in qualitative methods, the data collected in 2 institutions, which are Politeknik Kota Kinabalu and UNITAR International University. The data collected by interviewing participants from both of this Institution.

Keywords: AI Tools, Educators, Higher Learning, Teaching and Learning

1. Introduction

Ai-tools are software applications that use Artificial Intelligence (AI) and machine learning technology to perform a task, prediction etc. TN Fitria, (2021). using an algorithm based on the user's needs. The Ai tools are used in a wide field such as education, architecture, medical education, engineering and so on. Ai-tools being used widely among educators in recent years, they explore the AI-powered tools to enhance the teaching and learning experience, either in teaching activities in classrooms or for the assessment. AI-powered Tools may help the educator to suggest a classroom activity, create a quiz, assignment and other assessment, help in decision making, then help in giving a suggestion for the student's marks.TN Fitria, (2021) b. Ai can be applied in various ways in higher learning, including adaptive learning systems, chatbot, virtual assistant and learning analytics tools. These tools can help the educator to create a more engaging, creative and fun classroom environment and can help the educator to try something new and different from their usual classroom. Furthermore, AI-driven adaptive learning systems may modify the course materials' degree of difficulty in response to each student's performance, guaranteeing that every student obtains a mo dified education. There are several types of AI-tools, and their use shows in Table 1.

TYPES AI-TOOLS	USES
Personalized Learning	Analyzing students' data to identify strengths, weakness and learning preferences.
Automated Grading and Feedback	Automatically grade students' paper (assignment and exam)
Intelligent Tutoring Systems	Assist the educator in tutoring, a system that provides guidance and support, answering questions and offering explanation. Provide practice problem to their level of understanding
Classroom Insights	Analysis students' engagement, participation, and performance data from classroom, lectures and activities.
Content Creation	Create an engaging and effective learning material, such presentation, online activities etc.

Table 1: Types and uses of AI-tools

Overall, AI has the potential to transform the way of teaching and learning (Jaiswal,2021), therefore, this may help the educator to increase their capability in teaching besides it will improve the learning outcome and enhance overall learning experience.

After that, in higher learning, the use of Ai-tools is very important and powerful, this is because a lot of information needed to fully fill the requirement of the study and assessment. Even if the use of AI tools is

expanding, a thorough grasp of how they affect the educator, and the classroom is still necessary. This study intends to identify educators' attitudes, experiences, and views of these technologies as they relate to the employment of AI tools in higher education institutions. The goal of this research is to offer useful insights to educators, administrators, and policymakers who are looking to use AI technologies to enhance educational outcomes. Specifically, we will look at the present state of AI usage and how it affects teaching practices. This research focuses on the Social Science educator and TVET educator, from UNITAR International University Sabah and Politeknik Kota Kinabalu, this research will show how Ai-tools connected these 2 different courses, and how the utilization of the tools purposes help both of this Course's educator (lecturers). The influence of the AI-Tools is spreading widely among the educator in educational field, with tools like translator, paraphraser and chatbot supporting the educator in their teaching process, provides a quality assessment and gives a wide idea through their teaching activities. This study aims the utilization of Ai -tools among the educator in Higher-learning Institution.

1.2 Problem Statement

In recent years, there has been a significant surge in the adoption and utilization of Artificial Intelligence (AI) technologies within education, transforming traditional teaching methods and facilitating innovative learning experiences. Educators are increasingly incorporating AI tools such as chatbots, adaptive learning systems, and automated assessment platforms into their teaching and administrative workflows to enhance efficiency, student engagement, and learning outcomes (Fadel et al., 2022; Rizvi, 2023). However, despite these advancements, significant gaps remain in understanding the extent to which these AI tools are being effectively integrated into diverse educational settings, particularly within higher learning institutions.

The landscape of AI tools is vast, ranging from free, widely accessible platforms to complex, subscription-based solutions. This diversity can be overwhelming for educators who need to select the tools most aligned with their pedagogical goals. A lack of consistent understanding regarding the practical implementation of these tools poses challenges to realizing their full potential. Moreover, the success of AI tool integration heavily depends on the perceived ease of use, perceived usefulness, and educators' familiarity with these technologies.

Key issues, such as data privacy, algorithmic biases, and the continuous need for professional development, also serve as significant barriers to AI adoption. These barriers create a disparity in how effectively educators can use AI tools to achieve positive teaching outcomes, resulting in varying degrees of success in lesson planning, content delivery, and student engagement (Bilad et al., 2023). Additionally, the need for adequate teacher training and institutional support to overcome these challenges hig hlights a critical gap in the current literature on AI tool usage in education.

This study aims to bridge these gaps by exploring how AI tools are being utilized by educators in higher learning institutions, specifically at UNITAR International University and Politeknik Kota Kinabalu. By focusing on the experiences, attitudes, and challenges faced by educators, this research will provide valuable insights into the effective integration of AI technologies. It also seeks to identify the benefits of these tools and outline strategies to address the barriers hindering their successful adoption, ultimately contributing to more effective teaching practices and improved educational outcomes.

1.3 Research Objectives

i. To identify types of AI tools that are being used by the educator:
ii. To identify the benefit of AI tools among the educators.
iii. To identify the utilization of AI-tools among educators.
iv. To identify the challenges and limitations of using AI tools in teaching and what support educators need.

1.3 Research Questions

1.3.1 Types of AI Tools Used by Educators:

1. What are the most used AI tools you use?
2. How do you discover new AI tools to use in their teaching practices?
3. Whatcriteria do you use to select specific AI tools for their teachingneeds?
4. How do you stay updated on the latest developments and updates in AI tools?

5. What types of AI tools do you find most effective for classroom management?

These questions were designed to provide a comprehensive overview of the AI tools currently used by educators. They were adapted from practical approaches seen in educational technology research, which often investigates tool discovery, selection criteria, and awareness among educators. This helps map out which AI tools are in active use and how educators make decisions about adopting new technologies. The questions also draw on methodologies from studies that seek to understand technological awareness and professional practices (Chen et al., 2020)

1.3.2 Benefits of AI Tools for Educators:

1. In what ways have AI tools improved lesson planning for you?
2. How do AI tools help you enhance student engagement in the classroom?
3. What impact do AI tools have on the accuracy and quality of information provided by you?
4. How have AI tools affected the efficiency of grading and assessment processes?
5. What benefits do you experience in terms of administrative (creating a quiz, test, assignment and marking paper) tasks using AI tools?

These questions focus on capturing educators' experiences with the benefits of using AI tools. They were developed based on literature that discusses teaching effectiveness and administrative efficiency facilitated by digital tools in educational settings. By framing questions on the impact of AI on lesson planning, engagement, and grading efficiency, these questions aim to provide concrete examples of the value added by AI tools in the teaching process (Fitria, 2021; Abbas et al., 2023). Such questions were also inspired by studies that assess the impact of technology on teacher workload and student interaction.

1.3.3 Utilization of AI Tools Among Educators:

1. How do you use AI tools into your daily teaching routines?
2. What are the specific teaching activities where AI tools are most frequently utilized?
3. In what ways do AI toolsassisteducators in creating interactive and engaging classroom activities?
4. How do educators utilize AI tools for data analysis and student performance tracking?

1.3.4 Educators' Attitudes and Perceptions:

1. What are your overall attitudes towards the use of AI tools in higher learning institutions?
2. What is yourview of thepotential of AI tools to revolutionize teaching practices?
3. What concerns do you have regarding the use of AI tools in education?

These questions aim to understand how AI tools are practically integrated into teaching. The questions cover various aspects of daily usage and specific teaching activities where AI is applied. The inspiration for these questions comes from studies that focus on the integration of educational technologies into daily teaching routines and activities, such as using AI for interactive lesson creation, data-driven insights, and performance tracking (Dawson et al., 2019; Baker, 2019). The goal is to illustrate specific areas of teaching where AI tools make a significant impact, thus detailing their practical utility in the classroom.

1.3.5 Challenges and Limitations:

1. What challenges do you face when integrating AI tools into their teaching practices?
2. How do you overcome technical difficulties associated with using AI tools?
3. What limitations do you perceive in the current AI tools available for teaching?
4. What support or training do educators need to effectively use AI tools in their teaching

The following questions were adapted based on prevalent issues identified in the existing literature on technology integration in education. These questions are designed to uncover specific challenges that educators face, their coping strategies, and the support they need to effectively use AI tools.

2. Literature Review

Artificial intelligence has developed within an impressively short period into a higher educational transformative technology by creating numerous opportunities to enhance teaching and learning processes (Boubker, 2024). The infusion of AI tools within the educational setup reshapes conventional pedagogical practices providing personalized learning, bringing along better administrative efficiencies, and innovative assessment method (Owan et al., 2023). The literature review shows the current state of artificial intelligence in higher learning, considering its adoption with AI tools and their impact on teaching and learning, together with the challenges in their implementation (Chen et al., 2020). Concerning the adoption of AI tools in higher learning, there have been institutional adoptions of these technologies to enrich a wide range of aspects of educational experience (Sandu & Gide, 2019). The strategies of adaptation the institutions have used in effectively putting AI tools into their teaching and learning session (Alordiah, 2023). Similarly, discusses opportunities and challenges brought by AI-driven transformations in higher learning, noticing that AI tools are harnessed toward improving data analysis, personalizing learning, and smoothing administrative tasks (Vindaca et al., 2024).It has greatly affected the processes of teaching and learning by enabling educators to give more personalized and interactive instructions (Chen et al., 2020). Chen et al. (2020) presents an overview of the application of AI in education, stating that AI-based tools such as intelligent tutoring systems and adaptive learning platforms are being used to individualize instruction (Chen et al., 2020), provides a more in-depth discussion on specific AI tools within academia, emphasizing ways through which these tools enhance quality education, from enhanced delivery to assessment practices (Pinzolits, 2024). Besides improvements in instructional aspects, AI tools have been found to increase student engagement and outcomes (Boubker, 2024). That AI tools like ChatGPT have potential for enhancing student outcomes of learning and finds that such tools can significantly enhance student engagement through the help of real-time feedback and individual support (Yunina, 2023). AI tools applied to foreign language teaching, demonstrating how these technologies can help teach foreign languages more effectively and interactively (Yunina, 2023).

Then, all the benefits AI tools bring to education, there are challenges as well when it comes to integrating these tools into higher education (Kuleto et al., 2021). Discuss some ethical concerns related to AI use in education, such as data privacy, algorithm bias, and furthering already existing inequities in educational access via AI tools (Spivakovsky et al., 2023). Recommend that the issue needs to be addressed at the institutional policy level through the development of guidelines that may guarantee that the application of AI within educational settings is responsible (Vindaca et al., 2024). Moreover, serious changes are required in institutional practices and educators for the successful adoption of AI tools (Delcker et al., 2024). Comment that AI literacy will facilitate educators to integrate AI tools into their pedagogies; otherwise, "educators may not succeed in effectively teaching with AI tools" without proper training and support (Vindaca et al., 2024). Underlines this by saying a key predictor of successful AI tool use in higher education is educator AI competence (Delcker et al., 2024).

Desires for better educational outcomes and enhancement of operational efficiency resulted in the adoption of AI tools in higher education at institutional levels (Sandu & Gide, 2019). Regarding, focus on the institutional adoption of AI chatbots in Indian higher education institutions, underlining the role of these tools in enhancing student service and administrative processes (Sandu & Gide, 2019). Review potentials for AI tools in educational measurement and assessment, showing how such tools can be used to develop more accurate and more efficient methods of assessment (Owan et al., 2023). As such, institutions will find it imperative to have comprehensive policies governing the use of AI tools as adoption becomes quite widespread (Amdan et al., 2024). Amdan, M. A. B. et al., (2024) enumerates institutional policies that channel the use of AI tools in higher education, underscoring the necessity to provide clear guidelines on their ethical and effective use (Amdan et al., 2024). Provide the case study of AI tool adoption in Tamil Nadu, explaining how user satisfaction influenced the success of the implementation of those technologies (Sivaperumal et al., 2024).

AI in higher education presents many opportunities to develop teaching and learning, create efficiency in the performance of administrative tasks, and support highly personalized student experiences (Chen et al., 2020). However, fully realizing such potential requires a deep and careful consideration of the challenges and ethical concerns arising from AI use (Kuleto et al., 2021). Amdan, M. A. B. et al., (2024) b, stated that Policies should be developed, and training should be given to the educators in an institution to use those technologies both responsibly and effectively (Amdan et al., 2024). In the future, research should be carried out to see the long-term impact of these AI tools on educational outcomes and what best practices can be followed in their integration into higher learning institutions (Chen et al., 2020).

3. Methodology

A qualitative approach was done to gain in-depth knowledge from the perspective of the educator. Structured interviews were conducted with a sample of 6 lecturers, 3 from the UNITAR International University and 3 from Politeknik Kota Kinabalu.

3.1 Research instrument

The semi-structured interview with educators from both UNITAR International University and Politeknik Kota Kinabalu was the primary data collection tool used in the research study. 24 questions guided the interviews that align with the research objective.

Questions 1-5 were geared towards establishing the identity of AI tools used by educators, and hence, this has met the research objective Questions 6-10 attempted to establish the benefits that educators have gained, and hence, it has met Research Objective ii. Questions 11-14 established the use of AI tools in teaching practices, and hence, this has met Research Objective iii. Questions 21 -24 elicited challenges, limitations, and necessary support, which fell in line with the research of Research Objective iv.

Each interview conducted followed an interview guide to ensure all participants expose their experiences and perceptions in a similar manner. This guide contained probes for follow-up questions to be asked when a certain key response required details or an elaboration.

3.1.1 Data Collection Tools

The following instruments are used in collecting data to ascertain that the collection of data is accurate and complete:

- Digital Audio Recorder: A high-resolution digital audio recorder is used to record each interview, ensuring that responses of detailed participants are captured.
- Manual Notetaking: In addition to the audio recordings of each interview, there was also manual notetaking in which non-verbal hints, interesting moments, and first impressions were noted. These have greatly helped during the analysis phase.

3.1.2 Time and Location

The interviews went for 45-60 minutes each and were all conducted in noise-free places to ensure comfort and privacy for the participants. This setting minimized the potential for distractions and offered a comfortable avenue through which the participants could freely talk about their experiences. Those who could not meet physically did the interview via video calls (Teams and Zoom). Privacy and confidentiality were upheld as would have been in person.

3.1.3 Data Organization and Preparation

- Transcription: All audio recordings were transcribed verbatim using [transcription software, if applicable], followed by a manual check for inaccuracies to ensure completeness. This ensured the participant responses were accurately captured for analysis.
- Thematic Coding: These transcriptions were then analyzed using thematic coding, where codes allocated to segments of text would reveal patterns and themes pertaining to the research objectives.

3.1.4 Reliability and Validity Measures

Expert Validation: Subject experts in the field of educational technology validated the interview questions to ensure that they were valid and captured all the research objectives. Observations from these experts were used to refine the questions so that they were clearer and more relevant.

3.2 Participants

PARTICIPANT	UNIVERSITY	PROFESIONAL BACKGROUND	EXPERIENCE (YEARS)	GENDER
1	UNITAR KOTA KINABALU	MASTER IN MANAGEMENT	15	MALE
2	UNITAR KOTA KINABALU	BACHELOR IN EDUCATION	5	MALE
3	UNITAR KOTA KINABALU	BACHELOR IN EARLY CHILDHOOD EDUCATION	2	FEMALE
4	POLITEKNIK KOTA KINABALU	BACHELOR IN QUANTITY SURVEYING	13	MALE

5	POLITEKNIK KOTA KINABALU	BACHELOR IN QUANTITY SURVEYING	10	FEMALE
6	POLITEKNIK KOTA KINABALU	BACHELOR IN CIVIL ENGINEERING	12	MALE

Table 3: Participant Background

After the data collection, 6 participants were represented with a number 1 -6. The data was being transcribed manually and divided into themes. The research questions and theme are divided related to research objectives.

4. Finding and Analysis

6 participants were interviewed by Politeknik Kota Kinabalu and *UNITAR INTERNATIONAL UNIVERSITY*. Therefore, the data will be strong and valid to use for this research. Table 3.0 shows the basic details of the participants

4.1 The Most Used AI-Tools Among Educators

From the question given, all participants reported the most used AI-tools are Chat-GPT and Canva. The most common AI-tools. They use Chat-GPT to provide detailed explanations in various fields; after that, it helps in generating lesson plans, assessment, and writing educational content. Then, the second AI tool is Canva for visual content creation that enables educators to create appealing infographics, presentations, and custom educational resources. These tools also support digital literacy through studen t projects. Chat-GPT and Canva are more durable for educators, and it may help educators to reduce time for making an activity in class. With these tools, it contributes to better educational outcomes and essential skill development for students.

In addition, Participant 2 and Participant 3 use more complex AI such as Quilbot, Perplexity, DALL -E 3, Synthesia, and AIVA. Participant 5 also reported utilizing Synthesia to develop interactive videos for her classes, making the subject matter more engaging and accessible to visual learners.

Participant 3 used the VEED and DALL-E 3 tools to generate a video and image to make an interactive teaching and learning session. Both tools can only generate simple videos and images, but they help a lot in explaining the syllabus that relates to sensory learning. For Participant 4, she uses all the stated AI-tools shown in Table 3.0. This is because, when teaching early childhood education, she can maximize the AI-tools' capacity since the use of the AI-tools helps her in creating content for her teaching and learning sessions. Therefore, both participants actively used the AI-tools stated above. Participant 6 also highlighted that using AIVA, an AI music tool, was highly beneficial in creating customized background music for classroom activities, making the learning environment more dynamic and enjoyable for young students.

4.2 Advantages of AI-Tools for Tutors

The advantages reported in using AI tools according to the participants were: One of the participants commented that AI tools really improved lesson planning efficiency. This participant was able to write up detailed lesson plans and educational content at a fast rate with the aid of ChatGPT, which gave more time for students to interact and be engaged. Real-time insights from AI tools have made the creation of adaptive and engaging lessons possible. She added that such tools increased the engagement of students. For instance, engaging Canva in the making of creative and catchy presentations and infographics made the lessons more interactive and engaging for students. Further, as the participant noted, AI tools provided an opportunity to organize individualized learning experiences that could match diversified needs within the classroom.

Participant 3 highlighted the role of AI tools in enhancing the quality of teaching overall. This participant made use of a variety of AI tools, such as QuillBot and DALL-E 3, which helped enhance richness in terms of information to be passed on to learners. The tools helped generate content that was not merely informative but had engaging visual and contextual elements to help students learn better. Participant 4 also commented that AI tools had supported professional growth by providing continuous feedback and access to resources. The participant was a teacher of early childhood education and was using the AI tools to develop content that was more friendly to the young learners. The AI tools helped the teacher track students' progress for more efficient and timely intervention if needed.

Participant 5 noted that AI tools such as Synthesia and ChatGPT helped in making more diverse content presentations. This participant felt that the use of AI allowed her to better accommodate different learning styles, thereby reaching students who might otherwise struggle with traditional methods. Participant 6 added that AI tools had significantly improved the classroom atmosphere by allowing for interactive music and visual content, which boosted student enthusiasm and participation.

All the respondents agreed, in totality, that the tools provided an enormous scope for better individualization, efficiency, and high-quality education, finally leading to better student outcomes with improved teaching effectiveness.

4.3 Use of AI-Tools by Educators

The respondents had different uses of the AI tools because their needs and contexts in teaching vary from one to another: Participant 1 most frequently used AI tools for lesson planning and content creation. For this participant, ChatGPT and other similar tools were extremely helpful in developing detailed explanations and educational content that would serve as the basis for good classroom discussions and activities. Hence, the process was focused on enhancing instructional quality and ensuring the content covered was full without overwhelming students.

Participant 2 elicited high student engagement by using AI tools. This participant adopted visual tools such as Canva, which provided greater interaction and visuals in the instructional materials that retained the students' interest and participation. Such AI tools also allowed automating some administrative tasks to have more time for direct student interaction. Participant 3 exercises more advanced AI tools, like DALL -E 3 and VEED, to build interactive, dynamic multimedia. This participant incorporated such tools into the teaching- learning process in such a way that it would aid students who are perceptual learners. This makes those learning sessions dynamic and engaging in most of the courses where a hands-on approach is involved.

Participant 4 was making extensive use of AI tools in early childhood education. This participant used various AI tools to design educational activities appropriate for the age level and interests of young learners. Thus, AI tools helped in creating a structured but flexible learning environment wherein the content could be changed on the spot, depending on student responses and levels of engagement.

Participant 5 used AI tools like Synthesia and Perplexity for content delivery, making sessions more appealing through interactive video and diverse educational resources. These tools helped create a multisensory learning environment which contributed significantly to maintaining student interest, particularly for visual and auditory learners. Participant 6 found AI tools particularly effective in creating interactive music for learning sessions. Using AIVA, she could compose background music that helped ke ep the young learners engaged. In addition, she used ChatGPT for developing quizzes and assignments that were both challenging and fun for students.

Generally, the findings suggested that educators use AI tools subject to their previous experiences with technology and needs in the teaching environment. Those educators who initiated themselves with AI tools reported higher effectiveness and satisfaction in their teaching practices. Objective iv to identify the challenges and limitations of using AI tools and the support educators need to effectively use them was highlighted in the participants' comments regarding difficulties they faced, such as occasion al technical malfunctions, limited access to advanced features, and the need for ongoing training. Many participants, including Participant 5 and Participant 6, expressed that while AI tools significantly improved teaching efficiency, overcoming technical difficulties often required institutional support, which was sometimes lacking.

Emanating in the findings that ensured appropriate integration of AI tools with the educational practices was continuous professional development and training. Participant 6 stressed the importance of institutional training sessions to fully leverage AI capabilities in the classroom. This deep dive informs how various educators are applying AI tools to better their instructional practices, bringing out different strategies used by participants and the gains they have made in the process.

5. Discussion

The study aimed at examining the use of AI tools by educators in institutions of higher learning, types of AI tools in use, benefits derived, and how they have been integrated into teaching and learning. The problem addressed in the present study is to better understand how educators currently use these AI tools and the bearing they have on educational practices, against a fast-growing AI toolkit backdrop. This aligns with findings by Fitria (2021), who emphasized that the integration of AI tools can lead to significant improvements in teaching processes, particularly when educators have access to tools that enhance both planning and engagement.

The research aims to identify precisely which AI tools educators use, to identify the advantages that the tools make possible in enhancing educational outcomes, and to explore how educators integrate these tools into professional practice. Results from data analysis, based on interviews with educators from UNITAR International University and Politeknik Kota Kinabalu, show that the most used AI-based tools for the course of the study are ChatGPT for detailed explanation generation and Canva for visual content creation. These findings are

consistent with research by Chen et al. (2020), who found that AI-driven tools significantly improve content delivery and instructional quality through interactive features that cater to various learning styles. This indicates that educators are making use of AI tools that provide both cognitive support (ChatGPT) and visual engagement (Canva), thus catering to different student needs.

These tools have substantially affected lesson planning efficiency, student engagement, and the quality of teaching in general. (Amdan et al.,2024) previously noted that AI tools could reduce the administrative burden on educators, enabling them to focus more on interactive and student-centered learning. The current study's findings support this view, highlighting that educators were able to save time and enhance lesson quality with the help of these tools.

The data analysis directly addressed the research problem by providing empirical evidence concerning the most popular types of AI tools with educators and the gains they got from using them. In this case, ChatGPT was used mostly in lesson planning and production of educational content, saving educators time and improving the accuracy of information passed to students. This finding is aligned with Jaiswal and Arun (2021), who discussed how AI tools like ChatGPT improve educational efficiency by automating re petitive tasks and providing educators with high-quality content.

On the other hand, Canva was very instrumental in developing engaging visual materials that increased students' participation and interest. This is in line with (Janius N. et al.,2024), who highlighted the importance of visual and multimedia tools in sustaining student engagement and improving learning outcomes by providing a richer educational experience. After that, the analysis captured how AI tools are used differently by different educators because of their unique teaching context. The different applications of AI tools observed in this study are also reflected in Dawson et al. (2019), who noted that educators' varying backgrounds and teaching environments significantly influence the adoption and utilization of educational technologies. The current study further emphasizes that professional development tailored to each educator's context is crucial for maximizing the effectiveness of AI integration.

From this perspective, the need for professional development and continuous learning is underlined in the appropriate application of AI tools in education. Fitzgerald and Adam (2017) argue that ongoing training for educators is key to the successful adoption of educational technologies. The current findings align with this, suggesting that without structured and ongoing support, educators may not be able to fully exploit the potential of AI tools for enhancing student engagement and learning quality.

6. Conclusion

In conclusion, it is also underlined that while AI tools represent enormous advantages, their integration into pedagogical practice will have to be supported by profound knowledge of both the potential and limitations. There was an obvious case for continuous training and support of educators but also the need for the development of policies related to ethical concerns, such as personal data protection and algorithmic bias.

This research was able to portray a clearer picture of how AI tools are currently being utilized by educators in higher learning institutions, the benefits they bring to them, and the difficulties to be addressed for their effective integration. The research problem, objectives, and data analysis align in this work. The missing link in the literature has been closed; enormous insights are useful for educators, administrators, and policy farmers in trying to enhance educational outcomes with the use of AI technologies

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Multi-Purpose Portable Bipod for Levelling and Traversing Work

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Abstract

This project focuses on the development of a multi-purpose portable bipod designed to enhance the accuracy and efficiency of levelling and traversing tasks in land surveying. Surveyors often face challenges related to human error and environmental conditions, such as fatigue and difficulty maintaining stable instrument positioning under direct sunlight. The bipod provides a stable support system for levelling rods and stakes, reducing manual handling and improving measurement accuracy. A survey conducted among students of Politeknik Kota Kinabalu showed significant improvements in performance after the bipod's introduction, with 60% of respondents reporting better data accuracy and 75% noting reduced fatigue during fieldwork. This project demonstrates the potential of the bipod to reduce human error and improve the overall quality of surveying tasks. The bipod is recommended for future use in educational and professional surveying applications, with potential for further enhancement in terms of design and functionality.

Keywords: - Portable Bipod, Surveying Instruments, Measurement Accuracy, Levelling Work, Human Error Reduction, Land Surveying, Fatigue Reduction, Surveying Equipment Innovation, Environmental Impact on Surveying, Civil Engineering Tools

1. Introduction

1.1 Overview

In civil engineering, precise measurements are critical for successful project outcomes. This project introduces a multi-purpose portable bipod designed for levelling and traversing work, specifically for the Surveying Engineering course at Politeknik Kota Kinabalu. The bipod provides a stable and adjustable support system for levelling rods, stakes, and other surveying instruments, reducing human error during data collection in outdoor conditions.

1.2 Objectives

The objectives of this project are as follows:

1. To design a schematic plan for the bipod.
2. To create a physical prototype of the bipod.
3. To compare students' feedback and data accuracy before and after using the bipod.

1.3 Importance of the Project

This project addresses common challenges in land surveying, such as human error and environmental factors like extreme sunlight, which affect data accuracy. By introducing a portable bipod, the project aims to improve the stability of levelling stakes and reduce errors caused by fatigue or weather conditions. This innovation is particularly relevant for students in surveying courses, where accurate data collection is essential for academic success and future professional practice.

1.4 Problem Statement

Before the development of the bipod, surveyors encountered challenges related to human error, such as difficulty in maintaining stable positioning of the levelling staff under direct sunlight. These conditions contributed to inaccuracies in measurements and increased the risk of fatigue and heat-related health issues. The bipod was developed to address these issues by providing a stable and reliable support system that improves data accuracy and reduces the workload on surveyors.

2. Literature Review

2.1 Overview

The development of the bipod is rooted in existing knowledge about surveying equipment and error reduction. Surveying accuracy depends on stable and precise positioning of instruments like levelling stakes. Human error, environmental factors, and improper instrument handling can compromise the accuracy of collected data. The literature review examines key studies related to these issues, including the impact of

weather conditions on surveyors and the role of bipods in mitigating errors.

2.2 Surveying Errors and Human Factors

Surveying errors are typically classified into systematic and random errors. Systematic errors follow predictable patterns, while random errors occur due to various unpredictable factors. In land surveying, human factors play a significant role in random errors. Fatigue, environmental conditions, and improper handling of equipment can lead to inaccuracies. According to Joseph Paiva (2019), surveyors must understand common sources of errors and how they can affect the accuracy of measurements. Sunlight exposure and fatigue are also significant factors in outdoor surveying. Research has shown that extended exposure to high temperatures affects surveyors' focus, leading to inaccurate measurements. Studies on heat stress (Safeopedia, 2008) highlight that working under direct sunlight for prolonged periods can cause sunburn, heat exhaustion, or even heatstroke, compromising both safety and performance.

2.3 Bipod Development and Use in Surveying

The bipod, derived from the Latin word "bi" (two) and "pod" (foot), is commonly used in various fields, including photography, military, and surveying, to provide stability to instruments. In surveying, the bipod holds levelling rods and staff to ensure precise measurements. Advances in bipod technology include the use of lightweight materials like aluminum and carbon fiber, as well as quick-attachment mechanisms.

Previous studies suggest that the introduction of bipods in land surveying can significantly reduce human error by stabilizing the instruments, thus minimizing the movement caused by hand tremors or environmental conditions like wind. This makes bipods essential for achieving higher accuracy in surveying tasks.

3. Methodology

3.1 Design and Development of the Bipod

The project followed a structured design and development process. The bipod was designed to be lightweight, portable, and adjustable, making it easy to set up and use in different terrains. A schematic plan was developed, followed by the creation of a physical prototype. The key features of the bipod include:

- Adjustable legs for stability on uneven surfaces.
- Lightweight materials to ensure portability.
- A secure attachment mechanism to hold levelling rods or stakes firmly in place.

3.2 Data Collection

Data was collected through surveys distributed to students enrolled in the Surveying Engineering course at Politeknik Kota Kinabalu. The survey consisted of two phases: before and after the introduction of the bipod. In the first phase, students conducted levelling and traversing work without using the bipod, and their feedback on the experience was recorded. In the second phase, the students used the bipod, and their responses were compared to the initial survey.

The Likert scale was used to measure the students' feedback, with a focus on accuracy, ease of use, and overall satisfaction. In total, 81 students participated in the survey, including those from the Diploma in Civil Engineering (DKA) and Diploma in Quantity Surveying (DUB) programs.

3.3 Analysis of Results

The data collected was analyzed to identify any significant differences in the students' experiences before and after using the bipod. Factors such as accuracy of measurements, ease of setup, and fatigue reduction were evaluated. Statistical tools were used to determine the level of improvement in performance and accuracy.

4. Results and Findings

4.1 Overview

This section presents the results of the study based on the data collected from the survey responses before and after the use of the multi-purpose bipod. The analysis focuses on the feedback provided by the students on accuracy, ease of use, and the overall impact of the bipod on their surveying tasks. Comparisons are made between the responses collected during the initial phase (without the bipod) and the final phase (with the bipod).

4.2 Pre-Bipod Survey Results

Before the bipod was introduced, students relied on manually holding levelling rods and other instruments during surveying. A significant portion of the respondents reported difficulties in maintaining steady measurements due to environmental conditions like sunlight and uneven terrain. Fatigue from holding equipment for extended periods was also highlighted as a common issue.

- **Accuracy of Measurements**: 52.2% of the respondents strongly agreed that prolonged holding of levelling rods under direct sunlight led to inaccuracies (as shown in figure 4.1).

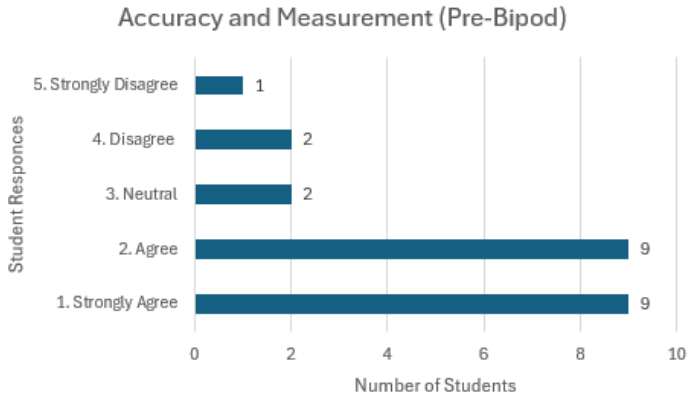

Fig 4.1: Accuracy of Measurement (pre-bipod)

Ease of Use: Most students (65%) indicated that setting up and stabilizing the equipment manually required considerable effort and time (as shown in figure 4.2).

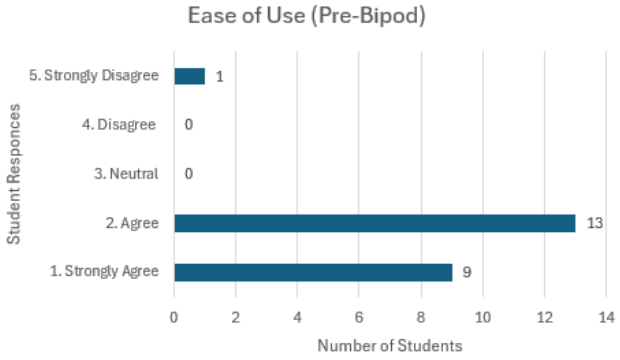

Fig 4.2: Ease of Use (pre-bipod)

Fatigue and Comfort: 55% of respondents reported experiencing fatigue during long field sessions, affecting their focus and data collection quality (as shown in figure 4.3).

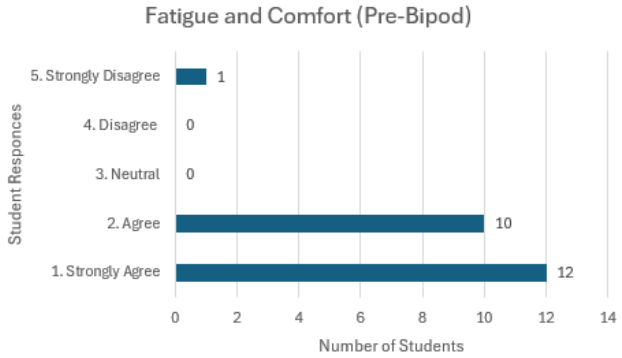

Fig 4.3: Fatigue and Comfort (pre-bipod)

4.3 Post-Bipod Survey Results

After the introduction of the bipod, the survey results showed a notable improvement in the students' overall experience. The bipod significantly reduced the need for manual handling of the instruments, leading to more accurate and reliable measurements.

- **Accuracy of Measurements:** 60% of the respondents strongly agreed that the bipod improved the accuracy of their data by stabilizing the levelling rods and reducing human errors (as shown in Figure 4.4).

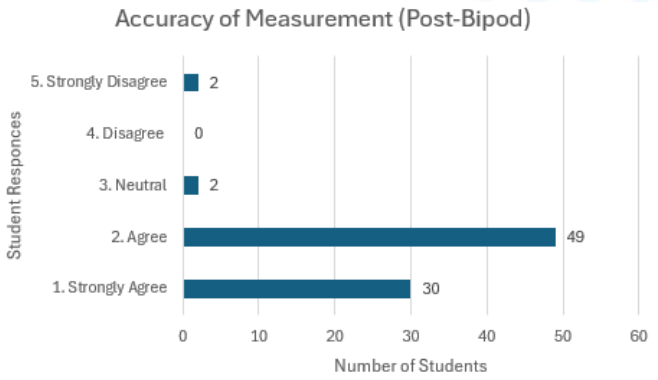

Fig 4.4: Accuracy of Measurement (post-bipod)

Ease of Use: 70% of the respondents found the bipod easy to set up and use, particularly uneven or rough terrains (as show in Figure 4.5).

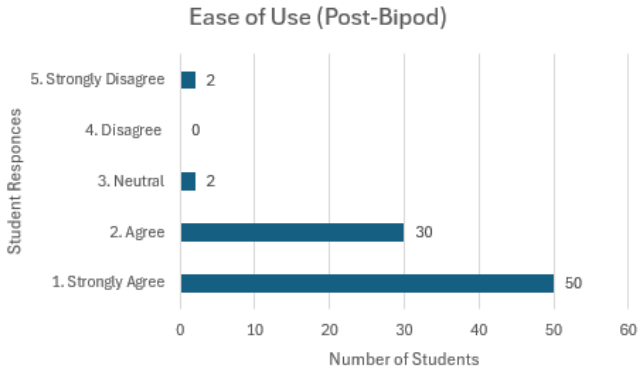

Fig 4.5: Ease of Use (post-bipod)

Fatigue and Comfort: 75% of the students reported feeling less fatigued during fieldwork after using the bipod, which helped them maintain a better focus throughout the session (as shown in Figure 4.6).

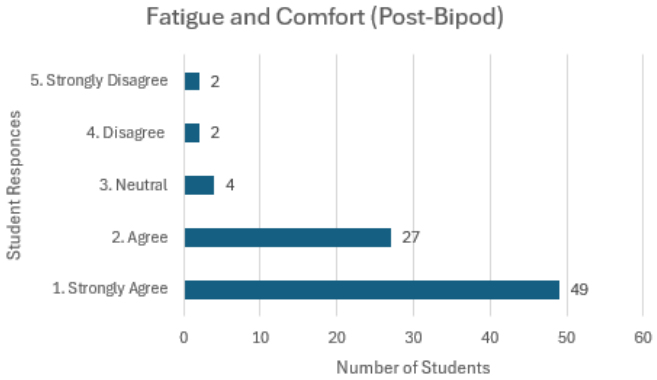

Fig 4.6: Fatigue and Comfort (post-bipod

4.4 Graphical Representation of Results

Before Bipod: The responses showed significant difficulty in maintaining accuracy due to manual handling. Most students experienced fatigue and discomfort after long hours of surveying.

After Bipod: The results indicated a substantial improvement in both accuracy and ease of use. The bipod reduced physical strain, allowing students to complete tasks more efficiently.

5. Discussion.

5.1 Analysis of Results

The results from both phases of the survey demonstrate that the multi-purpose bipod significantly enhanced the accuracy and efficiency of surveying tasks. Before the bipod was introduced, students faced common challenges such as difficulty in maintaining stable instrument positioning, leading to inaccurate measurements. These challenges were exacerbated by environmental conditions, such as direct sunlight and uneven terrain.

The introduction of the bipod addressed these issues by providing a stable support system that minimized the need for manual intervention. This led to a reduction in human error, particularly in scenarios where the surveyor needed to hold instruments for long periods under challenging environmental conditions. As a result, the students were able to collect more accurate data and complete their tasks more efficiently.

5.2 Comparison with Previous Studies

The findings from this project aligned with previous studies highlight the importance of reducing human error in surveying tasks. For example, research by Paiva (2019) emphasized the role of tools like bipods in improving data accuracy by providing stability to instruments. Additionally, studies on the effects of environmental factors, such as heat and sunlight, have shown that prolonged exposure can lead to physical fatigue and reduced focus, contributing to errors in data collection. This project further confirms that technological innovations like the multi- purpose bipod can significantly mitigate these issues and improve the overall quality of surveying tasks.

6. Conclusion

6.1 Summary of Findings

The multi-purpose portable bipod developed in this project successfully addressed key challenges in surveying tasks, particularly those related to human error and environmental factors. The bipod provided a stable and reliable support system for levelling rods and other instruments, significantly improving the accuracy of measurements. Additionally, the reduction in physical strain and fatigue enabled surveyors to maintain focus and productivity during long field sessions.

6.2 Recommendations

Based on positive feedback from the students, it is recommended that the bipod be integrated into future surveying courses at Politeknik Kota Kinabalu. Further improvements can be made to the design, such as incorporating lighter materials or adjustable features for different terrains, to enhance usability even more.

6.3 Future Work

Future projects could focus on testing the bipod in a wider range of environments and exploring additional features, such as automatic levelling systems or integration with GPS technology. Continued research on reducing human error in surveying through innovative tools and techniques will benefit both educational programs and professional practices in the field of civil engineering.

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POLITEKNIK KOTA KINABALU

Kesan Ketagihan Media Sosial ke atas Pencapaian Akademik: Kajian Perbandingan antara Jantina

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Abstrak

Kajian ini dijalankan untuk mengkaji kesan ketagihan media sosial ke atas pencapaian akademik pelajar dengan melihat perbezaan di antara pelajar lelaki dan perempuan di Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS). Soalan soal selidik telah diedarkan kepada 200 orang pelajar Jabatan Perdagangan POLIMAS. Data yang dikumpulkan adalah berkaitan ciri-ciri demografi responden, kesan media sosial terhadap pencapaian akademik pelajar dengan melihat kepada perbezaan jantina. Dapatan kajian ini menunjukkan media sosial memberi kesan terhadap pencapaian akademik pelajar secara sederhana dengan purata min keseluruhan adalah 3.26. Ujian-T telah dijalankan untuk mengetahui dengan lebih lanjut mengenai pengaruh media sosial ke atas pencapaian akademik dengan melihat kepada perbezaan jantina. Dapatan dari ujian ini mendapati bahawa terdapat perbezaan yang signifikan berkaitan tahap pencapaian akademik di antara pelajar lelaki dan pelajar perempuan kesan daripada media sosial.

Kata Kunci: Media Sosial, Pencapaian Akademik, Jantina.

1. Pengenalan

Media sosial telah menjadi medium baharu yang dapat membantu pengguna dalam memudahkan urusan harian. Penggunaan media sosial telah menjadikan komunikasi lebih cekap yang dibuktikan dengan peningkatan ketara pengguna media sosial di kalangan remaja yang menjadikan media sosial sebagai salah satu untuk berinteraksi, bekerjasama dan mendapatkan maklumat berkaitan pelajaran (Ali et.al, 2021). Kewujudan media sosial telah banyak membantu pengguna untuk mendapatkan makluman dan berhubung antara satu sama lain. Kualiti pendidikan yang lebih baik juga turut dihasilkan dengan kewujudan media sosial dimana ianya dapat membantu kepada kebolehgunaan media sosial kepada pelajar untuk meningkatkan proses pembelajaran. Ini dibuktikan melalui data yang dikeluarkan oleh Meltwater (2024) dimana pencarian maklumat menjadi fokus utama pengguna berumur 16 sehingga 64 tahun melayari internet iaitu sebanyak 78.3%. Ini turut membuktikan generasi muda telah memanfaatkan media sosial sebagai medium untuk memudahkan proses pembelajaran. Akses kepada aplikasi WhatsApp menduduki tangga teratas platform media sosial (26.8%) yang menjadi kegemaran pengguna diikuti dengan aplikasi TikTok (21.9%) (Meltwater, 2024). Veltri & Atanasova (2017) menyatakan corak penggunaan media sosial di antara lelaki dan perempuan turut menunjukkan perbezaan. Data Meltwater (2024) turut menyokong dapatan Veltri & Atanasova (2017) di mana secara purata 2 jam 48 minit digunakan oleh pengguna di Malaysia untuk mengakses kepada media sosial dengan 55.7% pengguna media sosial adalah lelaki yang membuktikan lelaki lebih aktif di media sosial berbanding perempuan.

1.1 Penyataan Masalah

Ledakan media sosial telah membawa kepada penggunaan secara meluas aplikasi seperti WhatsApp, Tiktok, Facebook untuk kegunaan harian segenap lapisan masyarakat. Media sosial turut membantu pelajar dalam mendapatkan informasi berkaitan pelajaran. Namun di sebalik kesan positif penggunaan media sosial kepada pembelajaran pelajaran ianya turut memberi kesan negatif kepada pelajar (Ratu et. al, 2019). Media sosial telah mula memberi kesan buruk kepada pelajar dimana penggunaan media sosial secara tidak terkawal boleh mendorong kepada kehilangan fokus dalam belajar yang akhirnya memberi kesan kepada prestasi akademik pelajar terbabit (Arwansyah et.al, 2022). Kehilangan fokus dalam pelajaran dikaitkan dengan keadaan dimana pelajar lebih banyak menghabiskan masa melayari media sosial untuk tujuan melunaskan keinginan mendapatkan kemaskini terbaru di media sosial. Berdasarkan data yang dikeluarkan oleh Meltwater (2024) didapati remaja lelaki lebih terdedah kepada penggunaan media sosial berbanding pelajar perempuan (55.7% vs. 44.3%) dengan akses ke atas internet secara purata selama 2 jam 48 minit setiap hari. Data turut menunjukkan aplikasi pilihan pengguna untuk melayari internet yang tertinggi adalah TikTok iaitu 38 jam 49 minit sehari (Meltwater, 2024). Oleh yang demikian, kajian ini akan merungkai kesan ketagihan media sosial ke atas prestasi akademik dengan melihat kepada perbezaan jantina pelajar di Politeknik Sultan Abdul Halim Mu'adzam Shah.

1.2 Objektif Kajian

Kajian ini dilaksanakan adalah untuk melihat kesan ketagihan media sosial ke atas prestasi akademik dengan melihat kepada perbezaan jantina pelajar di Politeknik Sultan Abdul Halim Mu'adzam Shah. Objektif kajian ini adalah:

- Untuk menilai kesan penggunaan media sosial ke atas pencapaian akademik pelajar.
- Untuk mengenalpasti perbezaan pencapaian akademik di antara pelajar lelaki dan perempuan.

1.3 Persoalan Kajian

1. Apakah kesan penggunaan media sosial ke atas pencapaian akademik pelajar?
2. Apakah terdapat perbezaan pencapaian akademik di antara pelajar lelaki dan perempuan?

1.4 Hipotesis Kajian

H1: Tidak terdapat perbezaan yang signifikan terhadap kesan penggunaan media sosial dan pencapaian akademik mengikut jantina.

H2: Terdapat perbezaan yang signifikan terhadap terhadap kesan penggunaan media sosial dan pencapaian akademik mengikut jantina.

2. Sorotan Kajian

Pendedahan kepada media sosial telah mewujudkan kesan positif dan negatif terutamanya kepada remaja yang memberi kesan langsung kepada pencapaian akademik pelajar tersebut melibatkan remaja lelaki dan perempuan. Krasnova et.al (2017) menyatakan terdapat perbezaan ketara fungsi media sosial kepada lelaki dan perempuan di mana pengguna media sosial perempuan didapati menggunakan media sosial untuk akses kepada maklumat berkaitan hubungan sosial manakala sebaliknya pula kepada pengguna lelaki dimana mereka lebih berminat kepada maklumat umum seperti sukan dan teknologi. Dapatan sebaliknya oleh Mazman & Usluel (2011) dimana wanita menggunakan media sosial bertujuan untuk mengekalkan hubungan dengan rakan-rakan sedia ada serta untuk tujuan akademik manakala lelaki pula bertujuan untuk mewujudkan hubungan dengan kawan-kawan yang baru.

Penggunaan media sosial dilihat telah mencetuskan kesan secara langsung dan tidak langsung kepada pencapaian akademik pengguna media sosial tersebut. Arwansyah et.al (2022) mendapati penggunaan media sosial secara tidak terkawal didapati memberi kesan negatif kepada pencapaian akademik pelajar melibatkan pengabaian kepada tugasan melibatkan akademik dan bukan akademik yang melibatkan hubungan sosial pelajar. Manakala Ali et.al (2021) pula mendapati media sosial memberi kesan positif kepada pencapaian akademik pelajar dimana secara amnya pelajar mengakses media sosial adalah untuk tujuan ilmiah seperti meningkatkan pemahaman berkaitan pelajaran dan membantu pelajar untuk mendapatkan saranan sekiranya terdapat sebarang masalah berkaitan pelajaran.

Alnjadat et.al (2019) mendapati prestasi akademik wanita lebih dipengaruhi oleh penggunaan media sosial yang berbanding lelaki walaupun secara lelaki lebih terdedah kepada penggunaan media sosial. Su et.al (2019) turut merekodkan pendedahan media sosial yang lebih tinggi adalah di kalangan lelaki berbanding wanita namun pencapaian akademik pelajar wanita dilihat lebih baik berbanding pelajar lelaki disebalik kesan pendedahan penggunaan media sosial tersebut. Dapatan kajian oleh Bhandarkar et. al (2021) turu t selari dengan kajian sebelumnya dimana pendedahan media sosial oleh pelajar wanita dilihat memberi kesan positif kepada pencapaian akademik berbanding pelajar lelaki.

Dapatan sebaliknya oleh Ogundele et.al (2023) dimana penggunaan media sosial memberi kesan yang lebih signifikan kepada pencapaian akademik melibatkan lelaki berbanding wanita. Dapatan kajian ini selari dengan Shen (2019) yang mendapati pelajar lelaki lebih banyak menghabiskan masa untuk melayari media sosial berbanding pelajar wanita yang menyumbang kepada pencapaian akademik.

Jafarkarimi et.al (2016) pula mendapati bahawa tiada perbezaan signifikan pencapaian akademik antara pelajar lelaki dan wanita disebabkan penggunaan media sosial. Najamuddin et.al (2019) turut menyokong dapatan oleh Jafarkarimi et.al (2016) dimana tiada kesan langsung penggunaan media sosial ke atas prestasi akademik pelajar. Namun kajian oleh Hossain & Prodhan (2020) pula mendapati kesan negatif kepada pencapaian akademik bagi pelajar lelaki dan wanita disebabkan penggunaan media sosial.

Dapatan dari kajian lepas menunjukkan kesan penggunaan media sosial terhadap pencapaian akademik pelajar lelaki dan wanita adalah tidak konsisten. Oleh yang demikian, kajian ini akan merungkai kesan ketagihan media sosial ke atas prestasi akademik dengan melihat kepada perbezaan jantina pelajar di

Politeknik Sultan Abdul Halim Mu'adzam Shah.

3. Metodologi Kajian

Kajian ini telah dijalankan di Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS) dengan mengedarkan borang soal selidik kepada 200 orang pelajar diploma dari Jabatan Perdagangan namun sebanyak 164 soal selidik telah dikembalikan kepada penyelidik. Kajian ini dijalankan secara deskriptif kuantitatif dengan mengadaptasi kaedah persampelan bukan kebarangkalian iaitu teknik persampelan mudah (*convenience sampling*). Kajian ini telah mengadaptasi borang soal selidik penggunaan media sosial dan prestasi akademik daripada Sutarno (2019).

Borang soal selidik ini telah dibahagikan kepada dua bahagian, iaitu A dan B. Bahagian A terdiri daripada tujuh soalan yang mengumpulkan maklumat peribadi seperti jantina, tahun pengajian, program pengajian, bentuk media sosial kegemaran, dan masa yang dihabiskan di media sosial setiap minggu. Manakala Bahagian B pula terdiri daripada 22 soalan yang menggunakan Skala Likert yang melihat penggunaan media sosial dan kesannya terhadap prestasi akademik. Item di dalam borang soal selidik diukur dengan menggunakan skala (1) Sangat Tidak Bersetuju, (2) Tidak Bersetuju, (3) Neutral, (4) Bersetuju, dan (5) Sangat Bersetuju. Untuk menganalisis data yang menggunakan skala likert, pengkaji menggunakan jadual interpretasi skor min yang dikemukakan oleh Durrishah (2004). Jadual interpretasi skor min adalah seperti dibawah:

Jadual 1: Jadual Interpretasi Skor Min

Julat Min Skor	Interpretasi Skor Min
1.00 – 2.33	Rendah
2.34 – 3.67	Sederhana
3.68 – 5.00	Tinggi

4. Dapatan Kajian

Sebanyak 200 borang soal selidik diedarkan secara rawak kepada pelajar diploma dari Jabatan Perdagangan di Politeknik Sultan Abdul Halim Mu'adzam Shah (POLIMAS), dengan 164 (82%) borang soal selidik telah dikembalikan kepada penyelidik. Analisis kajian dibahagikan kepada dua bahagian iaitu analisis deskriptif dan inferensi. Analisis deskriptif digunakan untuk menganalisis ciri demografi responden manakala analisis inferensi digunakan untuk melihat hubungan diantara pembolehubah kajian iaitu menggunakan tafsiran nilai min dan Ujian T.

Jadual 2: Ciri-ciri Demografi Responden

Jantina	Bilangan	Peratus (%)
Lelaki	40	24.2
Perempuan	124	75.8
Jumlah	164	100.0

Berdasarkan data di dalam Jadual 2 di atas bilangan responden perempuan adalah seramai 124 (75.8%) manakal responden lelaki adalah seramai 40 orang (24.4%) yang menjadikan jumlah responden adalah 164 orang.

Jadual 3: Masa Yang Dihabiskan di Platform Media Sosial Dalam Sehari

Jam	Lelaki (%)	Perempuan (%)
0-1 jam	66.7	33.3
2-3 jam	28.6	71.4
4-5 jam	26.7	73.3
5-6 jam	0	100
Lebih daripada 6 jam	0	100

Majoriti pelajar lelaki melayari media sosial dalam lingkungan 1 jam sehari sebanyak 66.7% berbanding pelajar perempuan iaitu 33.3%. Walaubagaimanapun, pelajar perempuan dilihat menggunakan lebih banyak masa pada lingkungan masa lebih 6 jam dalam melayari media sosial iaitu sebanyak 100% berbanding pelajar

lelaki. Dapatan di dalam jadual 3 membuktikan pelajar perempuan lebih banyak menghabiskan masa di platform media sosial berbanding pelajar lelaki.

Jadual 4: Sebab Pelajar Terlibat dengan Media Sosial

Sebab	Lelaki (%)	Perempuan (%)
Sosial	22.6	77.4
Permainan	40.0	60.0
Profesional	33.3	66.7
Akademik	0	6.5

Jadual 4 menerangkan dapatan berkaitan penyebab pelajar melayari media sosial mengikut jantina. Pelajar perempuan dilihat lebih banyak mengakses media sosial untuk tujuan sosial, permainan dan profesional berbanding pelajar lelaki. Dapatan di atas turut membuktikan pelajar perempuan menggunakan platform media sosial untuk tujuan akademik berbanding pelajar lelaki.

Jadual 5: Maklumbalas Pelajar Mengenai Kesan Media Sosial Terhadap Prestasi Akademik

Item	Min	Tahap
Menggunakan media sosial semasa melakukan tugasan menjejaskan kualiti kerja anda secara negatif	3.05	Sederhana
Saya fikir terdapat hubungan yang signifikan antara prestasi akademik pelajar dan penggunaan dan penggunaan media sosial	3.49	Sederhana
Saya percaya bahawa media sosial telah menjejaskan prestasi akademik saya secara negatif	3.07	Sederhana
Saya merasakan bahawa media sosial akan mengganggu kepada aktiviti pembelajaran akademik saya	3.07	Sederhana
Masa yang saya habiskan dalam talian di media sosial menghabiskan masa belajar saya	3.29	Sederhana
Rangkaian sosial dalam talian mengalihkan perhatian saya daripada pengajian saya	3.39	Sederhana
Waktu yang saya habiskan dalam talian di media sosial adalah lebih daripada masa yang saya habiskan untuk membaca berkaitan dengan akademik oleh politeknik	3.56	Sederhana
Akses tanpa had saya ke media sosial melalui telefon bimbit mengganggu saya di dalam kelas	3.20	Sederhana
Media sosial telah memberi kesan positif kepada GPA saya	3.44	Sederhana
Media sosial telah memberi kesan negatif terhadap GPA saya	3.02	Sederhana
Penggunaan media sosial untuk penyelidikan berkaitan kelas telah membantu meningkatkan gred saya	3.76	Tinggi
Media sosial telah menjejaskan kemahiran menulis saya secara negatif	2.56	Sederhana
Saya tidak akan mencapai prestasi yang baik dalam akademik jika saya berhenti menggunakan media sosial	2.90	Sederhana
Media sosial telah meningkatkan kemahiran komunikasi saya	3.80	Tinggi
PURATA MIN	**3.26**	**Sederhana**

Jadual 5 menunjukkan data berkaitan maklumbalas pelajar mengenai kesan media sosial ke pencapaian akademik. Skor min tertinggi adalah 3.80 untuk item "Media sosial telah meningkatkan kemahiran komunikasi saya". Dapatan ini menunjukkan pelajar secara aktif menggunakan kelebihan yang terdapat pada media sosial untuk meningkatkan kemahiran komunikasi sekaligus membantu pelajar dalam pencapaian akademik. Item "Media sosial telah menjejaskan kemahiran menulis saya secara negatif" merekodkan nilai min terendah iaitu 2.56 yang membuktikan pendedahan pelajar kepada media sosial tidak memberikan kesan negatif kepada pencapaian akademik pelajar. Secara keseluruhan, media sosial memberikan kesan yang sederhana ke atas pencapaian akademik pelajar di mana purata min keseluruhan adalah 3.26.

Jadual 6: Perbezaan Kesan Media Sosial Terhadap Pencapaian Akademik Berdasarkan Jantina berdasarkan Ujian-T

Jantina	N	Min	Sisihan Piawai	Nilai t	Nilai P
Lelaki	40	3.60	0.163	4.667	0.006
Perempuan	124	2.84	0.076		

Berdasarkan Jadual 6 didapati skor min pelajar lelaki (min=3.60) adalah lebih tinggi berbanding pelajar perempuan (min=2.84). Ini menunjukkan bahawa media sosial lebih memberi implikasi terhadap pelajar lelaki berbanding pelajar perempuan. Ujian T telah dijalankan untuk mengetahui dengan lebih lanjut mengenai pengaruh media sosial ke atas pencapaian akademik dengan melihat kepada perbezaan jantina. Dapatan dari ujian ini mendapati bahawa terdapat perbezaan yang signifikan berkaitan tahap pencapaian akademik di antara pelajar lelaki dan pelajar perempuan kesan daripada media sosial dimana ujian T merekodkan nilai t=4.667 pada tahap signifikan p=0.006 ($p<0.05$). Mengikut dapatan daripada ujian T dalam jadual di atas maka hipotesis H1 yang menjelaskan tidak terdapat perbezaan yang signifikan terhadap kesan penggunaan media sosial dan pencapaian akademik mengikut jantina ditolak.

5. Perbincangan dan Kesimpulan

Secara keseluruhan, kajian ini mendapati bahawa media sosial memberi kesan terhadap pencapaian akademik pelajar secara sederhana. Berdasarkan dapatan daripada soal selidik, media sosial telah digunakan dengan baik oleh kalangan pelajar sekaligus ianya tidak memberi kesan langsung kepada pencapaian akademik. Melalui kajian ini juga, media sosial didapati dapat membantu pelajar untuk meningkatkan kemahiran komunikasi. Kemahiran komunikasi ini boleh digunakan oleh pelajar dalam membantu kepada pencapaian akademik pelajar semasa di kelas. Dapatan ini adalah selari dengan kajian oleh Ida & Ratna Roshida (2021) yang mendapati media sosial tidak memberi pengaruh negatif kepada pencapaian akademik pelajar bahkan media sosial didapati mampu berfungsi sebagai medium untuk mengurangkan kelesuan selepas sesuatu tempoh pembelajaran. Media sosial secara amnya tidak memberi kesan negatif sekiranya digunakan dengan berhemah namun sebaliknya akan berlaku sekiranya masa untuk akses kepada media sosial tidak dikawal seperti dapatan oleh Arwansyah et.al (2022).

Kajian ini turut mendapati bahawa terdapat hubungan yang signifikan antara penggunaan media sosial terhadap pencapaian akademik pelajar dengan melihat kepada perbezaan di antara pelajar lelaki dan perempuan. Pelajar lelaki didapati lebih terkesan dengan pengaruh media sosial berbanding pelajar perempuan. Dapatan kajian ini menyokong dapatan kajian sebelumnya oleh Ogundele et.al (2023) dimana penggunaan media sosial memberi kesan yang lebih signifikan kepada pencapaian akademik melibatkan lelaki berbanding pelajar perempuan. Oleh yang demikian, kajian ini membuktikan terdapat perbezaan ketara pencapaian akademik ekoran daripada akses kepada media sosial oleh para pelajar.

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POLITEKNIK KOTA KINABALU

Evaluating The Effectiveness of The Diploma In Quantity Surveying Program At Politeknik Kota Kinabalu: Graduate Perspectives And Outcomes

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Abstract

This research aims to assess the effectiveness of the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu by evaluating recent graduates' perceptions and experiences. The focus is on determining how well the program's learning outcomes have been achieved and identifying areas for improvement. Through a detailed exit survey, we will gather data on graduates' technical knowledge, problem-solving abilities, communication skills, social responsibilities, and professional ethics. The findings will provide valuable insights for enhancing curriculum design and supporting continuous improvement in educational quality.

Keywords: Program Learning Outcomes, Program Exit Survey

1. Introduction

The Diploma in Quantity Surveying program at Politeknik Kota Kinabalu is designed to prepare students with the skills and knowledge needed to thrive in the construction and built environment industries. This research seeks to evaluate how effectively the program meets its intended learning outcomes. By collecting feedback from recent graduates, we aim to gain insights into their experiences and assess how well the program has equipped them for their professional careers. The findings from this study will provide valuable information for ongoing curriculum development, helping to keep the program relevant and aligned with industry demands.

The field of Quantity Surveying has evolved significantly over the years, necessitating the integration of both technical knowledge and soft skills to meet the demands of the construction and built environment industries. The Diploma in Quantity Surveying program at Politeknik Kota Kinabalu aims to produce well- rounded graduates who are not only technically proficient but also capable of effective communication, ethical practice, and lifelong learning. This study seeks to evaluate the effectiveness of this program through an exit survey of recent graduates. By examining the alignment between program learning outcomes and graduate experiences, this research aims to provide valuable insights for continuous curriculum improvement and professional development.

Recent studies highlight that graduates in quantity surveying often lack critical communication and teamwork skills, which are essential for the modern construction industry (Johnston & Smith, 2019). Employers have raised concerns regarding the soft skills gap among new graduates, citing inefficiencies in project management due to poor communication. Moreover, research from national employment data shows that 25% of graduates struggle to find employment due to inadequate technical and interpersonal skills (Lim et al., 2021). These issues emphasize the need for the Diploma in Quantity Surveying at Politeknik Kota Kinabalu to be rigorously assessed to ensure its relevance to industry demands.

The construction industry has undergone significant transformations with the integration of technologies like Building Information Modeling (BIM). BIM is reshaping the role of quantity surveyors, making digital literacy and collaboration critical skills (Wong & Cheung, 2020). Therefore, it is crucial that educational programs align with these evolving needs (Smith & Tan, 2021). This research aims to evaluate how well the Diploma in Quantity Surveying at Politeknik Kota Kinabalu prepares students for these changes, focusing on both technical proficiency and soft skills such as communication and teamwork.

2. Problem Statement

Despite offering a comprehensive curriculum, the Diploma in Quantity Surveying at Politeknik Kota Kinabalu has not been formally evaluated. With the growing complexity of the construction industry and increasing demand for well-rounded professionals, it is essential to assess whether graduates are meeting expectations in terms of both technical competencies and soft skills. This study aims to fill this gap by gathering and analyzing feedback from recent graduates to inform curriculum improvements."

3. Research Objectives

Based on the PEOs, the following are the research objectives:

- To evaluate the graduates' proficiency in applying technical and social science/humanities knowledge to well-defined quantity surveying problems, contributing to both professional and personal development.
- To assess the graduates' effectiveness in demonstrating technical skills, communicating with various stakeholders, and applying critical thinking to solve quantity surveying-related problems.
- To analyze the graduates' preparedness in recognizing contemporary knowledge and technologies for lifelong learning, adhering to professional ethics, and applying social and entrepreneurial skills in their future careers.

4. Literature Review

The role of Quantity Surveyors has expanded beyond traditional cost management to include a range of responsibilities such as contract administration, project management, and sustainability assessment. According to Ashworth and Perera (2018), the evolving nature of the construction industry requires Quantity Surveyors to possess a blend of technical skills and soft skills, such as communication and ethical decision - making. The integration of social science and humanities knowledge in Quantity Surveying education has also been emphasized to enhance the holistic development of graduates.

Moreover, effective communication skills are paramount in the Quantity Surveying profession, given the need to interact with various stakeholders, including clients, contractors, and regulatory bodies. Critical thinking and problem-solving skills are equally vital, as they enable Quantity Surveyors to navigate complex project challenges and make informed decisions. The importance of lifelong learning and keeping abreast of contemporary technologies is underscored by the rapid technological advancements in the industry, such as Building Information Modeling (BIM) (Wong & Fan, 2013).

Furthermore, the emphasis on professional ethics and social responsibilities is crucial in ensuring that Quantity Surveyors uphold the integrity and standards of the profession (Fellows & Liu, 2015). Basic entrepreneurship skills are increasingly recognized as essential for Quantity Surveyors, enabling them to explore diverse career opportunities and adapt to the changing market landscape (Akintoye & Hardcastle, 2003).

Technological advancements, particularly the adoption of BIM, have transformed quantity surveying practices. BIM integrates various aspects of project management and cost estimation, making it a crucial tool for modern quantity surveyors. Recent studies also suggest that graduates who are proficient in BIM are more likely to secure employment in top-tier construction firms

Previous research often overlooks the importance of ethical considerations and teamwork in the field of quantity surveying. For instance, while Cheung (2017) emphasizes the need for communication skills, the curriculum of many programs continues to focus predominantly on technical aspects, with little emphasis on interpersonal development. This study will fill that gap by evaluating both hard and soft skills, offering a more holistic assessment of how well the program prepares students for the professional world.

5. Research Methodology

This research employs a quantitative approach through an online survey to gather data from recent graduates of the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu. The survey is designed to assess the achievement of program learning outcomes and includes questions on technical knowledge, communication skills, ethical practices, and more.

The survey will be administered using Google Forms, a versatile and accessible tool that allows for efficient data collection and analysis. The questionnaire will include both closed-ended and Likert scale questions to capture quantitative data on graduates' perceptions and experiences. The survey used for this study consists of 17 closed-ended and Likert-scale questions. These questions were designed to assess key areas such as graduates' technical knowledge, communication skills, problem-solving abilities, and ethical practices. The survey link will be distributed via email to graduates who completed the program in the past academic year, ensuring a recent and relevant dataset.

A total of 50 graduates, who completed the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu in the past academic semester, participated in the survey. This represents approximately 90% of the total graduates from that cohort. While this is a significant response rate, there is a potential for **self-selection**

bias, as graduates who had positive experiences with the program may have been more likely to participate in the survey. To minimize this bias, efforts were made to reach all graduates through multiple follow-up calls and chat. However, the limitation remains that the responses may not fully represent the experiences of those who did not respond, which could affect the generalizability of the findings. The survey was distributed via group chat using Google Forms, a widely accessible platform that facilitated easy collection of responses.

The collected data will be analyzed using Microsoft Excel, a widely-used software for statistical analysis. Descriptive statistics, including mean and standard deviation, will be calculated to summarize the responses. Additionally, cross-tabulation and graphical representations will be employed to illustrate the relationships between different variables, such as the correlation between technical skills and perceived job preparedness.

The use of an online survey method presents certain limitations, including the potential for lower response rates compared to in-person surveys. Additionally, since the survey was distributed only to graduates from the past academic semester, the findings may not fully capture the long-term effectiveness of the program. Future research could mitigate these issues by employing a mixed-methods approach, including follow-up interviews or focus groups, to gain deeper insights and improve the robustness of the findings.

The analysis will focus on identifying trends and patterns in the data, providing insights into the effectiveness of the program in achieving its learning outcomes. The findings will be used to make recommendations for curriculum enhancement and to highlight areas where additional support or resources may be needed.

6. Research Analysis

This chapter provides a detailed analysis of the survey results collected from recent graduates of the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu. The analysis focuses on assessing the program's effectiveness in achieving its intended Program Learning Outcomes (PLOs). The survey data, presented in figures, include mean scores for each PLO, reflecting the graduates' self-assessed competencies in various areas. This chapter aims to interpret these results in the context of the research objectives and draw conclusions about the program's strengths and areas for improvement. We conducted a survey with 50 recent graduates. These graduates, who completed their studies within the past academic calendar, have since entered the professional world and brought with them a wealth of experiences and perspectives. Their feedback provides a valuable window into how the program has prepared them for the challenges and opportunities in their careers.

Mean Scores for PLO 1		
apply knowledge to produce and resolve quantity surveying related matters and problem to fulfils standards, regulations and stakeholders' requirement		
Item No	**Item Statement**	**Mean**
1	I am able to apply knowledge of Quantity Surveying courses in my program.	4.38
2	I am able to produce accurate and reliable quantity surveying documentation that meet standards, regulation and stakeholders' requirement	4.22
Average Mean for PLO 1		4.30

Figure 1

Figure 1 displays the mean scores for PLO 1, which focuses on the graduates' ability to apply technical and social science/humanities knowledge to well-defined quantity surveying problems. The mean scores for the two items, "I am able to apply knowledge of Quantity Surveying courses in my program" (4.38) and "I am able to produce accurate and reliable quantity surveying documentation that meet standards, regulation, and stakeholders' requirement" (4.22), indicate a high level of proficiency. The average mean score for PLO 1 is 4.30.

Mean Scores for PLO 2		
synthesize problems arise from quantity surveying matters and formulate strategies and solutions		
Item No	**Item Statement**	**Mean**
1	I am able to solve problems using methods, tools and skills related to quantity surveying program	4.14
2	I am able to think critically and logically to solve problem in planning, organizing and completing a task	4.24
Average Mean for PLO 2		4.19

Figure 2

Figure 2 presents the mean scores for PLO 2, which evaluates the graduates' problem-solving abilities. The scores for the items "I am able to solve problems using methods, tools, and skills related to quantity surveying program" (4.14) and "I am able to think critically and logically to solve problems in planning, organizing, and completing a task" (4.24) highlight a strong capability in critical thinking and problem-solving, with an average mean score of 4.19.

Mean Scores for PLO 3		
perform quantity surveying technical proficiency and skill by using appropriate solution		
Item No	**Item Statement**	**Mean**
1	I am able to demonstrate my practical skills effectively.	4.40
2	I am able to use computing technology for applications in my quantity surveying program.	4.50
Average Mean for PLO 3		4.45

Figure 3

Figure 3 shows the mean scores for PLO 3, related to technical proficiency. The items "I am able to demonstrate my practical skills effectively" (4.40) and "I am able to use computing technology for applications in my quantity surveying program" (4.50) reflect high levels of technical skills, resulting in an average mean score of 4.45.

Mean Scores for PLO 4		
demonstrate social skills and responsibilities in engaging with society and stakeholders		
Item No	**Item Statement**	**Mean**
1	I am able to work with different backgrounds peoples.	4.26
2	I have the capability to communicate effectively with others.	4.28
Average Mean for PLO 4		4.27

Figure 4

This figure outlines the mean scores for PLO 4, focusing on social skills and responsibilities. The items "I am able to work with people from different backgrounds" (4.26) and "I have the capability to communicate effectively with others" (4.28) suggest strong social skills and communication abilities, with an average mean score of 4.27.

Mean Scores for PLO 5		
organize relevant information and pursue new knowledge in lifelong learning		
Item No	**Item Statement**	**Mean**
1	I am able to continuously learn new skills and knowledge.	4.56
2	I am able to engage in continuous learning beyond the classroom.	4.36
Average Mean for PLO 5		4.46

Figure 5

Figure 5 highlights the mean scores for PLO 5, which pertains to lifelong learning. The items "I am able to continuously learn new skills and knowledge" (4.56) and "I am able to engage in continuous learning beyond the classroom" (4.36) indicate a strong commitment to lifelong learning, with an average mean score of 4.46.

Mean Scores for PLO 6		
integrate self-role as highly capable individual, contributing team member to convey ideas through effective communication methods		
Item No	**Item Statement**	**Mean**
1	I have the ability to work in a team with tolerance and respect	4.54
2	I am able to show good communication with team members and supervisors.	4.54
3	I am able to present and defend my ideas in a professional setting	4.38
Average Mean for PLO 6		4.48

Figure 6

This figure illustrates the mean scores for PLO 6, assessing teamwork and communication. The items "I have the ability to work in a team with tolerance and respect" and "I am able to show good communication with team members and supervisors" both scored 4.54, while "I am able to present and defend my ideas in a professional setting" scored 4.38. The average mean score for PLO 6 is 4.48.

Mean Scores for PLO 7		
adopt managerial capabilities and entrepreneurial mind set for career development		
Item No	**Item Statement**	**Mean**
1	I am able to apply basic entrepreneurship skills for future career development.	4.34
2	I am able to build/develop my career upon completion of my studies.	4.36
Average Mean for PLO 7		4.35

Figure 7

Figure 7 shows the mean scores for PLO 7, which focuses on managerial and entrepreneurial skills. The items "I am able to apply basic entrepreneurship skills for future career development" (4.34) and "I am able to build/develop my career upon completion of my studies" (4.36) indicate a strong entrepreneurial mindset, with an average mean score of 4.35.

Mean Scores for PLO 8		
share values, ethics and accountability in societal and professional engagement		
Item No	Item Statement	Mean
1	I have a responsibility to demonstrate work professionalism, integrity and ethics.	4.44
2	I am able to contribute positively to society through my professional work	4.46
Average Mean for PLO 8		4.35

Figure 8

This figure presents the mean scores for PLO 8, which involves professional ethics and societal contributions. The items "I have a responsibility to demonstrate work professionalism, integrity, and ethics" (4.44) and "I am able to contribute positively to society through my professional work" (4.46) highlight a strong sense of ethics and social responsibility, with an average mean score of 4.35.

Mean Scores for PLO 1 - 8		
Item No	PLO Statement	Mean
1	apply knowledge to produce and resolve quantity surveying related matters and problem to fulfils standards, regulations and stakeholders' requirement	4.30
2	synthesize problems arise from quantity surveying matters and formulate strategies and solutions	4.19
3	perform quantity surveying technical proficiency and skill by using appropriate solution	4.45
4	demonstrate social skills and responsibilities in engaging with society and stakeholders	4.27
5	organize relevant information and pursue new knowledge in lifelong learning	4.46
6	integrate self-role as highly capable individual, contributing team member to convey ideas through effective communication methods	4.48
7	adopt managerial capabilities and entrepreneurial mind set for career development	4.35
8	share values, ethics and accountability in societal and professional engagement	4.35
Average Mean for PLO 1 - 8		4.36

Figure 9

Figure 9 indicates that graduates generally feel well-prepared across various competencies, with an overall average mean score of 4.36 for all PLOs. Specifically, the highest mean score was observed in PLO 5, which pertains to lifelong learning, indicating that graduates feel confident in their ability to continuously learn and adapt (mean score: 4.46). This is closely followed by PLO 6, which focuses on effective communication and teamwork, highlighting the program's success in fostering these essential soft skills (mean score: 4.48).

PLO 3, which assesses technical proficiency and skills, also received high ratings (mean score: 4.45), demonstrating that the program effectively equips students with the necessary technical knowledge and abilities. Additionally, PLO 1, which covers the application of knowledge to resolve quantity surveying problems, received a solid score (mean score: 4.30), further emphasizing the graduates' confidence in their technical capabilities.

The lower yet still strong scores for PLOs 4, 7, and 8 (mean scores of 4.27, 4.35, and 4.35, respectively) suggest that while graduates feel adequately prepared in areas such as social skills, entrepreneurship, and ethical responsibilities, there is room for further enhancement.

Overall, the results reflect a positive perception of the program's effectiveness in preparing graduates for the professional world. However, continuous curriculum improvements are essential to maintain and enhance the quality of education, ensuring that it remains responsive to industry trends and the evolving needs of the workforce. This study contributes valuable insights for faculty and administrators, serving as a foundation for ongoing efforts to refine the program and support the holistic development of students.

The analysis of the survey data reveals that the graduates generally perceive themselves as well-prepared in various aspects covered by the PLOs. Specifically:

- **Objective 1:** The analysis demonstrates that the graduates have a solid foundation in applying technical and social science knowledge to quantity surveying problems (PLO 1), with a mean score of 4.30. This aligns with the first objective of evaluating graduates' proficiency in these areas.
- **Objective 2:** The results indicate strong capabilities in technical skills, critical thinking, and communication (PLOs 2, 3, and 4), with mean scores of 4.19, 4.45, and 4.27, respectively. This supports the second objective of assessing the graduates' effectiveness in these competencies.
- **Objective 3:** The high mean scores in lifelong learning, teamwork, entrepreneurship, and ethical practices (PLOs 5, 6, 7, and 8) suggest that the program has successfully instilled these values and skills in its graduates, reflecting the third objective.

Overall, the findings suggest that the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu has been effective in achieving its intended learning outcomes. The high mean scores across all PLOs indicate that graduates feel confident in their abilities and are well-prepared for their professional careers. This analysis provides a comprehensive overview of the program's strengths and highlights potential areas for further enhancement, ensuring continued relevance and responsiveness to industry needs.

7. Conclusion

The average mean score of 4.30 for PLO 1 reflects a generally high level of proficiency among graduates in applying quantity surveying knowledge. The results of this research could play a crucial role in shaping the academic and professional journeys of graduates from the Quantity Surveying program. By pinpointing both the strengths and areas that need improvement within the current curriculum, we can provide valuable guidance for future updates to the program. This will help ensure that graduates are well-equipped to meet the demands of the industry. Furthermore, this research will offer valuable insights to the wider educational community, shedding light on effective teaching and learning practices in the field of quantity surveying education.

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Evaluating Employer Satisfaction with Diploma in Quantity Surveying Graduates: A Survey on Technical Competence and Adaptability In The Construction Industry

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Abstract

This research paper aims to evaluate employer satisfaction with graduates from the Diploma in Quantity Surveying program at Politeknik Kota Kinabalu. The study assesses the alignment of graduates' competencies with the Program Educational Objectives (PEOs) which emphasize technical knowledge, communication skills, ethical problem-solving, and entrepreneurship. The findings highlight the significance of employer feedback in enhancing the QS curriculum to meet industry standards and expectations. The research underscores the critical role of QS professionals in the construction industry and the continuous need for curriculum development to produce graduates who can adapt to technological advancements and industry challenges.

Keywords: Diploma in Quantity Surveying, Employer Satisfaction

1. Introduction

The construction industry is a cornerstone of economic development, necessitating a continuous supply of highly skilled professionals to ensure its growth and sustainability. Quantity Surveying (QS) is a pivotal profession within this sector, involving the management of all costs related to building and civil engineering projects from the initial estimates to the final financial figures. The proficiency of Quantity Surveyors is crucial for ensuring that projects are completed within budget and meet the required quality standards. With the rapid advancements in technology and evolving challenges in the construction industry, QS graduates must be equipped with up-to-date knowledge and skills to remain relevant and competitive in the job market.

Politeknik Kota Kinabalu offers a QS program aimed at producing graduates who are knowledgeable, technically competent, effective communicators, ethical problem solvers, and lifelong learners. These attributes are encapsulated in the Program Educational Objectives (PEO) which guide the curriculum and teaching methods. Evaluating the effectiveness of the QS program in meeting these objectives is essential, and one effective method is through conducting an employer satisfaction survey. This survey assesses ho w well the graduates' competencies align with industry expectations and identifies areas for improvement in the curriculum.

2. Problem Statement

Despite the critical role of QS professionals in the construction industry, there is growing concern about the gap between the competencies of QS graduates and the expectations of employers. Employers frequently report deficiencies in certain practical skills among graduates, along with challenges in effective communication and preparedness to handle the ethical and innovative demands of the profession. This competency gap can hinder the employability of graduates and impact the overall quality of construction projects.

The QS program at Politeknik Kota Kinabalu is designed to address these issues by equipping students with the necessary skills and knowledge. However, it is crucial to regularly evaluate the program's effectiveness in achieving its PEOs. Understanding employer satisfaction is vital as it provides direct feedback from the industry regarding the preparedness and performance of graduates. This feedback can highlight specific areas where the program excels and where it needs improvement, ensuring that the curriculum remains relevant and up-to-date with industry standards.

Moreover, with rapid technological advancements and the increasing complexity of construction projects, QS professionals must continually adapt and upgrade their skills. Lifelong learning and entrepreneurial skills are becoming increasingly critical for successful career advancement in this dynamic field. Therefore, this research aims to analyze employer satisfaction concerning QS graduates from Politeknik Kota Kinabalu, focusing on the alignment of graduates' competencies with industry needs as outlined in the PEOs.

3. Research Objectives

Based on the PEOs, the research objectives are:

i. To assess the technical competence and adaptability of Quantity Surveying graduates in response to technological advancements and challenges in the construction industry.

ii. To evaluate the effectiveness of Quantity Surveying graduates in communication, social skills, leadership qualities, and their responsibility towards societal development.

iii. To analyze the capability of Quantity Surveying graduates in solving problems innovatively, creatively, and ethically, ensuring organizational security.

4. Literature Review

4.1 Importance of the Quantity Surveying Profession

Quantity Surveyors are crucial in the construction industry for their expertise in cost management, contract administration, and financial control. Their role ensures the financial viability of projects and helps in mitigating risks associated with construction. As the industry evolves, the demand for QS professionals who are technically competent and adaptable to new technologies increases. Smith (2016) emphasizes that the QS profession has grown beyond traditional cost management to include a wider range of responsibilities, such as project management and sustainability assessment. Johnson (2018) adds that technological advancements, like Building Information Modeling (BIM), have revolutionized the QS profession, necessitating ongoing skills development for practitioners to remain relevant.

Technological advancements, particularly Building Information Modeling (BIM) and other digital tools, have significantly transformed the role of Quantity Surveyors (QS). BIM offers a multidimensional platform for integrating design, construction, and operation processes, allowing for more precise cost estimation, project simulations, and improved collaboration among stakeholders (Tee et al., 2022). However, the rise of BIM has presented challenges for QS professionals. The automation of traditional QS tasks, such as quantity take-offs, threatens to reduce the need for manual intervention, potentially altering the profession's scope and reducing demand for QS services (Olatunji et al., 2010). Furthermore, while BIM enhances project efficiency, the steep learning curve and the need for specialized expertise in using BIM tools have created additional hurdles for QS practitioners who must adapt to remain competitive in a digitally driven construction landscape (Gee, 2010). Despite these challenges, the continued integration of BIM is likely to redefine the QS profession, emphasizing the importance of digital skills and interdisciplinary collaboration.

4.2 Roles of Quantity Surveying Profession

Quantity Surveyors (QS) are pivotal in the construction and other sectors by overseeing financial and contract administration throughout a project's life cycle. Traditionally, QS responsibilities focused on tasks such as preparing Bills of Quantities (BQ) and final accounts. However, their roles have broadened across multiple industries, including procurement, oil and gas, green building, and banking. In green construction, QS professionals are increasingly involved in sustainability strategy development, l ife cycle cost appraisals, and advising on eco-friendly designs, which include evaluating cost-effective options for sustainable projects (Salleh et al., 2020). Similarly, in the oil and gas sector, QS professionals manage procurement, risk analysis, and cost estimation, particularly for offshore projects and steelwork, highlighting their adaptability in complex industries (Odesanya & Ebhohimen, 2017). Moreover, in the banking sector, QS experts conduct technical appraisals for development loans, helping financial institutions assess the viability of construction projects, thus demonstrating the profession's versatility beyond traditional construction roles (Perera et al., 2007). The profession continues to evolve, adapting to emerging sectors and technological advancements (Salleh et al., 2020).

4.3 Employer Expectations and Satisfaction in the Construction Industry.

Employer expectations and satisfaction in the construction industry for Quantity Surveyors (QS) are shaped by various factors, notably job performance, communication, and salary. Employers often expect QS professionals to possess clarity in their roles and responsibilities, as this directly impacts their job satisfaction and, subsequently, productivity (Musa et al., 2012). Financial rewards, such as competitive salaries and bonuses, are also critical in fostering satisfaction, with many employers using these incentives to retain skilled QS professionals (Singh et al., 2004). In addition, a positive working environment, including supportive communication with superiors, significantly enhances job satisfaction for QS professionals (Javed et al., 2014). The combination of these factors clear job roles, adequate compensation, and a conducive work environment aligns with employer expectations and contributes to the overall satisfaction and performance of QS professionals.

4.4 Importance of Employer Satisfaction Toward Program Offer

Employer satisfaction is a critical indicator of the success of educational programs. Satisfied employers are more likely to hire graduates, provide positive feedback, and engage in collaborative efforts with educational institutions. This satisfaction also reflects the relevance and effectiveness of the curriculum in preparing students for real-world challenges. Williams and Walker (2017) conducted a study that highlights the direct correlation between employer satisfaction and the employability of graduates, showing that employers value graduates who can immediately contribute to their organizations. Brown (2019) further underscores that aligning curriculum with industry needs through continuous feedback from employers is essential for producing competent graduates.

4.5 Quantity Surveying Program Offered at Politeknik Kota Kinabalu

The QS program at Politeknik Kota Kinabalu aims to equip students with comprehensive knowledge and skills in quantity surveying. The curriculum includes modules on construction technology, contract management, cost planning, and professional practice. The program emphasizes practical training, industry engagement, and continuous learning to ensure graduates are well-prepared for the construction industry. The program structure is designed to balance theoretical knowledge with practical application, preparin g students to meet industry standards and expectations.

4.6 Studies on Employer Satisfaction

Previous studies have highlighted the importance of aligning educational outcomes with industry needs. Employers value graduates who are not only technically proficient but also possess strong communication, leadership, and ethical decision-making skills. Davis (2015) found that employers often look for graduates who exhibit problem-solving abilities and can work efficiently in teams, reflecting the need for comprehensive soft skills development in educational programs. Ahmad (2021) discusses the benefits of industry-education collaboration, noting that partnerships with industry stakeholders can provide valuable insights into curriculum development and help in aligning educational outcomes with market demands. Lee (2018) highlights the importance of continuous curriculum evaluation and enhancement based on employer feedback to ensure the relevance and effectiveness of QS programs.

Clark (2017) suggests that professional skills, including ethical practices and leadership qualities, are increasingly important in the QS profession and should be integral parts of the curriculum . Green (2020) supports this by emphasizing that ethical practices and professionalism are crucial for maintaining industry standards and trust, thus should be deeply embedded in QS education.

5. Research Methodology

This research employs a quantitative methodology to evaluate employer satisfaction with graduates of the Quantity Surveying (QS) program at Politeknik Kota Kinabalu. Quantitative research is suitable for this study as it allows for the systematic investigation of phenomena by gathering quantifiable data and performing statistical analysis. The research design focuses on descriptive analysis to summarize the data and provide insights into employer perceptions of graduate competencies.

Descriptive analysis involves calculating measures such as mean, median, standard deviation, minimum, and maximum values to understand the distribution and central tendency of the data collected from respondents. This method helps in identifying trends, patterns, and variations in employer satisfaction with different aspects of the QS graduates' performance.

5.1 Research Sample

The research sample consists of 8 employers who have hired graduates from the QS program at Politeknik Kota Kinabalu. Data will be collected through an online survey using Google Forms. This method is chosen for its efficiency and ability to reach a diverse group of respondents. The survey will include questions designed to assess various aspects of graduate performance as outlined in the Program Educational Objectives (PEOs).

The sample size of 8 respondents is considered sufficient for an initial exploratory study to gather preliminary insights. The respondents will be selected based on their direct experience working with QS graduates from Politeknik Kota Kinabalu, ensuring the relevance and accuracy of the feedback.

5.2 Research Instrument

The primary instrument for data collection and analysis is the Sistem Pengukuran Pencapaian PEO Unit Kejuteraan Awam & Alam Bina (S3Pukaab). This system is specifically designed to measure the achievement of PEOs in the context of civil engineering and built environment programs. The S3Pukaab instrument includes a set of criteria and metrics that align with the PEOs of the QS program, allowing for a comprehensive evaluation of graduate competencies.

The survey has been categorized into three categories. Part A, "Sector of Industry," aims to gather information on the specific industries in which respondents are employed, helping to categorize responses based on their industry sector. This is crucial for understanding any sector-specific trends or insights. Part B, "Years of Involvement," collects data on the duration of respondents' experience in their respective industries, which may influence their perspectives on employer satisfaction. Finally, Part C, "Employer Satisfaction," focuses on gauging respondents' satisfaction with their current employment, which can provide valuable insights into how factors like industry sector and years of involvement impact overall job satisfaction.

The survey will include items related to the following PEOs:

PEO 1: Knowledgeable, technically competent in Quantity Surveying discipline and able to adapt themselves with new technological advancement and challenges in construction industry.

PEO 2: Effective in communication and able to prepares them with social skills, leadership qualities, good moral behaviour and willing to be responsible towards developing country and community.

PEO 3: Capable to participate in solving problems related to quantity surveying matters innovatively, creatively and ethically to secure organizations against internal and external security threats.

PEO 4: Able to demonstrate entrepreneurship skills and recognize the need of lifelong learning for successful career advancement.

Respondents will rate graduates on a scale (e.g., 1 to 5) for each item related to the PEOs. The evalution will be based on the following scale:

i. Poor
ii. Fair
iii. Good
iv. Very good
v. Excellent

This research instrument is divided into two parts as shown in Figure 1

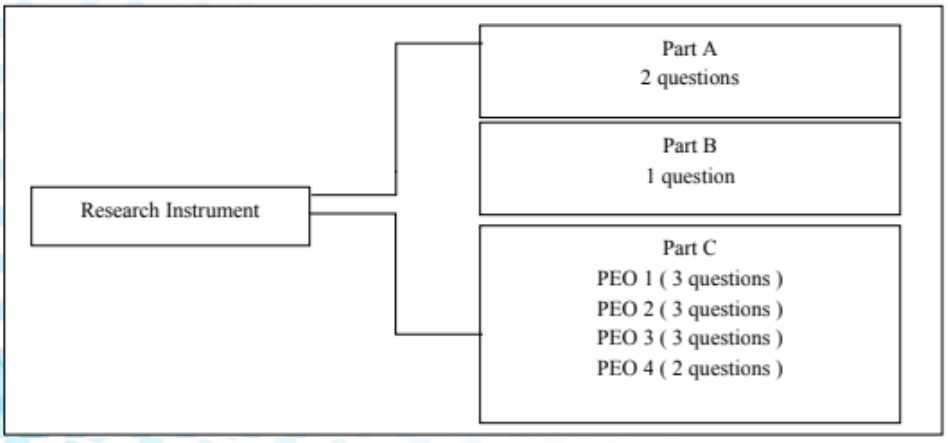

Figure 1

The data collected will be analyzed using descriptive statistics to calculate the mean, median, standard deviation, minimum, and maximum scores for each PEO. This analysis will provide a clear picture of how well the QS program meets its educational objectives from the perspective of employers. By using the quantitative research design, a well-defined sample, and a robust analysis instrument, this study aims to provide actionable insights into the effectiveness of the QS program at Politeknik Kota Kinabalu in preparing graduates for successful careers in the construction industry.

6. Data Analysis and Discussion

In this chapter, a comprehensive analysis of the data collected from the employer satisfaction survey regarding graduates of the Quantity Surveying (QS) program at Politeknik Kota Kinabalu. The primary objective of this analysis is to evaluate the alignment of graduates' competencies with the Program Educational Objectives (PEOs) and to identify areas for potential improvement in the curriculum. Utilizing descriptive statistical methods, this research will examine the mean, and standard deviation for each PEO to provide a detailed understanding of employer satisfaction.

The analysis of employer satisfaction data reveals several strengths in the Program Educational Objectives (PEOs) of the Quantity Surveying (QS) program at Politeknik Kota Kinabalu. These strengths are highlighted by the high mean scores across various PEOs, indicating a positive reception of the graduates' competencies by the employers.

6.1 Respondent Demography

Respondent Demography	
Item	**Responce**
Sector	
Government	3
Non-government	5
Involvement in the Industry	
<5 years	0
5 years – 10 years	0
>10 years	8

Figure 2

6.2 Scores Analysis for PEO

Mean Scores for PEO 1		
Item No	**Item Statement**	**Mean**
1	Knowledgeable in the fields of quantity surveying in accordance with the needs of the industry	4.38
2	Competent in the technical field of quantity surveying in accordance with the needs of the industry	4.50
3	Able to adapt to new technological advances in the construction industry	4.50
4	Able to adapt to any challenges in the construction industry	4.50
Average Mean for PEO 1		4.47

Figure 2

The average mean score for PEO 1 is 4.47, indicating that employers generally rate graduates highly in terms of their knowledge and technical competence in the Quantity Surveying discipline. Employers' ratings reflect that graduates are well-prepared to adapt to new technological advancements and challenges in the construction industry, demonstrating the effectiveness of the curriculum in covering current industry practices and innovations.

The high ratings align with the literature emphasizing the evolving role of Quantity Surveyors (QS) in the construction sector, where technical competence is crucial for managing costs and ensuring project viability. As noted by Smith (2016) and Johnson (2018), the QS profession now demands skills beyond traditional cost management, including project management and sustainability assessment, which necessitates continuous skills development, particularly in technological areas like Building Information Modeling (BIM) (Tee et al., 2022). This suggests that the QS curriculum at Politeknik Kota Kinabalu is effective in preparing students for these challenges, particularly with respect to BIM and other digital tools, supporting the employability of graduates.

Mean Scores for PEO 2		
Item No	**Item Statement**	**Mean**
1	Able to communicate well	4.50
2	Have good social skills	4.38
3	Have good leadership qualities	4.25
4	Have good morals and attitude	4.63
5	Ready to take responsibility for the development of the country and society	4.38
Average Mean for PEO 1		4.43

Figure 3

The mean score of 4.43 for PEO 2 shows that employers find graduates effective in communication, an essential skill for successful project management and client relations in the construction industry. The high scores in this PEO reflect the program's success in preparing graduates with the social skills, leadership qualities, and ethical standards required for professional conduct and team management.

These findings are consistent with research by Williams and Walker (2017), who highlighted that employer satisfaction with graduates often stems from their soft skills, such as communication and leadership, in addition to technical knowledge. The data also reflects the importance of social skills in project management and team coordination, as supported by Musa et al. (2012). Furthermore, employers appreciate graduates' leadership abilities, which are essential for guiding project teams, echoing the need fo r continuous development of leadership skills emphasized in QS education (Clark, 2017).

Mean Scores for PEO 3		
Item No	**Item Statement**	**Mean**
1	Able to participate in solving problems related to the field of quantity surveying in an innovative and creative way	4.38
2	Ethical in protecting the organization from any internal threats	4.25
3	Ethical in protecting the organization from any external threats	4.25
Average Mean for PEO 1		4.29

Figure 4

Employers have given a high mean score of 4.29 for PEO 3, indicating that graduates are perceived as capable of solving problems innovatively and creatively. This suggests that the program effectively fosters critical thinking and problem-solving skills. The feedback suggests that graduates are well-prepared to tackle complex issues and provide innovative solutions, aligning with the dynamic and challenging nature of the construction industry.

As the literature suggests, the construction industry increasingly values innovation and creativity in solving complex problems (Ahmad, 2021; Lee, 2018). QS professionals are expected to offer innovative solutions while maintaining high ethical standards, particularly in protecting organizations from internal and external threats (Olatunji et al., 2010). The strong scores in this area suggest that the QS program at Politeknik Kota Kinabalu effectively fosters both innovative thinking and ethical decision-making, aligning with industry expectations (Green, 2020).

Mean Scores for PEO 4		
Item No	**Item Statement**	**Mean**
1	Apply the entrepreneurial skills learned for career advancement	3.88
2	Recognize the need for lifelong learning for career advancement	4.38
Average Mean for PEO 1		4.13

Figure 5

With a mean score of 4.13, employers recognize the entrepreneurial skills of graduates, indicating that the program successfully incorporates elements of business acumen and innovation. The program's focus on lifelong learning and entrepreneurship equips graduates with the mindset and skills necessary for career advancement and adaptation to future industry trends.

The findings support literature's emphasis on the growing importance of entrepreneurial skills and the need for continuous learning in the construction sector (Brown, 2019). The curriculum's focus on entrepreneurship equips graduates with a forward-thinking mindset necessary for navigating a competitive job market and advancing in their careers (Salleh et al., 2020). Employers' appreciation of these skills shows that the program aligns with industry trends, particularly the need for QS professionals to adap t to technological and market changes over time.

7. Conclusion

The analysis of the employer satisfaction data demonstrates that graduates from the QS program at Politeknik Kota Kinabalu are well-equipped to meet industry standards in terms of technical competence, communication, leadership, problem-solving, and ethical behavior. The alignment of these findings with the literature reinforces the importance of continuous curriculum development to ensure graduates remain competitive and relevant in an evolving construction landscape.

The strengths identified in the PEOs indicate that the QS program at Politeknik Kota Kinabalu is highly effective in preparing graduates with the necessary knowledge, technical skills, communication abilities, ethical standards, problem-solving capabilities, entrepreneurial mindset, and commitment to lifelong learning. These strengths are reflected in the positive feedback from employers, underscoring the program's success in meeting industry expectations and preparing graduates for successful careers in the construction sector. The consistent high ratings across various competencies highlight the program's comprehensive and balanced approach to Quantity Surveying education.

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Hubungan Tahap Pencapaian Matematik SPM Terhadap Keputusan Matematik 1 Program Asasi Tvet di Politeknik Tuanku Syed Sirajuddin

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Abstract

The outcomes achieved by students in Mathematics at the higher education level are influenced by various factors. There is a study conducted by researchers indicating that these outcomes stem from foundational weaknesses in Mathematics during secondary school. Therefore, this quantitative study aims to examine the performance of students in SPM Modern Mathematics, SPM Additional Mathematics, and Engineering Mathematics 1 in the Tvet Foundation Program, as well as the relationship and influence of Modern Mathematics and Additional Mathematics on the performance in Engineering Mathematics 1 of the Tvet Foundation Program. The sample for this study consists of 78 students who took the Engineering Mathematics 1 course in semester 1. The data obtained were analyzed using Statistical Packages For Social Sciences (SPSS) version 26.0, employing descriptive analysis and Spearman-Rho correlation. Findings from the descriptive analysis indicate that the achievement in SPM Modern Mathematics based on the minimum score obtained is at a high and very satisfactory level. On the other hand, the achievement for SPM Additional Mathematics is at a low and unsatisfactory level, while the achievement in Engineering Mathematics 1 of the Tvet Foundation Program obtained a minimum score at a moderate and fairly satisfactory level. Findings from the Spearman correlation analysis show that there is no significant correlation between SPM Modern Mathematics and Engineering Mathematics 1 of the Tvet Foundation Program ($r = 0.168$), whereas there is a strong correlation between SPM Additional Mathematics and Engineering Mathematics 1 of the Tvet Foundation Program ($r = 0.597$). Overall, this study concludes that SPM Additional Mathematics is crucial and has a stronger impact compared to SPM Modern Mathematics in influencing the outcomes of Engineering Mathematics 1 in the Tvet Foundation Program.

Keywords: SPM; Tvet Foundation; Mathematics;

Abstrak

Keputusan yang diperolehi pelajar dalam subjek Matematik di peringkat pengajian tinggi dipengaruhi oleh pelbagai faktor. Terdapat kajian yang dilakukan oleh penyelidik menyatakan ianya berpunca dari kelemahan asas Matematik semasa di peringkat sekolah menengah. Oleh itu, kajian kuantitatif ini bertujuan untuk melihat pencapaian pelajar dalam Matematik Moden SPM, Matematik Tambahan SPM dan Matematik Kejuruteraan 1 Program Asasi Tvet serta hubungan dan pengaruh Matematik Moden dan Matematik Tambahan dengan pencapaian Matematik 1 Program Asasi Tvet. Sampel bagi kajian ini seramai 78 orang pelajar yang telah mengambil kursus Matematik Kejuruteraan 1 pada semester 1. Data yang diperolehi dianalisis menggunakan perisian Statistical Packages For Social Sciences (SPSS) versi 26.0 iaitu dengan melakukan analisis deskriptif dan Korelasi Spearman-Rho. Dapatan daripada analisis deskriptif mendapati pencapaian Matematik Moden SPM berdasarkan skor min data yang diperolehi adalah berada pada tahap tinggi dan sangat memuaskan. Pencapaian bagi Matematik Tambahan SPM pula berada pada tahap rendah dan tidak memuaskan, manakala pencapaian Matematik 1 Program Asasi Tvet memperolehi skor min pada tahap sederhana dan agak memuaskan. Dapatan dari analisis Korelasi Spearman mendapati bahawa tidak terdapat hubungan di antara Matematik Moden SPM dengan Matematik Kejuruteraan 1 Asasi Tvet iaitu $r = 0.168$ manakala terdapat hubungan yang kuat di antara Matematik Tambahan SPM dengan Matematik Kejuruteraan 1 Program Asasi Tvet iaitu $r=0.597$. Secara keseluruhannya dalam kajian ini, mendapati Matematik Tambahan SPM adalah penting dan mempunyai kesan yang lebih kuat berbanding Matematik Moden SPM dalam mempengaruhi keputusan Matematik 1 Asasi Tvet.

Kata Kunci: SPM; Tvet Foundation; Mathematics;

1. Pengenalan

Program Asasi Tvet mula dilaksanakan bagi kumpulan pelajar pertama pada Julai 2023 di lima (5) buah Politeknik Malaysia. Politeknik Tuanku Syed Sirajuddin merupakan antara politeknik yang terpilih melaksanakan program ini. Para pelajar yang mengikuti program ini dikehendaki mengambil lapan belas (18) kursus dalam tempoh dua (2) semester. Dua (2) daripada kursus tersebut merupakan kursus Matematik 1 dan Matematik 2. Tidak semua kursus-kursus yang diambil ini akan dikira untuk markah hpnm bagi permohonan ke universiti. Hanya terdapat empat (4) kursus teras sahaja dikira untuk kemasukan ke universiti bagi Program Sarjana Muda Teknologi Kejuruteraan. Kursus wajib bagi pengiraan tersebut adalah kursus Matematik 1 dan Matematik 2 yang dikira sebagai satu kursus di mana markahnya diambil secara purata manakala tiga (3) kursus teras yang lain akan dipilih berdasarkah markah terbaik yang diperolehi oleh pelajar.

Oleh itu, pencapaian pelajar dalam kursus Matematik di peringkat Program Asasi Tvet adalah sangat penting. Selain itu, kegunaan dan kepentingan matematik itu sendiri sangat meluas. Matematik mempunyai kegunaannya dalam hampir semua bidang pengajian termasuklah dalam bidang teknologi kejuruteraan. Malah, matematik adalah satu kemahiran yang mana diaplikasikan dalam banyak bidang yang lain termasuk sains, perniagaan dan juga sains sosial. Kerana kepentingannya, banyak institusi pengajian tinggi memerlukan kelulusan kredit dari pelajar sekolah menengah yang ingin belajar di pelbagai kursus di institusi ini (A.Awodun et.al, 2013).

Penguasaan pelajar dalam matematik biasanya diukur berdasarkan gred yang diperolehi oleh pelajar tersebut. Manakala pencapaian gred pelajar pula ditentukan oleh banyak faktor pembolehubah. Oleh itu, kajian ini mengkaji hubungan pencapaian Matematik Moden SPM dan Matematik Tambahan SPM dengan keputusan markah bagi kursus Matematik 1 di peringkat Program Asasi Tvet. Namun, kajian ini hanyalah merangkumi kajian kes bagi kumpulan pelajar Asasi Tvet di Politeknik Tuanku Syed Sirajuddin sahaja.

2. Objektif Kajian

Objektif utama kajian penyelidikan ini adalah untuk mengkaji hubungan pencapaian Matematik SPM dengan keputusan kursus Matematik 1 Program Asasi Tvet.

Objektif khusus kajian ini adalah seperti berikut:

i. Mengkaji tahap pencapaian Matematik Moden SPM.

ii. Mengkaji tahap pencapaian Matematik Tambahan SPM.

iii. Mengkaji tahap pencapaian Matematik 1 Program Asasi Tvet.

iv. Mengkaji hubungan yang signifikan antara pencapaian Matematik Moden SPM dengan keputusan Matematik 1 Program Asasi Tvet

v. Mengkaji hubungan yang signifikan antara pencapaian Matematik Tambahan SPM dengan keputusan Matematik 1 Program Asasi Tvet.

3. Persoalan Kajian

Dalam kajian ini penyelidik mengemukakan persoalan kajian bagi menentukan objektif kajian tercapai iaitu:

i. Apakah pencapaian pelajar dalam mata Pelajaran Matematik SPM dan Matematik 1 Asasi Tvet.

ii. Adakah mata Pelajaran Matematik Moden di peringkat SPM mempunyai hubungan dengan keputusan Matematik 1 Program Asasi Tvet di Politeknik Tuanku Syed Sirajuddin (PTSS).

iii. Adakah mata Pelajaran Matematik Tambahan di peringkat SPM mempunyai hubungan dengan keputusan Matematik 1 Program Asasi Tvet di Politeknik Tuanku Syed Sirajuddin (PTSS).

4. Skop Kajian

Kajian ini dilaksanakan di PTSS . Responden merupakan pelajar Program Asasi Tvet kumpulan pertama iaitu seramai 78 orang yang telah mengambil Matematik Moden, Matematik Tambahan di peringkat SPM dan Matematik Kejuruteraan 1 di semester 1 Program Asasi Tvet.

Data Keputusan Matematik SPM pelajar diperolehi melalui data Hal Ehwal Pelajar PTSS manakala data bagi keputusan kursus Matematik 1 Program Asasi Tvet diperolehi dari Unit Peperiksaan PTSS melalui pautan Sistem Pengurusan Maklumat Pelajar (SPMP).

5. Kajian Literatur

Terdapat pelbagai faktor yang mempengaruhi pencapaian gred matematik pelajar. Berdasarkan kajian yang dijalankan oleh Mohd Rizal dan Yin Yeh Ling(2021) mendapati bahawa pelajar yang gagal dalam matematik adalah berpunca daripada tahap keyakinan diri yang rendah dan masalah kehidupan peribadi pelajar. Kajian ini juga telah menyenaraikan beberapa strategi yang perlu dilaksanakan oleh pelajar bagi menguasai konsep asas dalam matematik. Antaranya ialah bersedia melakukan perubahan kecil dalam pembelajaran, mem bina keyakinan diri bersama rakan sebaya dan juga perlu mengambil inisiatif dalam mengenalpasti masalah dan mencari penyelesaiannya.

Selain itu terdapat juga faktor lain yang turut memainkan peranan dalam menyumbang kepada pencapaian pelajar di peringkat pengajian tinggi. Berdasarkan tinjauan literatur oleh penyelidik lain, kebanyakannya mengkaji hubungan gred Matematik SPM dengan subjek Matematik lanjutan di peringkat lebih tinggi misalnya bagi pelajar tingkatan 6, pra-universiti, diploma dan juga ijazah. Terdapat dapatan yang menyokong adanya hubungan kuat diantara pencapaian pelajar dalam Matematik di peringkat SPM terutamanya Matematik Tambahan dengan pencapaian Matematik di peringkat pengajian tinggi.

Berdasarkan kajian yang dibuat oleh Norazlina binti Ahmad (2017), menggambarkan jika pelajar berupaya mencapai keputusan yang baik dalam Matematik SPM maka dapat membantu pelajar menguasai kursus kejuruteraan di politeknik. Oleh itu, kebanyakan pelajar yang memperolehi keputusan yang baik dan cemerlang bagi subjek Matematik dan Matematik Tambahan SPM akan dapat mengekalkan prestasi mereka dalam sebarang kursus yang melibatkan pengiraan semasa peringkat pengajian tinggi.

Kajian Rozinah@Nurhaizi binti Ramli, Hasanah binti Shafie@ Safien, Muhamad Izzat bin Badarudin (2020), ini mendapati pencapaian Matematik Tambahan di peringkat SPM mempengaruhi pencapaian kursus Matematik Kejuruteraan 1 dan Matematik Kejuruteraan 2 di Politeknik Kota Bharu. Dalam kajian ini mencadangkan agar pihak pengambilan politeknik lebih memberi perhatian terhadap kelayakan pelajar yang ingin menyambung dalam bidang kejuruteraan berdasarkan mata pelajaran Matematik Tambahan di peringkat SPM. Hal ini kerana pelajar lemah akan tertekan dengan kursus yang melibatkan pengiraan yang akan mereka pelajari disebabkan kurang mahir.

Berdasarkan Siti, Noor'Aina, Maisurah dan Fadzilawani (2017) mendapati bahawa pelajar pra diploma mendapat skor yang agak rendah sekiranya gred Matematik Moden SPM kurang cemerlang dan sebaliknya. Namun, kajian ini hanyalah memberi penekanan kepada asas matematik sahaja.

Asiahwati (2017) mendapati bahawa pelajar yang mendapat gred Matematik SPM yang cemerlang berada dalam tahap numerasi yang tinggi. Dapatan juga menunjukkan wujudnya hubungan linear positif yang sederhana kuat antara gred Matematik SPM dengan tahap numerasi pelajar lepasan menengah (Tingkatan 6) dalam bidang Nombor.

Nor, Nurul, dan Amran (2019) mendapati bahawa terdapat kesinambungan pengetahuan dan kemahiran matematik bagi Matematik SPM, Matematik Kejuruteraan 1, 2 dan 3. Sehubungan itu, pelajar -pelajar perlu menguasai kesemua kemahiran matematik yang asas bagi membolehkan mereka mendapat skor yang cemerlang bagi matematik di peringkat seterusnya.

Hasil dapatan Husnira, Marina dan Rohayu (2018) dari analisis regresi menunjukkan bahawa terdapat hubungan positif yang signifikan antara pencapaian Matematik SPM dengan pencapaian Matematik Kejuruteraan 2 di politeknik dan ini juga membuktikan bahawa Matematik Tambahan SPM adalah salah satu medium untuk kecemerlangan pelajar dalam bidang Kejuruteraan Matematik 2 di politeknik.

Namun terdapat perbezaan pula dengan beberapa kajian yang lain di mana pencapaian pelajar dalam matapelajaran matematik di peringkat SPM tidak memberi hubungan linear secara positif dengan pencapaian pelajar di peringkat pengajian tinggi.

Kajian yang dijalankan oleh Maisurah, Noor 'Aina, Siti dan Fadzilawani (2017) yang menemui dapatan bahawa pelajar yang cemerlang dalam Matematik Moden SPM tidak semestinya mempunyai tahap asas matematik yang baik.

Kajian Siti Balqis Mahlan, Fadzilawani Astifar Alias, Maisurah Shamsudin (2022) ini mendapati pencapaian subjek statistik di peringkat ijazah kurang dipengaruhi oleh pencapaian Matematik Moden dan Matematik Tambahan SPM. Dalam kajian ini juga mendapati terdapat pelajar yang cemerlang SPM namun memperolehi prestasi yang kurang memuaskan apabila memasuki ke peringkat pengajian tinggi. Perkara ini terjadi mungkin disebabkan oleh faktor-faktor lain seperti minat, sikap pelajar, kaedah pengajaran pensyarah dan dorongan ibu-bapa.

Kajian Wan Izyani Wan Jusoh, Wan Saliha Wan Alwi, Muhammad Ikmal Syakir Bustamam, Azahan Daud

(2020) ini mendapati gred pencapaian Matematik Tambahan SPM tidak memberi pengaruh yang besar terhadap gred pencapaian kursus matematik kejuruteraan bagi pelajar yang bergraduat pada masanya. Dalam kajian ini mencadangkan kepentingan peranan pensyarah dalam membimbing dan memberi motivasi kepada pelajar untuk berjaya. Selain itu, program kecemerlangan yang memberi tumpuan kepada kefahaman pelajar juga perlu dilakukan terhadap mereka yang tiada asas bagi mata pelajaran Matematik Tambahan di peringkat SPM.

Terdapat juga sorotan kajian yang lepas mendapati terdapat perbezaan antara hubungan Matematik Moden dengan Matematik Tambahan dengan pencapaian pelajar di peringkat pengajian tinggi. Menurut kajian Wan Mohd Zawawi Wan Yunus, Ade Azman Ahmad, Rohaizad Salleh (2017) ini mendapati asas dalam Matematik Tambahan adalah penting dan mempunyai kesan yang lebih kuat berbanding Matematik Moden dalam mempengaruhi pencapaian Matematik Kejuruteraan 2. Ini disebabkan pelajar-pelajar yang mengambil mata pelajaran Matematik Tambahan di peringkat SPM telah mempunyai pendedahan dan kemahiran awal topik- topik seperti Indeks, Logaritma, Pembezaan dan Pengamiran.

6. Metodologi Kajian

6.1 Rekabentuk Kajian

Data yang digunakan dalam kajian ini merupakan data kuantitatif iaitu data dalam bentuk angka. Data yang dikumpul akan diproses menggunakan perisian Statistical Packages For Social Sciences (SPSS) version 26.0. Data yang terkumpul dianalisis dengan analisis statistik deskriptif dan Korelasi Spearman-Rho.

6.2 Persampelan

Instrumen data melibatkan 78 orang pelajar. Gred pencapaian pelajar bagi matapelajaran Matematik Moden SPM, Matematik Tambahan SPM dan Matematik 1 Program Asasi Tvet diklasifikasikan dalam bentuk skala likert seperti berikut:

Jadual 1. Klasifikasi Gred Markah Matematik SPM

Gred Matematik Moden/Matematik Tambahan	Skala
A, A, A-	5
B+, B	4
C+, C	3
D, E	2
G	1

Jadual 2. Klasifikasi Gred Markah Matematik 1 Program Asasi

Gred Matematik 1 Asasi TVET	Skala
A, A-	5
B+, B	4
B-	3
C+, C	2
C-, D+, D, E, F	1

6.3 Prosedur Menganalisis Data

Pengkaji menganalisis data deskriptif bagi memperolehi nilai skor min dan sisihan piawai untuk mengkaji tahap pencapaian Matematik Moden SPM, Matematik Tambahan SPM dan Matematik 1 Program Asasi Tvet. Selain itu, bagi memperolehi hubungan yang signifikan antara pencapaian Matematik Moden SPM dengan Matematik 1 Program Asasi Tvet dan hubungan yang signifikan antara pencapaian Matematik Tambahan SPM dengan Matematik 1 Program Asasi Tvet, pengkaji menggunakan kaedah Korelasi Spearman-Rho. Hipotesis nul H_{01} diuji bagi menunjukkan hubungan Matematik Moden dengan Matematik 1 manakala hipotesis nul H_{02} diuji bagi menunjukkan pencapaian Matematik Tambahan dengan Matematik 1. Data bagi pembolehubah bebas dalam kajian ini adalah gred bagi matapelajaran Matematik Moden SPM dan Matematik Tambahan SPM manakala data pembolehubah bersandar dalam kajian ini adalah merujuk kepada gred Matematik 1 Program Asasi Tvet. Hubungan pembolehubah yang dianalisis ini akan mengambilkira kekuatan hubungan berpandukan kepada Skala Kekuatan Hubungan oleh Cohen, Manion dan Marrison (2011) seperti jadual 3.

Jadual 3. Pekali Nilai Kolerasi

Saiz Pekali Korelasi	Kekuatan Korelasi
±0.80 – 1.00	Sangat Kuat
±0.51 – 0.80	Kuat
±0.31 – 0.50	Sederhana
±0.21 – 0.30	Lemah
±0.01 – 0.20	Sangat Lemah

6.4 Analisis dan Perbincangan

Dalam analisis statistik deskriptif, pengkaji telah menjalankan tiga (3) analisis bagi mengenalpasti tahap pembolehubah iaitu pencapaian Matematik Moden SPM, pencapaian Matematik Tambahan SPM dan pencapaian Matematik 1 Program Asasi Tvet melalui nilai skor min dan nilai sisihan piawai. Nilai skor min yang digunakan adalah dalam julat 1.00 hingga 5.00 dan tahap pembolehubah ini diklasifikasikan kepada tiga tahap iaitu tahap rendah dan tidak memuaskan, tahap sederhana dan agak memuaskan dan tahap tinggi dan memuaskan. Interpretasi tahap skor min bagi pembolehubah kajian adalah seperti jadual 4 di bawah yang digunakan hasil pengubahsuaian Zulkifli Awang (2012).

Jadual 4. Interpretasi Skor Min bagi Pemboleh Ubah

Skor Min	Interpretasi
1.00 hingga 2.49	Rendah dan tidak memuaskan
2.50 hingga 3.79	Sederhana dan agak memuaskan
3.80 hingga 5.00	Tinggi dan sangat memuaskan

Jadual 5. Statistik Diskriptif Bagi Pencapaian Matematik Moden

N=78	Min	Max	Skor Min	Sisihan Piawai	Interpretasi
Matematik Moden	3	5	4.91	.36701	Tinggi dan sangat memuaskan

Jadual 6. Statistik Diskriptif Bagi Pencapaian Matematik Tambahan

N=78	Min	Max	Skor Min	Sisihan Piawai	Interpretasi
Matematik Tambahan	1	5	2.12	.89075	Rendah dan tidak memuaskan

Jadual 7. Statistik Diskriptif Bagi Pencapaian Matematik 1 Asasi Tvet

N=78	Min	Max	Skor Min	Sisihan Piawai	Interpretasi
Matematik 1 Asasi Tvet	2	5	3.10	1.16875	Sederhana dan agak memuaskan

Berdasarkan Jadual 5 di atas, pencapaian Matematik Moden SPM berdasarkan skor min data yang diperolehi adalah berada pada tahap tinggi dan sangat memuaskan (M=4.91, SP=0.36701). Pencapaian bagi Matematik Tambahan SPM pula berada pada tahap rendah dan tidak memuaskan (M=2.12, SP=0.89075) sepertimana Jadual 6 manakala pencapaian Matematik 1 Program Asasi Tvet memperolehi skor min pada tahap sederhana dan agak memuaskan (M=3.10, SP=1.16875) sepertimana Jadual 7.

6.5 Pengujian Hipotesis

Terdapat dua jenis pengujian hipotesis iaitu H01 yang merujuk kepada tidak terdapat hubungan antara pencapaian Matematik Moden SPM dengan pencapaian Matematik 1 Program Asasi Tvet dan H02 yang merujuk kepada tidak terdapat hubungan antara pencapaian Matematik Tambahan SPM dengan pencapaian Matematik 1 Program Asasi Tvet.

Bagi menguji hipotesis nul pertama di dalam kajian ini, ujian Kolerasi Spearman-Rho dijalankan secara

statistik bagi melihat hubungan pembolehubah bebas (Matematik Moden SPM) dengan pembolehubah bersandar (Matematik Kejuruteraan 1 Asasi Tvet).

Jadual 8. Kolerasi Spearman-Rho antara Pencapaian Matematik Moden SPM dengan Pencapaian Matematik 1 Program Asasi Tvet

			MateModen	Mate1Asasi
Spearman's rho	**MateModern**	**Correlation Coefficient**	1.000	.168
		Sig. (2-tailed)		.141
		N	78	78
	Mate1Asasi	**Correlation Coefficient**	.168	1.00
		Sig. (2-tailed)	.141	
		N	78	78

Berdasarkan Jadual 8, didapati nilai r = .168 di mana data ini menunjukkan terdapat korelasi yang sangat lemah. Nilai p = .141 yang diperolehi pula adalah tidak signifikan (p>0.05). Maka hipotesis nul pertama di dalam kajian ini diterima di mana tidak terdapat hubungan Matematik Moden SPM dengan Matematik Kejuruteraan 1 Asasi Tvet. Ini juga menunjukkan tidak ada bukti kukuh yang dapat mengatakan terdapat hubungan linear positif di antara pencapaian Matematik 1 dengan gred Matematik Moden SPM.

Bagi menguji hipotesis nul kedua di dalam kajian ini, ujian Kolerasi Spearman-Rho turut dijalankan secara statistik bagi melihat hubungan pembolehubah bebas (Matematik Tambahan SPM) dengan pembolehubah bersandar (Matematik Kejuruteraan 1 Asasi Tvet).

Jadual 9. Kolerasi Spearman-Rho antara Pencapaian Matematik Tambahan SPM dengan Pencapaian Matematik 1 Program Asasi Tvet

			MateTamb	Mate1Asasi
Spearman's rho	**MateModern**	**Correlation Coefficient**	1.000	.597**
		Sig. (2-tailed)		.000
		N	78	78
	Mate1Asasi	**Correlation Coefficient**	.597**	1.00
		Sig. (2-tailed)	.000	
		N	78	78

** Correlation is significant at the 0.01 level (2-tailed)

Berdasarkan Jadual 9, didapati nilai r = .597 di mana data ini menunjukkan terdapat korelasi yang kuat diantara Matematik Tambahan SPM dengan Matematik Kejuruteraan 1 Program Asasi Tvet. Nilai p<0.01 yang diperolehi pula menunjukkan bahawa terdapat hubungan yang signifikan diantara Matematik Tambahan SPM dengan Matematik Kejuruteraan 1 Program Asasi Tvet. Maka hipotesis nul kedua bagi hubungan diantara Matematik Tambahan SPM dengan Matematik Kejuruteraan 1 Program Asasi Tvet ditolak di dalam kajian ini. Ini membuktikan terdapat hubungan linear positif di antara pencapaian Matematik 1 dengan gred Matematik Tambahan SPM.

7. Kesimpulan dan Cadangan

Berdasarkan kajian yang dijalankan ini didapati pelajar-pelajar Asasi Tvet Politeknik Tuanku Syed Sirajuddin mempunyai latarbelakang pencapaian Matematik Moden SPM pada tahap yang tinggi manakala pencapaian Matematik Tambahan SPM pula berada pada tahap yang rendah. Seterusnya, diperingkat pengajian asasi tvet, keputusan pelajar-pelajar ini bagi kursus Matematik 1 adalah pada tahap yang sederhana. Hubungan pencapaian Matematik Moden SPM dengan pencapaian Matematik 1 Program Asasi Tvet adalah sangat lemah dan tidak signifikan manakala hubungan pencapaian Matematik Tambahan SPM dengan Matematik 1 Program Asasi Tvet pula adalah kuat dan signifikan. Oleh itu, pelajar yang cemerlang bagi mata pelajaran Matematik Tambahan SPM mempunyai kelebihan untuk cemerlang dalam kursus Matematik 1 di peringkat asasi. Walaubagaimanapun pelajar yang tidak cemerlang bagi matapelajaran Matematik Tambahan diperingkat SPM bukanlah bererti pelajar tidak boleh cemerlang bagi kursus Matematik 1 di peringkat asasi ini kerana semua topik-topik tersebut, akan dipelajari semula diperingkat asas. Oleh itu, pelajar-pelajar ini masih mempunyai peluang yang baik untuk cemerlang di peringkat asasi seterusnya di peringkat sarjana muda dalam bidang teknologi kejuruteraan. Daripada kajian ini juga, pihak politeknik khususnya para pensyarah matematik boleh menjadikan panduan untuk memberi perhatian yang lebih kepada kumpulan pelajar yang lemah dalam pencapaian Matematik Tambahan atau yang tidak mengambil Matematik Tambahan di peringkat SPM dengan menyusun program seperti kelas tambahan, bengkel atau klinik matematik. Ini kerana silibus

bagi Matematik 1 program Asasi Tvet ini banyak melibatkan mata pelajaran Matematik Tambahan dan bilangan topik yang akan dipelajari juga agak banyak. Jadi tempoh masa pertemuan pensyarah dengan pelajar di dalam kelas agak terhad dan memerlukan program sampingan di luar waktu kelas sebagai sokongan kepada pelajar untuk cemerlang. Selain itu, sikap positif pelajar dan dorongan yang kuat oleh ibu -bapa juga mampu memberi kesan yang positif kepada pelajar untuk berjaya mencapai keputusan yang cemerlang dalam matematik di peringkat pengajian tinggi.

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POLITEKNIK KOTA KINABALU

Stres Dan Burnout Dalam Kalangan Pelajar: Tahap Dan Kesannya Kepada Prestasi Akademik

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Abstract

Sepanjang pelajar berada di alam pengajian, mereka umumnya menghadapi pelbagai tekanan sama ada dalam aspek akademik, sosial, dan peribadi yang boleh menyebabkan mereka berada dalam tahap stres dan burnout yang tinggi. Oleh yang demikian, kajian ini bertujuan untuk a) menilai tahap stres dan burnout dalam kalangan pelajar dan b) Kajian ini penting bagi membantu mengenal pasti pelajar yang mungkin mengalami tekanan emosi atau stres yang tinggi, yang boleh membawa kepada masalah kesihatan mental seperti kecemasan dan kemurungan. Dengan mengetahui tahap stres dan burnout, langkah-langkah boleh diambil untuk menyediakan sokongan dan perkhidmatan kesihatan mental yang sesuai kepada pelajar yang memerlukan supaya mereka mampu menghabiskan sesi pengajian mereka dengan cemerlang. Kajian ini melibatkan pelajar Politeknik Kota Kinabalu sebagai responden. Teknik pensampelan rawak digunakan untuk memilih sampel kajian ini. Soal selidik 5-skala Likert digunakan sebagai instrumen untuk mengumpul data daripada responden. Analisis deskriptif digunakan untuk menganalisis data yang diperoleh. Hasil kajian ini akan memberikan gambaran yang jelas mengenai tahap stres dan burnout dalam kalangan pelajar Politeknik Kota Kinabalu serta kesannya terhadap prestasi akademik mereka.

Keywords: - Stres, Burnout, Prestasi Akademik

1. Pengenalan

Dalam era globalisasi dan pelbagai cabaran dalam menjalani kehidupan, seperti orang awam, pelajar juga menghadapi pelbagai tekanan sama ada dari segi akademik, sosial, dan peribadi. Dalam pembelajaran, biasanya pelajar akan menghadapi stres untuk mencapai prestasi akademik yang tinggi, memenuhi jangkaan keluarga, hubungan rakan sebaya, serta pelbagai cabaran-cabaran kehidupan moden boleh menyebabkan peningkatan tahap stres dalam kalangan pelajar. Menurut Drăghici dan Cazan (2022), stres dan burnout hadir dalam setiap aspek kehidupan individu, terutamanya juga kepada pelajar yang bekerja sambil belajar menghadapi tekanan tentang penglibatan mereka dalam pembelajaran, menyiapkan tugasan akademik dan menamatkan pengajian mereka. Stres yang berterusan dan tidak diurus dengan baik boleh membawa kepada burnout (Lin et al., 2021), iaitu satu keadaan di mana pelajar merasa letih secara fizikal, emosi, dan mental. Burnout bukan sahaja menjejaskan prestasi akademik pelajar tetapi juga kesejahteraan keseluruhan mereka, termasuk kesihatan mental dan fizikal. Berdasarkan senario ini, kajian perlu dijalankan untuk memahami tahap stres dan burnout dalam kalangan pelajar, dan kesannya kepada prestasi akademik pelajar. Dengan memahami isu ini secara empirikal, pihak institusi terutamanya pensyarah dan penasihat akademik dapat merangka sebarang program yang lebih berkesan untuk menyokong pembangunan emosi pelajar dan memastikan mereka mampu menjalani sesi kuliah dan aktiviti kampus dengan seronok. Liu et al. (2023) juga menjelaskan bahawa program kesihatan yang berkesan dan penilaian burnout jangka panjang setiap tahun tahunan mungkin dapat mengurangkan burnout dalam kalangan pelajar.

Stres dan burnout umumnya membawa banyak kesan buruk kepada pelajar. Walau bagaimanapun, beberapa penemuan tidak jelas dalam literatur, yang menunjukkan pada masa ini tidak jelas sejauh mana keletihan mempengaruhi pencapaian akademik seperti yang dinyatakan oleh Madigan & Curran (2021). Untuk menjelaskan hubungan ini, kajian ini dijalankan dengan objektif a) menilai tahap stres dan burnout dalam kalangan pelajar dan b) mengenal pasti kesan stres dan burnout terhadap prestasi akademik pelajar. Kajian ini sangat penting kerana nilai sebuah pendidikan tidak boleh dipandang remeh. Pencapaian akademik merupakan satu hasil yang sangat penting kepada masyarakat. Ini kerana menurut OECD (2016), pelajar yang berprestasi baik biasanya mempunyai kesihatan dan kesejahteraan yang lebih baik berbanding dengan pelajar yang tidak mempunyai kesihatan yang baik.

2. Sorotan Kajian

Kajian berkaitan stres dan burnout dalam kalangan pelajar menjadi perhatian banyak penyelidik. Dalam sains psikologi, stres adalah perasaan tekanan dan ketegangan mental. Tahap tekanan yang rendah mungkin diingini, berguna, dan juga sihat. Stres dalam bentuk positif boleh meningkatkan kesihatan biopsikososial dan meningkatkan prestasi. Selain itu, stres positif dianggap sebagai faktor penting kepada motivasi, penyesuaian dan reaksi terhadap persekitaran sekeliling (Shahsavarani et al., 2015). Walau bagaimanapun, tahap stres yang tinggi boleh mengakibatkan masalah biologi, psikologi dan sosial dan juga kemudaratan yang serius kepada manusia (Tucker et al., 2008). Selain itu, berkaitan dengan stres adalah burnout. Menurut Maslach dan Leiter (2017), burnout digambarkan sebagai keletihan fizikal, emosi dan mental yang disebabkan oleh penglibatan jangka panjang dalam situasi yang menuntut emosi. Sekiranya dilihat pandangan Liu et al. (2023), majoriti pelajar mengalami kelesuan (burnout) akademik. Jantina, gred, perbelanjaan sara hidup bulanan, merokok, tahap pendidikan ibu bapa, tekanan belajar dan kehidupan, dan tahap minat pengetahuan profesional semasa memberi kesan yang ketara kepada kelesuan akademik. Burnout juga selalu dikaitkan dengan kebimbangan (Shin et al., 2011). Kebimbangan akademik dianggap sebagai perasaan gugup dan bimbang secara umum dalam konteks akademik disebabkan oleh tuntutan luaran seperti ujian, tugasan, dan tekanan tinggi dalam memperoleh gred yang baik, dan setiap pelajar mempunyai pengalaman berbeza berkaitan kebimbangan ujian (Shapiro, 2014).

3. Methodology

Kajian ini dijalankan mengikut kaedah penyelidikan kuantitatif. Sampel kajian adalah pelajar Politeknik Kota Kinabalu, Sabah. Seramai 64 pelajar dari semua semester pengajian telah mengambil bahagian dalam kajian ini. Instrumen kajian adalah menggunakan borang soal selidik untuk mendapatkan data kajian. Borang soal selidik diedarkan secara dalam talian ke atas pelajar Kolej Komuniti di Sarawak. Item kajian adalah adaptasi dari kajian Ryu dan Han (2021). Analisis yang digunakan adalah analisis deskriptif iai tu berdasarkan nilai min untuk menerangkan latar belakang responden, tahap stres dan burnout dalam pelajar. Penentuan tahap berdasarkan nilai min dipetik dalam kajian Ngadiman et al. (2019) bermula dari 1.00 – 1.99 (Lemah), 2.00– 2.99 (Rendah), 3.00– 3.99 (Sederhana) dan 4.00– 5.00 (Tinggi). Manakala analisis regresi linear digunakan untuk mengenal pasti hubungan antara stres dan burnout terhad prestasi pembelajaran (HPNM).

4. Hasil Kajian

4.1 Latar Belakang Responden

Jadual 1 di bawah meringkaskan statistik data bagi latar belakang responden hasil kajian ini yang merangkumi jantina, pencapaian HPNM, Jumlah pendapatan ibu bapa responden dan hasil maklumat tentang latar belakang keluarga responden.

Item		n	%
Jantina	Lelaki	23	35.9
	Perempuan	41	64.1
HPNM	2.01 - 3.00	11	17.2
	3.01 - 4.00	53	82.8
Pendapatan Ibu Bapa	RM4360 - RM9619	6	9.4
	RM4360 dan ke bawah	57	89.0
	RM9619 dan ke atas	1	1.6
Adakah pelajar dari keluarga bermasalah?	Mungkin	21	32.8
	Tidak	34	53.1
	Ya	9	14.1

Jadual 1 : Latar Belakang Responden

Responden kajian ini adalah daripada pelajar Politeknik Kota Kinabalu. Jadual 1 menunjukkan seramai 64 pelajar terlibat dalam kajian ini yang terdiri daripada pelajar perempuan (64.1%) dan 35.9% adalah lelaki. Dari segi tahap HPNM, majoriti pelajar (82.8%) menunjukkan tahap HPNM yang tinggi (3.01 - 4.00),

manakala hanya 17.2% berada pada tahap yang lebih rendah (2.01 - 3.00). Dalam hal pendapatan ibu bapa, sebahagian besar pelajar berasal dari keluarga dengan pendapatan RM4360 dan ke bawah (89.0%), sementara hanya 1.6% berasal dari keluarga dengan pendapatan melebihi RM9619. Mengenai isu keluarga, sebahagian besar pelajar (53.1%) tidak menganggap diri mereka berasal dari keluarga bermasalah, tetapi 32.8% menganggap mungkin, dan 14.1% merasakan mereka berasal dari keluarga bermasalah. Data ini memberikan gambaran yang jelas tentang hubungan antara latar belakang sosial-ekonomi dan persepsi pelajar mengenai stres dan burnout.

4.2 Tahap Stres dan Burnout

Analisis desriptif untuk tahap *stres* dam tahap *burnout* masing-masing akan ditunjukkan oleh Jadual 2 dan jadual 3 dibawah.

4.2.1 Tahap Stres

Jadual 2 di bawah menunjukkan hasil analisis deskriptif tahap-tahap stres dalam kalangan pelajar untuk 15 item soalan dengan skala antara 1 hingga skala 5, beserta dengan hasil min dan sisihan piawai.

Jadual 2: Analisis Deskriptif Tahap *Stres* Dalam Kalangan Pelajar.

Bil	Item	Skala[1]					Min	S.P
		1	2	3	4	5		
1	Saya bimbang jika saya belajar bersungguh-sungguh, gred saya tidak akan meningkat	17.2	14.1	34.4	21.9	12.5	3.0	1.3
2	Saya jengkel kerana terlalu banyak ujian/ penilaian kursus	17.2	25.0	42.2	12.5	3.1	2.6	1.0
3	Saya berada pada had kemampuan untuk belajar saya	10.9	23.4	39.1	17.2	9.4	2.9	1.1
4	Suasana di institusi saya terlalu membosankan	21.9	40.6	25.0	9.4	3.1	2.3	1.0
5	Saya jengkel kerana terpaksa mengambil ujian/ penilaian kursus yang terlalu kerap	20.3	32.8	32.8	12.5	1.6	2.4	1.0
6	Saya takut untuk pergi ke kelas di mana pensyarah terlalu “strict”	18.8	20.3	23.4	20.3	17.2	3.0	1.4
7	Terlalu banyak yang perlu saya risaukan selain belajar di university	6.3	26.6	26.6	25.0	15.6	3.2	1.2
8	Saya bimbang tidak tahu cara belajar dengan berkesan	14.1	25.0	28.1	18.8	14.1	2.9	1.3
9	Saya merasa tertekan dengan beban tugasan akademik saya.	9.4	34.4	39.1	12.5	4.7	2.7	1.0
10	Saya merasa letih dan lesu walaupun selepas berehat.	15.6	29.7	26.6	12.5	15.6	2.8	1.3
11	Saya merasa kekurangan sokongan dari keluarga dan rakan-rakan.	40.6	23.4	23.4	9.4	3.1	2.1	1.1
12	Saya merasa tertekan dengan tarikh akhir penghantaran tugasan dan peperiksaan.	10.9	31.3	31.3	17.2	9.4	2.8	1.1
13	Saya merasa sukar untuk tidur kerana memikirkan tentang akademik.	12.5	20.3	39.1	20.3	7.8	2.9	1.1
14	Saya merasa tidak cukup masa untuk menyelesaikan semua tugasan akademik.	9.4	32.8	40.6	10.9	6.3	2.7	1.0
15	Saya merasa tekanan untuk mencapai keputusan yang baik.	14.1	18.8	34.4	23.4	9.4	3.0	1.2

[1] Skala adalah dalam bentuk kekerapan:1: Tidak pernah; 2: Jarang-jarang; 3: Kadang-kadang; 4: Kerap kali; 5: Sentiasa

Jadual 2 menunjukkan tahap stres dalam kalangan responden. Sekiranya dilihat pada skor min, dapatan menunjukkan tahap stres antara sederhana (min = 3.00– 3.99), dan rendah (min = 2.00– 2.99). Walaupun begitu, ada tiga item tertinggi yang perlu diberi perhatian. Pertama, pelajar terlalu banyak risau tentang perkara-perkara selain daripada pembelajaran di universiti (min = 3.2) menunjukkan bahawa beban emosional dan tekanan dari faktor luar boleh mengganggu tumpuan mereka terhadap akademik. Kedua, kebimbangan mengenai sama ada usaha mereka dalam belajar akan meningkatkan gred (min = 3.0) menjelaskan

hasil akademik yang boleh menjejaskan motivasi belajar mereka. Manakala yang ketiga iaitu pelajar takut menghadapi pensyarah yang dianggap terlalu "strict" (min = 3.0) menunjukkan bahawa sikap dan pendekatan pensyarah juga memainkan peranan penting dalam membentuk pengalaman pembelajaran pelajar.

4.2.2 Tahap Burnout

Jadual 3 di bawah menunjukkan hasil analisis deskriptif tahap-tahap *burnout* dalam kalangan pelajar untuk 10 item soalan dengan skala antara 1 hingga skala 5, beserta dengan hasil min dan sisihan piawai.

Jadual 3: Analisis Deskriptif Tahap *Burnout* Dalam Kalangan Pelajar.

Bil	Item	Skala[1]					Min	S.P
		1	2	3	4	5		
1	Saya merasa kehilangan minat dan motivasi untuk belajar.	20.3	35.9	26.6	14.1	3.1	2.4	1.1
2	Saya berasa letih apabila bangun pagi dan perlu menghadapi hari kuliah yang lain.	12.5	34.4	35.9	9.4	7.8	2.7	1.1
3	Saya merasa mudah marah atau cepat marah	15.6	26.6	35.9	15.6	6.3	2.7	1.1
4	Saya merasa terasing dari rakan-rakan dan pensyarah	39.1	29.7	15.6	10.9	4.7	2.1	1.2
5	Saya sering berfikir untuk berhenti pengajian atau menukar kursus	45.3	25.0	15.6	10.9	3.1	2.0	1.2
6	Saya merasa tidak mampu untuk menghadapi tugasan akademik.	32.8	37.5	20.3	6.3	3.1	2.1	1.0
7	Saya merasa prestasi akademik saya semakin menurun	29.7	32.8	17.2	7.8	12.5	2.4	1.3
8	Saya merasa tidak mempunyai masa untuk diri sendiri kerana beban akademik	31.3	40.6	15.6	4.7	7.8	2.2	1.2
9	Saya merasa kurang kepuasan dalam pencapaian akademik saya.	14.1	31.3	25.0	17.2	12.5	2.8	1.2
10	Saya merasa sering mengalami keletihan emosi akibat beban akademik	18.8	32.8	28.1	15.6	4.7	2.5	1.1

[1] Skala adalah dalam bentuk kekerapan:1: Tidak pernah; 2: Jarang-jarang; 3: Kadang-kadang; 4: Kerap kali; 5: Sentiasa

Jadual 3 menunjukkan tahap *burnout* dalam kalangan responden. Sekiranya dilihat pada skor min, dapatan menunjukkan tahap *burnout* adalah rendah (min = 2.00– 2.99). Walaupun begitu, ada tiga item tertinggi yang perlu diberi perhatian. Pertama, pelajar merasa kurang kepuasan dalam pencapaian akademik mereka (Min = 2.8). Dapatan ini menjelaskan bahawa kepuasan akademik yang rendah menunjukkan bahawa pelajar mungkin merasa usaha mereka tidak membuahkan hasil yang memuaskan, yang boleh mengurangkan motivasi belaja r dan meningkatkan *burnout*. Kedua ialah pelajar merasa mudah marah atau cepat marah (Min = 2.7) menjelaskan bahawa pelajar mungkin berhadapan dengan tekanan yang tinggi dan kurang keupayaan untuk menguruskan *burnout* secara berkesan. Manakala yang ketiga adalah, pelajar berasa letih apabila bangun pagi dan perlu menghadapi hari kuliah yang lain (Min = 2.7). Item ini menjelaskan bahawa rasa letih yang berterusan menandakan keletihan fizikal dan mental, yang boleh mengganggu keupayaan pelajar untuk terlibat dalam pembelajaran dan boleh membawa kepada kemerosotan prestasi akademik pelajar.

4.3 Hubungan Antara Stres dan Burnout dengan Pencapaian Akademik

Jadual 4 dibawah menunjukkan hasil hubungan *stres* dam *burnout* dengan pencapaian akademik melalui bacaan pembolehubah bebas, pembolehubah bersandar, sisihan piawai, nilai beta, nilat-t. tahap signifikan serta status kesignifikan hasil kajian.

Jadual 4: Hubungan Antara *Stres* Dan *Burnout* Terhad Prestasi Pembelajaran.

Pemboleh ubah Bebas	Pemboleh ubah Bersandar	S.P	Beta	nilai-t	Sig.	Status
Stres	HPNM	0.091	0.082	0.476	0.636	Tidak signifikan
Burnout		0.079	-0.293	-1.696	0.095	Tidak signifikan

Sementara itu, hasil analisis regresi menunjukkan bahawa hubungan antara *stres* dan HPNM, serta *burnout* dan HPNM, tidak signifikan. Untuk *stres*, nilai p ialah 0.636, Ini menjelaskan bahawa faktor *stres* dan *burnout* tidak memainkan peranan utama dalam mempengaruhi prestasi akademik pelajar dalam kajian ini. Keadaan ini kerana pelajar akan berusaha sehabis daya dalam peperiksaan akhir sehingga mendapat keputusan yang baik.

5. Kesimpulan

Secara kesimpulannya, kajian ini dapat menilai tahap stres dan burnout dalam kalangan pelajar dan penyelidik dapat mengenal pasti kesan stres dan burnout terhadap prestasi akademik pelajar.Sebagai langkah pelajar terlalu banyak risau tentang perkara-perkara selain daripada pembelajaran di universiti. Manakala langkah menagani pelajar berasa letih apabila bangun pagi dan perlu menghadapi hari kuliah ialah menggalakan pelajar untuk bersenam secara lebih kerap ; dengan ini, pelajar akan lebih bersemangat. Den gan kajian ini,ia boleh digunakan oleh pihak HEP untuk merancang Minggu Transformasi Siswa bagi mencegah stress dan burnout di kalangan pelajar.

Dalam kajian ini juga,beberapa cadangan yang boleh disarankan kepada pihak-pihak yang terlibat. Di peringkat pelajar, mereka memerlukan bimbingan tentang pengurusan masa yang baik untuk menangani tahap stres dan burnout. Antara yang boleh dilakukan oleh pihak pelajar adalah berani berbincang dengan pensyarah untuk meringkankan jumlah tugasan. Kebanyakan masalah kadang-kadang bukan berpunca daripada susunan jadual waktu tetapi daripada pengurusan masa yang tidak betul. Pelajar akhirnya membuat tugasan las t-minute dan tidak membuat sesuatu mengikut keutamaan. Di peringkat institusi pula, harus ada galakan kepada pelajar untuk menyertai program berbentuk sesi motivasi dan kaunseling yang kebanyakannya memang ada perkhidmatan untuk membantu pelajar bermasalah. Pelajar bermasalah perlu dikenalpasti untuk tindakan kawalan dan pencegahan mengangani stres, burnout dan kes buli. Kes buli mungkin tidak berlaku di Institusi, walau bagaimanapun pihak institusi perlu memantau sekiranya terdapat aduan dan kes buli di kalangan pelajar, kes tersebut perlulah diselesaikan dengan segera dan seadil yang mungkin. Kes buli adalah bukan perkara biasa kerana jika ianya dipantau dengan teliti oleh pihak Institusi, tidak akan ada ruang untuk berlkunya kes buli. Akhirnya di peringkat pensyarah, mereka harus memberi wajaran ke atas pemberian tugasan yang bersesuaian dengan tahap penilaian yang diukur. Tutorial dan tugasan yang berlebihan tidak membantu pelajar dan mereka perlulah diberi bimbingan bagaimana menyelesaikan sebarang tugasan yang mungkin agak sukar difahami. Tahap burnout yang tinggi adalah disebabkan pelajar tidak mencukupi masa untuk menyelesaikan segala tugasan dalam tempoh singkat. Disini, pensyarah juga berperanan dalam menyesuaikan bahan tugasan dengan kemampuan pelajar dari segi masa dan tenaga. Keluarga pelajar secara khususnya memberi pengaruh besar ke atas kesan stres terhadap pelajar. Kaum keluarga mungkin boleh memberi sokongan tinggi kepada pelajar dan tidak terlalu mendesak pelajar untuk mencapai di luar had kemampuan mereka.

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POLITEKNIK KOTA KINABALU

Evaluating Student Perspectives on Final Year Project (FYP) Idea Generation Programs in IT Diploma Courses

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Abstract

This study evaluates a program designed for Diploma in Information Technology (IT) students across three tracks (Software and Application Development, Information Security, and Networking Systems) in course DFT50114 Integrated Project. It assesses the program's effectiveness and participant satisfaction. Feedback from a structured survey was used to evaluate various aspects including overall experience, material quality, program duration, and the likelihood of participants recommending the program to others. Results indicate a high level of satisfaction, with average ratings exceeding 4.5 out of 5. While the program appears well-received, several valuable improvement suggestions emerged. To enhance the learning experience, more hands-on activities and interactive elements were suggested. Additionally, reconsidering the session durations could give students more time to fully understand and assimilate the concepts that have been taught. The feedback indicates that while the program is strong, there's still room for improvement in these areas. These insights are valuable for educators looking to refine their programs to better meet participants' needs by building on the program's strengths and addressing areas for further development. Furthermore, this study can guide other educational institutions who are seeking to implement similar approaches in their curriculum, ensuring that they create a more engaging and effective learning environment.

Keywords: DFT50114 Integrated Project, Diploma in Information Technology (IT), effectiveness, participation satisfaction, feedback

1. Introduction

Diploma in Information Technology(Digital Technology) is a course in the Department of Information Technology and Communication, Polytechnic Ungku Omar and the program have three major tracks(Software and Application Development, Information Security, and Networking Systems).As stated in the academic curriculum of Polytechnic, DFT50114 Integrated Project are also known as final year project are compulsory subject to be taken by students (ICT Deparment, 2023). The students must be form minimal group of 3. The stages of proposal writing for final year project began with topic submission from the students to the supervisor(Meidelfi et al., n.d.)

Final year projects (FYPs) are crucial components of diploma programs, particularly in Information Technology (IT) and related fields. They provide students with opportunities to apply knowledge, develop research skills, and solve real-world problems (Menon & Poroor, 2020). When students choose topics for their final year projects (FYP), they frequently encounter challenges in matching their individual skills with the project criteria. This difficulty arises from a lack of experience in real-world problem-solving, which hold back their capacity to develop appropriate ideas. (Razak et al., 2021). These developments highlight the need for continued research and innovation in FYP management and implementation. This paper presents an analysis of the feedback collected from participants of a particular program. The program aims to consider participant satisfaction and achievement of objectives, as well as gather recommendations for improvement. In particular, there is a noticeable gap between students' initial project proposals and their ability to execute those ideas successfully, which indicates a need for more support during this transitional phase **.** Participants were asked to complete a survey reflecting on different aspects of the program. This included their overall satisfaction with how the program was carried out, whether the program objectives were met, their satisfaction with the program's duration, the quality of content provided by speakers, and the likelihood of recommending similar programs in the future. Participants were also asked to provide helpful suggestions to enhance future versions of the program.

This study aims to analyze collected data to gain insights into participant perceptions, identify strengths, and highlight areas for improvement. Furthermore, this study will provide recommendations for enhancing

the program's effectiveness. These insights are invaluable for educational practitioners and program designers who seek to refine their offerings and better meet the needs and expectations of their target audience.

2. Literature Review

Evaluation of educational programs is important to know what effects they have, make them more useful, and make sure they meet the goals they were made to achieve. The main ideas and frameworks related to participant feedback, program evaluation, and suggestions for improving instructional initiatives are analysed in this overview of the literature.

This literature review explores key concepts and frameworks related to program evaluation, participant feedback, and recommendations for enhancing educational programs. Effective teaching and learning processes involve identifying learning objectives, developing resources, and implementing strategies (Munna & Kalam, 2021). To improve feedback practices, developing student feedback literacy is crucial, which can be embedded in the curriculum through eliciting, processing, and enacting mechanisms (Malecka et al., 2022). While outcome evaluation models like Kirkpatrick's are widely used in health professions education, there is a growing emphasis on program evaluation models to understand how and why outcomes occur (Allen et al., 2022). Various curriculum and program evaluation models have been developed since the 1960s, focusing on assessing whether programs meet their defined objectives. Choosing an appropriate evaluation model depends on factors such as context, purpose, and expected outcomes (Nouraey et al., 2020). These approaches collectively contribute to understanding program impact, improving effectiveness, and ensuring alignment with intended outcomes.

Program evaluation frameworks provide systematic methods for evaluating the efficacy and results of educational efforts. An often-used framework is the Context, Input, Process, and Product (CIPP) model, which was created by Stufflebeam in 1971. This approach prioritizes the assessment of programs based on four key aspects: the program's operating environment, the resources allocated to it, the implementation methods, and the accomplished results. Through a comprehensive analysis of these factors, lecturers can identify both strengths and weaknesses, empowering them to make well-informed decisions to improve the curriculum.

To measure program performance and participant satisfaction, it is essential to fully understand participant input. The effectiveness of a program is largely influenced by how participants evaluate its quality, relevance, and their entire experience. Research highlights the importance of comprehensive feedback and effective faculty development programs in educational settings. Darling-Hammond et al., 2022 emphasize the significance of high-quality learning experiences for principals, while (Hudson, 2020) examines a diversity training program for faculty that resulted in improved inclusive teaching strategies.

In addition to identifying strengths and weaknesses, effective program evaluation involves the implementation of recommendations for development that are supported by participant feedback and evaluation findings. It's important to keep improving in order to meet the changing wants and goals of students. This requires defining educational objectives, receiving feedback, improving, and assessing progress.

This literature review emphasizes the importance of systematic program evaluation and students feedback in educational contexts. Feedback plays a crucial role in helping students achieve learning objectives and promoting active learning (Kutasi, 2023). Effective program evaluation models assess whether educational programs meet their defined objectives, with the choice of model depending on factors such as context and purpose (Nouraey et al., 2020). Integrating instructional design models with learning theo ries can enhance student motivation and support innovative teaching methods, although challenges like accessibility issues and evaluation difficulties may arise (Abuhassna et al., 2024). By utilizing well-established evaluation frameworks and gathering thorough participant feedback, educators can improve program effectiveness and promote significant educational achievements.

3. Methodology

In this study, we used a structured survey tool to gather important feedback from students about their experience with the FYP Idea program. The survey included a set of questions that covered various aspects of the program, such as its implementation, content, and participant satisfaction. The questions listed below are part of the Likert scale, which is designed to gather detailed feedback on various aspects of the FYP Idea program:

i. Are you satisfied with the program that was conducted?

ii. Did the program content achieve the objectives set for DFT50114 students?

iii. How satisfied are you with the duration of the program?

iv. How satisfied are you with the content delivered by the speakers?

v. Would you recommend a program like this to be conducted again in the future?

Questions 1-5 were for quantitative responses using Likert scale options, while question 6 allowed qualitative feedback and program enhancement suggestions. The survey engaged 143 respondents, consisting of 67 students from the Information Security track, 48 students from Software and Application Development, and 28 students from Networking Systems. A convenience sampling technique was used, which the students were randomly chosen based on their enrollment in the DFT50114 course.

Data has been collected using an online survey platform to ensure accessibility for students. The survey remained open and available for others to participate for a specified period to ensure students had sufficient time to respond. We have enlisted students based on the target audience of the program who were among the students enrolled in DFT50114. Participation was voluntarily presenting, and we collected responses over a specified period to ensure we had a valid sample of program attendees.

The quantitative data from Likert scale responses (questions 1-5) has been analysed using descriptive statistics. This involved calculating the frequencies and percentages of participant responses, which helped to provide insights into overall satisfaction levels and perceived achievement of program objectives. It also provided satisfaction with program duration and content. At the same time, it also helped to cater the likelihood of program recommendation.

4. Results and Discussion

Table 1. Data analysis of students perception on FYP Idea Generation program exposure

Area	Avg. Satisfaction	Avg. Achievement of Objectives	Avg. Satisfaction with Duration	Avg. Satisfaction with Content	Likelihood to Recommend
Information Security	4.6	4.6	4.6	4.5	92. %
Software Application & Development	4.6	4.5	4.4	4.5	93%
Networking System	4.7	4.6	4.6	4.7	90%

The survey was conducted to evaluate students' satisfaction and feedback in three major track areas, Information Security, Software Application & Development, and Networking System. The results provided valuable insights into the perception of these programs and areas which helped to determine if there is needed of improvements

To ensure the appropriateness of the measures of central tendency, a Shapiro-Wilk test was conducted to assess the normality of the data distribution (Shapiro & Wilk, 1965). The test showed that the data were normally circulated, allowing the use of mean scores for further analysis. The results collected from participants in various program areas have consistently shown exceptionally high levels of satisfaction, with an average rating of over 4.5 out of 5. These findings indicate that the majority found the programs to be effective and beneficial.

Therefore, the survey results indicate that students across all tracks expressed high satisfaction with the FYP Idea Generation program, with an average rating of 4.5 or higher across most categories. The Networking Systems track achieved the highest satisfaction scores, particularly in terms of content delivery (4.7/5). These results suggest that the program effectively met its objectives, particularly in terms of content relevance and delivery. However, the suggestion to incorporate more interactive and hands-on sessions highlights a need for more experiential learning, aligning with existing research that emphasizes active learning and student engagement (Kutasi, 2023).

Furthermore, based on the reports, students have expressed gratified satisfaction with both the duration and content of the programs, with average scores around 4.5 out of 5. This suggests that the timing of sessions and the relevance of the content were well-received which have been contributing positively to their overall experience.

A significant percentage of students across all tracks indicated that a high likelihood will be recommending the programs to others, with an average recommendation rate of over 90%. This provides the perceived value and quality of the educational experiences provided.

5. Conclusion

After a thorough analysis based on each of the students' feedback, there are several important conclusions can be made. First and foremost, students have consistently expressed high levels of satisfaction, as reflected in average ratings exceeding 4.5 out of 5 across different evaluation criteria. This has pointed out a strong endorsement of the programs' qualities and effectiveness in achieving educational objectives.

The students strongly believed that the programs have successfully met their goals, underlining the relevance and alignment of the content with their learning needs. The positive feedback also embraced the program elements such as duration and content delivery, suggesting that these aspects were well-received and contributed significantly to overall satisfaction.

The FYP Idea Generation program received strong positive feedback, with students across all IT tracks expressing high levels of satisfaction. The findings emphasize the program's success in meeting the objectives of the program, particularly in delivering pertinent and compelling content. However, the suggestions for incorporating more practical hands-on sessions and increasing interactivity have created the probabilities for further improvement. By including these ideas and recommendations in future updates, the program can cater student needs, promote deeper learning, and enhance the overall educational experience.

In addition, a significant number of students have indicated that they would be happy to recommend these programs to others, highlighting their positive experiences and the perceived value of the programs. These insights carry significant implications for the future design and delivery of educational programs. By integrating students feedback into program revisions, educational institutions might be able to improve the engagement process, learning outcomes, and overall participant satisfaction. This gradual approach will ensure that the programs evolve in response to the participant's needs, which will maintain relevance and effectiveness in addressing educational goals.

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Kajian Pencapaian Program Educational Objective (PEO) Alumni DHM Politeknik Kota Kinabalu Tahun 2023

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Abstrak

Kajian ini bertujuan untuk menilai pencapaian Objektif Pembelajaran Program (Program Educational Objective, PEO) bagi program pengajian Diploma Pengurusan Hotel (DHM) yang ditawarkan di Politeknik Kota Kinabalu yang telah dibangunkan di peringkat Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK), Kementerian Pendidikan Malaysia (KPM) sejak Disember 2015. Pencapaian PEO ini dinilai bagi mengenalpasti tahap kemenjadian graduan dan sumbangan graduan selepas tiga hingga lima tahun bergraduat. Kajian ini menggunakan pendekatan kuantitatif, di mana data mentah dari sampel alumni tahun 2023 digunakan untuk menafsirkan pencapaian setiap PEO. Data ini kemudian dikaitkan dengan Programme Learning Outcome (PLO) yang diperoleh oleh pelajar semasa di politeknik untuk melihat sejauh mana PLO tersebut memberi manfaat kepada graduan dalam konteks industri. Dapatan daripada kajian ini diharapkan dapat digunakan untuk penambahbaikan dalam kurikulum serta proses penyampaian pengajaran di Politeknik Kota Kinabalu. Ini termasuk pemantapan PLO yang lebih sesuai dengan keperluan industri dan meningkatkan relevansi program dengan keperluan pasaran kerja. Dengan melakukan analisis yang teliti dan menggunakan data secara sistematik, Politeknik Kota Kinabalu khususnya dapat terus meningkatkan standard pendidikan dan melahirkan graduan secara holistik serta relevan dengan keperluan industri masa kini dan akan datang.

Keywords: Objektif Pembelajaran Program; Program Learning Outcome

1. Pengenalan

Pendidikan Teknikal dan Latihan Vokasional (TVET) memainkan peranan yang signifikan dalam menyediakan tenaga kerja yang kompeten dan berdaya saing dalam pelbagai sektor industri. TVET, seperti yang digariskan dalam Pelan Strategik Kementerian Pendidikan Tinggi Malaysia 2023-2025, bertujuan untuk memperkukuh keupayaan institusi pendidikan dalam menyediakan program-program yang relevan dengan keperluan industri semasa dan masa depan. Dalam konteks ini, Politeknik Kota Kinabalu, melalui Program DHM, berusaha untuk memenuhi keperluan TVET dengan menawarkan kurikulum yang merangkumi aspek teori dan praktikal yang penting dalam pengurusan hotel.

Salah satu pendekatan utama yang digunakan dalam Program DHM adalah Pembelajaran Berasaskan Kerja (WBL). WBL adalah pendekatan pendidikan yang mengintegrasikan pengalaman kerja sebenar dengan teori akademik untuk meningkatkan kemahiran praktikal pelajar. Melalui WBL, pelajar diberikan peluang untuk menerapkan pengetahuan yang dipelajari dalam bilik kuliah dalam persekitaran kerja sebenar, yang membantu mereka memahami lebih baik tentang aplikasi praktikal dalam industri. Pendekatan ini juga selaras dengan hala tuju Transformasi Politeknik 2023-2030 yang menekankan kepentingan pendidikan berasaskan pengalaman kerja dalam meningkatkan kebolehpasaran graduan.

Program DHM di Politeknik Kota Kinabalu direka untuk mempersiapkan pelajar dengan pengetahuan dan kemahiran yang diperlukan dalam industri pelancongan dan hospitaliti. Program ini menggabungkan teori dan praktikal melalui pendekatan Pembelajaran Berasaskan Kerja (Work-Based Learning -WBL) untuk membekalkan pelajar dengan kemahiran yang relevan dan aplikatif dalam dunia pekerjaan sebenar.

Kajian ini bertujuan untuk menilai pencapaian Program Educational Objective (PEO) bagi alumni Program Diploma Pengurusan Hotel (DHM) di Politeknik Kota Kinabalu untuk tahun 2023. Penilaian ini penting untuk memahami sejauh mana objektif yang telah ditetapkan dalam program ini dapat dicapai oleh graduan selepas tamat pengajian mereka, dengan fokus kepada bagaimana program tersebut telah mempersiapkan mereka untuk menghadapi cabaran dalam industri pelancongan dan hospitaliti.

2. Kajian Literatur

Kajian pencapaian Program Educational Objective (PEO) dalam kalangan alumni adalah penting untuk menilai keberkesanan dan relevansi program akademik, terutamanya dalam konteks pendidikan Teknikal dan Latihan Vokasional (TVET). PEO biasanya merangkumi objektif jangka panjang yang diharapkan dapat dicapai oleh graduan selepas beberapa tahun tamat pengajian. Objektif ini merangkumi pelbagai aspek, termasuk kemahiran profesional, pencapaian kerjaya, keupayaan untuk terus belajar, dan sumbangan kepada masyarakat.

2.1 Pendidikan Teknikal dan Latihan Vokasional (TVET)

Pendidikan TVET memainkan peranan penting dalam menyediakan tenaga kerja yang kompeten dan berdaya saing. Menurut laporan oleh UNESCO (2020), TVET menjadi elemen penting dalam pembangunan modal insan yang mampu menyokong keperluan ekonomi dan industri. Politeknik, sebagai salah satu institusi TVET, ditugaskan untuk menawarkan program-program yang relevan dengan kehendak industri semasa dan masa depan. Dalam hal ini, PEO dirangka untuk memastikan graduan bukan sahaja menguasai pengetahuan dan kemahiran teknikal, tetapi juga bersedia untuk menghadapi cabaran dalam dunia pekerjaan.

2.2 Program Educational Objective (PEO)

PEO merupakan matlamat jangka panjang yang ditetapkan oleh program akademik bagi memastikan graduan dapat mencapai tahap tertentu dalam kerjaya mereka. Menurut Astin (1993), PEO adalah penunjuk kepada sejauh mana program akademik berjaya menyediakan pelajar dengan kemahiran dan pengetahuan yang diperlukan untuk berjaya dalam bidang profesional mereka. Kajian pencapaian PEO alumni membolehkan institusi pengajian tinggi menilai keberkesanan program yang ditawarkan dan menyesuaikan kurikulum serta kaedah pengajaran mengikut keperluan semasa.

2.3 Keberkesanan Program DHM

Dalam konteks Program Diploma Pengurusan Hotel (DHM) di Politeknik Kota Kinabalu, PEO bertujuan untuk memastikan graduan mampu bekerja dalam industri perhotelan dengan cekap, menunjukkan kepimpinan dan etika profesional, serta terus berkembang dalam kerjaya mereka. Dalam konteks Malaysia, Pelan Pembangunan Pendidikan Malaysia 2015-2025 (Pendidikan Tinggi) (PPPM 2015-2025 PT) mengakui bahawa terdapat ketidaksepadanan antara penawaran dan permintaan graduan, di mana majikan melaporkan bahawa terdapat para graduan yang kurang pengetahuan, Kemahiran dan sikap yang diperlukan dalam industri. Menurut kajian oleh Zulkifli dan rakan-rakan (2018) mendapati bahawa salah satu faktor utama dalam pencapaian PEO adalah keberkesanan pendekatan pembelajaran, termasuk Pembelajaran Berasaskan Kerja (WBL). Justeru itu, WBL didapati mampu meningkatkan kemahiran praktikal pelajar, sekali gus meningkatkan kebolehpasaran graduan dalam industri perhotelan.

2.4 Kepentingan Kajian Pencapaian PEO

Kajian pencapaian PEO adalah penting untuk memahami sejauh mana objektif program akademik tercapai dalam tempoh tertentu selepas pelajar menamatkan pengajian. Kajian ini juga membolehkan politeknik mengenal pasti aspek-aspek yang perlu ditingkatkan bagi memastikan graduan mereka terus relevan dan kompetitif dalam pasaran pekerjaan. Hasil kajian pencapaian PEO boleh digunakan sebagai asas untuk menambah baik kurikulum dan strategi pengajaran, serta memperkukuh hubungan dengan industri untuk memastikan kesesuaian program dengan keperluan pasaran.

2.5 Kajian-kajian Terdahulu

Kajian terdahulu menunjukkan bahawa pencapaian PEO boleh dipengaruhi oleh pelbagai faktor, termasuk kurikulum, kaedah pengajaran, kemudahan pembelajaran, dan kerjasama dengan industri. Contohnya, kajian oleh Ahmad dan Abdullah (2017) mendapati bahawa graduan yang terlibat dalam program WBL menunjukkan pencapaian yang lebih tinggi dalam PEO berbanding mereka yang mengikuti program akademik tradisional. Ini disebabkan oleh pendedahan praktikal yang lebih mendalam serta pengalaman kerja yang diperoleh semasa tempoh pengajian.

2.6 Kesimpulan

Literatur yang dikaji menunjukkan bahawa pencapaian PEO adalah penunjuk penting kepada keberkesanan program akademik dalam mencapai matlamat jangka panjang untuk graduan. Dalam konteks DHM Politeknik Kota Kinabalu, kajian pencapaian PEO alumni pada tahun 2023 adalah penting untuk menilai sejauh mana objektif program tercapai dan bagaimana program ini boleh ditambah baik untuk terus relevan dengan keperluan industri perhotelan. Kajian ini juga memberikan panduan kepada politeknik dalam

merangka strategi penambahbaikan program akademik dan kerjasama dengan industri di masa hadapan.

3. Metodologi

3.1 Reka Bentuk Kajian

Kajian ini menggunakan pendekatan kuantitatif untuk menilai pencapaian Program Educational Objective (PEO) dalam kalangan alumni Program Diploma Pengurusan Hotel (DHM) di Politeknik Kota Kinabalu. Pendekatan kuantitatif dipilih kerana ia membolehkan penyelidik mengukur dan menganalisis data numerikal secara objektif. Dengan menggunakan skala Likert 5 mata, kajian ini dapat menilai persepsi dan pencapaian alumni berdasarkan kriteria yang ditetapkan. Reka bentuk kajian ini termasuk pengumpulan data melalui so al selidik digital yang membolehkan pengumpulan maklumat secara sistematik dan efisien dari pelbagai responden.

3.2 Populasi dan Sampel

3.2.1 Populasi Kajian:

Populasi kajian terdiri daripada alumni Program DHM di Politeknik Kota Kinabalu yang tamat pengajian dalam tempoh kohort berikut:

- Kohort Disember 2015 yang tamat pada Jun 2018.
- Kohort Jun 2016 yang tamat pada Disember 2018
- Kohort Disember 2016 yang tamat pada Jun 2019
- Kohort Jun 2017 yang tamat pada Disember 2019
- Kohort Disember 2017 yang tamat pada Jun 2019
- Kohort Jun 2018 yang tamat pada Disember 2020.

3.2.2 Sampel Kajian:

Sampel kajian diambil dari populasi di atas dengan menggunakan kaedah persampelan rawak berstrata. Ini memastikan bahawa alumni dari setiap kohort dipilih secara rawak untuk memastikan keterwakilan yang seimbang dari setiap kumpulan tamat pengajian. Kaedah ini membolehkan pengumpulan data yang lebih representatif dan meningkatkan kebolehpercayaan hasil kajian.

3.3 Instrumen Kajian

Instrumen utama untuk pengumpulan data dalam kajian ini adalah soal selidik yang dibangunkan khusus untuk menilai pencapaian PEO. Soal selidik ini mengandungi soalan-soalan yang diukur menggunakan skala Likert 5 mata. Skala Likert 5 mata digunakan untuk menilai sejauh mana alumni bersetuju atau tidak bersetuju dengan pernyataan yang berkaitan dengan pencapaian PEO. Penggunaan soal selidik item jenis pilihan mengikut kesesuaian (Chua, 2014a) memerlukan responden menjawab berdasarkan skala persetujuan likert 5 kerana ia mempunyai kesahihan dan kebolehpercayaan yang tinggi. Respondan di minta menjawab Sangat Setuju (5), Setuju (4), Tidak Pasti (3), Tidak Setuju (2) atau Sangat Tidak Setuju (1). Aspek-aspek yang dinilai termasuk:

i. **Keupayaan Pengetahuan dan Kemahiran Teknikal:** Menilai pemahaman alumni dalam industri pelancongan dan hospitaliti serta kemahiran teknikal mereka.

ii. **Kemahiran Komunikasi dan Kepimpinan:** Menilai bagaimana alumni menggunakan kemahiran kepimpinan, kerja berpasukan, dan kemahiran sosial dalam industri.

iii. **Pemikiran Kritikal dan Penyelesaian Masalah:** Menilai kemampuan alumni dalam menerapkan pemikiran kritis dan menyelesaikan masalah dalam industri.

iv. **Kebolehan Pengurusan dan Keusahawanan:** Menilai kebolehan alumni dalam pengurusan dan keusahawanan melalui pembelajaran berterusan.

Soal selidik ini dibangunkan berdasarkan kajian literatur dan disesuaikan dengan konteks kajian untuk memastikan kesahan dan kebolehpercayaan instrumen.

3.4 Prosedur Pengumpulan Data

Data dikumpulkan menggunakan platform Google Forms untuk memudahkan pengumpulan data secara

dalam talian. Prosedur pengumpulan data adalah seperti berikut:

3.4.1 Pembangunan Soal Selidik:

Soal selidik dibangunkan dan diuji untuk memastikan kesahan dan kebolehpercayaan. Soal selidik ini memfokuskan pada empat aspek utama pencapaian PEO dan dibangunkan oleh Bahagian Kurikulum Jabatan Pembangungan Politekenik dan Kolej Komuniti (JPPKK) untuk kesemua institusi di bawah Program DHM.

3.4.2 Penghantaran Soal Selidik:

Soal selidik digital dihantar kepada alumni mengikut kohort yang ditentukan menggunakan alamat e -mel yang tersedia serta menggunakan platform komunikasi lain yang digunakan oleh institusi.

3.4.3 Tempoh Pengumpulan Data:

Alumni diminta untuk melengkapkan soal selidik dalam tempoh masa yang ditetapkan. Untuk meningkatkan kadar respons, peringatan dihantar kepada responden melalui e-mel dan platform komunikasi lain yang digunakan oleh institusi.

3.4.4 Pengumpulan dan Penyimpanan Data:

Data yang dikumpul melalui Google Forms dianalisis untuk memastikan ketepatan dan kerahsiaan maklumat. Semua data adalah anonim untuk mengurangkan bias dalam jawapan dan melindungi privasi responden. Setelah soal selidik dimasukkan ke dalam platform yang dipilih, pemakluman mengenai soal selidik tersebut boleh disampaikan melalui pelbagai saluran media sosial. Menggunakan pendekatan ini, saiz sampel Snow Ball lebih besar dan lebih besar kerana setiap subjek tambahan mengambil lebih banyak subjek (Rahman, 2023). Antara cara yang boleh digunakan termasuk:

- Laman Web Institusi: Memaparkan maklumat tentang soal selidik di laman utama atau bahagian khusus untuk alumni.
- Facebook Persatuan Alumni: Menggunakan halaman atau kumpulan Facebook untuk berkongsi pautan dan maklumat tentang soal selidik.
- Kumpulan WhatsApp: Menghantar mesej secara langsung kepada ahli kumpulan untuk mengingatkan mereka mengenai soal selidik dan pentingnya penyertaan mereka.
- Telegram Alumni: Menggunakan saluran Telegram untuk memudahkan komunikasi dan mengingatkan ahli tentang soal selidik.
- Media Sosial Lain: Platform seperti Instagram, Twitter, atau LinkedIn juga boleh digunakan untuk mencapai lebih ramai alumni.

Dengan menggunakan pelbagai platform ini, diharapkan penyertaan dalam soal selidik dapat ditingkatkan dan maklumat dapat disebarkan dengan lebih efektif.

3.5 Analisis Data

Data yang diperoleh akan dianalisis menggunakan teknik statistik deskriptif untuk menilai pencapaian PEO alumni. Data yang telah dikumpul, boleh dianalisis dengan menggunakan perisian yang bersesuaian seperti SPSS. Analisis ini akan memberikan gambaran tentang pencapaian matlamat program berdasarkan jawapan yang diberikan oleh responden. Penilaian akan merangkumi pengiraan purata, peratusan, dan distribusi respons untuk setiap aspek yang dinilai.

3.6 Kesimpulan

Metodologi yang digunakan dalam kajian ini membolehkan penyelidik menilai pencapaian PEO secara komprehensif dengan menggunakan data kuantitatif yang diperoleh daripada soal selidik digital. Dengan pendekatan ini, kajian diharapkan dapat memberikan maklumat yang berguna untuk penambahbaikan program DHM dan memastikan keberkesanan pendidikan dalam memenuhi keperluan industri.

4. Data Analisis

4.1 Kesahan Instrument Soal Selidik

Bagi menguji kebolehpercayaan item soal selidik nilai Alpha Cronbach dirujuk untuk mengukur nilai kebolehpercayaan ke semua item dalam instrumen soal selidik yang akan digunakan dalam kajian sebenar. Menurut Muhammad Nidzam, (2016) nilai pekali Alpha Cronbach yang melebihi nilai 0.6 adalah boleh

dipertimbangkan dan diterima. Berdasarkan jadual 1, dapat dilihat di sini bahawa instrument soal selidik ini mempunyai kebolehpercayaan yang baik kerana nilai Alpha Cronbach dalam mengukur tahap pencapaian obejktif program (OP) Program Diploma Pengurusan Hotel (DHM) di Politeknik Kota Kinabalu dengan Jadual 1 berikut:

Jadual 1: Nilai pekali kepercayaan Alpha Cronbach

nilai α=0.963		
	Nilai pekali kepercayaan Alpha Cronbach	
	Bilangan item	**α**
PEO	26	0.963

4.2 Demografi Dan Maklumat Latar Belakang Responden

Maklumat demografi responden merangkumi jantina, status pekerjaan, bekerja mengikut bidang, pengalaman bekerja dan pendapatan bulanan. Maklumat demografi ini diringkaskan dalam jadual 2 di bawah.

Jadual 2: Maklumat Demografi Responden

Perkara	**Bilangan**	**Peratus (%)**
Jantina		
Lelaki	16	23.5
Perempuan	52	76.5
Kelayakan Akademik		
Diploma	39	57.3
Ijazah Sarjana Muda	29	42.7
Master	0	0
Tahun Bergraduan		
2019	24	35.9
2020	23	33.8
2021	10	14.7
2022	11	16.2
Status Pekerjaan Sekarang		
Bekerja	49	72
Menyambung Pengajian	14	20.5
Belum Bekerja	5	7.5
Bekerja mengikut bidang		
Ya	29	42.6
Tidak	39	57.4
Pendapatan bulanan		
RM 1,000.00 - RM 2,000.00	38	70
RM 2,000.00 - RM 3,000.00	8	15
RM 2,000.00 – RM4,000.00	8	15

Dapatan kajian menunjukkan seramai 49 orang respondan telah bekerja manakala 14 orang respondan telah menyambung pengajian dan hanya 5 orang responden masih belum bekerja, Majoriti responden bekerja tidak mengikut bidang pengajian dan selebihnya 29 responden yang berkeja mengikut bidang. Majoriti responden mempunyai pendapatan bulanan sebanyak RM 1,000.00 hingga RM2,000.00 dan ke atas,

4.3 Analisis Data Deskriptif

Analisis statistik deskriptif bertujuan untuk mendeskripsikan dan menggambarkan data yang telah terkumpul tanpa membuat generalisasi atau kesimpulan yang lebih luas. Dalam konteks ini, data dianalisis menggunakan Sistem Pengukuran Pencapaian PEO Program Diploma Pengurusan Hotel (DHM) di Politeknik Kota Kinabalu. Jadual Interpretasi Skor Min yang dibina oleh Creswell (2011) digunakan dalam kajian ini untuk mengukur skor min. Berikut adalah cara analisis statistik deskriptif dapat dilakukan dalam kajian ini:

Jadual 3: Interpretasi skor min

Julat Skor min	**Interpretasi skor min**
1.00 - 1.80	Sangat Rendah

1.81 – 2.60	Rendah
2.61 – 3.40	Sederhana
3.41– 4.20	Tinggi
4.21 – 5.00	Sangat Tinggi

Sumber: *Creswell*, 2011

4.3.1 Objektif Program (PEO)

Kajian ini mempunyai empat objektif Programme Educational Objectives (PEO) yang melibatkan:

i. PEO 1

Able to display critical knowledge-based understanding, coherent with highly developed technical skills projected in a polished attitude in tourism and hospitality industry.

ii. PEO 2

Communicate effectively and utilize excellent leadership, teamwork and social skills to fulfill industrial needs.

iii. PEO 3

Apply critical thinking and problems solving skills professionally in dealing with various tourism and hospitality challenges.

iv. PEO 4

Able to apply management, entrepreneurship skills and adhere to the need of continuous learning for successful career advancement

4.3.2 Tahap pencapaian PEO 1

Dalam kajian ini, PEO 1 mempunyai lima item soalan yang terkandung dalam instrument kajian. Jadual 4 menunjukkan markah min dan sisih piawaian untuk PEO 1 yang melibatkan 68 responden.

Jadual 4:Markah min dan sisih piawaian untuk PEO 1

No Item	Penyataan Item	Skor min	Sisihan piawai
S1	Saya dapat menggunakan kemahiran sedia ada dalam pekerjaan semasa.	4.25	0.936
S2	Saya dapat menggunakan pengetahuan sedia ada sesuai dengan jangkaan industri.	4.15	0.797
S3	Saya dapat menggunakan kelayakan yang ada untuk melaksanakan tugas dan peranan khusus di industri.	4.04	0.999
S4	Saya dapat mengaplikasi pengetahuan teori sedia ada yang diperlukan oleh industri.	4.21	0.856
S5	Program ditawarkan membekalkan saya kemahiran teknikal berkaitan dengan industri.	4.10	0.917

Jadual 4 menunjukkan data mengenai skor min dan sisihan piawai bagi beberapa pernyataan item berkaitan dengan PEO 1. S1 mempunyai skor min tertinggi 4.25, menunjukkan bahawa peserta merasa sangat yakin dalam menggunakan kemahiran sedia ada mereka dalam pekerjaan semasa. S3 mempunyai skor min terendah 4.04 tetapi masih menunjukkan penilaian yang agak positif mengenai penggunaan kelayakan dalam tugas khusus di industri. Manakala bagi sisih piawai S2 mempunyai sisihan piawai terendah 0.797, menunjukkan bahawa terdapat nilai yang lebih tinggi dalam penilaian mengenai penggunaan pengetahuan sedia ada sesuai dengan jangkaan industri. Manakala S3 mempunyai sisihan piawai tertinggi 0.999, yang menunjukkan variasi yang lebih besar dalam penilaian mengenai penggunaan kelayakan untuk melaksanakan tugas dan peranan khusus di industri. Secara keseluruhan, semua item mempunyai skor min yang tinggi, menunjukkan penilaian positif mengenai penggunaan kemahiran, pengetahuan, dan kelayakan dalam konteks industri. Sisihan piawai yang lebih rendah menunjukkan nilai yang lebih besar dalam penilaian, sementara sisihan piawai yang lebih tinggi menunjukkan variasi dalam pandangan peserta.

4.3.3 Tahap pencapaian PEO 2

Jadual 5 adalah analisis data berdasarkan statistik skor min dan sisihan piawai untuk item-item dalam PEO 2 yang merangkumi enam item soalan, yang melibatkan kemahiran komunikasi dan tanggungjawab sosial responden.

Jadual 5: Markah min dan sisih piawaian untuk PEO 2

No Item	Penyataan Item	Skor Min	Sisihan piawai
S6	Saya boleh berkomunikasi secara efektif.	4.47	.680
S7	Saya dapat menerima perubahan persekitaran pekerjaan.	4.47	.610
S8	Saya mampu memimpin organisasi.	4.04	.818
S9	Saya mampu bekerja di dalam penyeliaan yang minimum.	4.28	.730
S10	Saya memiliki kemahiran-kemahiran penting dalam pengurusan semasa menjalankan tugas.	4.28	.750
S11	Saya mampu bekerja secara berkumpulan.	4.56	.583

Skor min S11 dalam Jadual 4 menunjukkan "Saya mampu bekerja secara berkumpulan." mempunyai skor min tertinggi 4.56, menunjukkan penilaian yang sangat positif mengenai kebolehan dalam bekerja secara berkumpulan. Selain itu, S8 "Saya mampu memimpin organisasi." mempunyai skor min terendah 4.04, tetapi masih menunjukkan penilaian positif mengenai kebolehan memimpin. Bagi data S11 mempunyai sisihan piawai terendah 0.583, yang menunjukkan bahawa penilaian mengenai kebolehan bekerja secara berkumpulan adalah sangat konsisten di kalangan responden. Manakala S8 mempunyai sisihan piawai tertinggi 0.818, menunjukkan terdapat variasi yang lebih besar dalam pandangan responden mengenai kebolehan memimpin organisasi. Kesimpulannya, semua item dalam PEO 2 menunjukkan skor min yang memuaskan, mencerminkan pandangan positif responden mengenai kemahiran komunikasi dan tanggungjawab sosial mereka. Data ini menunjukkan bahawa responden secara umumnya yakin dalam kemahiran insaniah mereka, dengan sedikit variasi dalam kebolehan memimpin. Penekanan boleh diberikan kepada pengukuhan kemahiran kepimpinan untuk meningkatkan keseragaman dalam penilaian di masa depan.

4.3.4 Tahap pencapaian PEO 3

Jadual 6 menunjukkan hasil dapatan PEO 3 yang mempunyai lima item soalan yang merangkumi pemikiran kritis dan Kemahiran penyelesaian masalah. Skor min dan sisih piawai adalah seperti jadual 6 berikut.

Jadual 6: Markah min dan sisih piawaian untuk PEO 3

No Item	Penyataan Item	Skor Min	Sisihan piawai
S12	Saya boleh menyumbang idea untuk penambahbaikan organisasi.	4.10	.794
S13	Saya boleh menyelesaikan masalah yang timbul secara kreatif dalam pelbagai situasi.	4.21	.703
S14	Saya berkelakuan dan bertindak secara profesional semasa menjalankan tugas.	4.29	.734
S15	Saya mengamalkan etika yang baik semasa bekerja.	4.44	.678
S16	Saya dapat menggambarkan bagaimana kita boleh berhasil melaksanakan sesuatu.	4.24	.735

Secara keseluruhannya, jadual 6 menunjukkan skor min bagi S15 iaitu "Saya mengamalkan etika yang baik semasa bekerja." mempunyai skor min tertinggi 4.44, menunjukkan bahawa responden merasa sangat baik dalam mengamalkan etika kerja. Selain itu, S12 "Saya boleh menyumbang idea untuk penambahbaikan organisasi." mempunyai skor min terendah 4.10, tetapi masih menunjukkan penilaian positif. Seterusnya Sisihan Piawai bagi jadual 5 menunjukkan S15 mempunyai sisihan piawai terendah (0.678), menunjukkan bahawa penilaian mengenai amalan etika di tempat kerja adalah konsisten di kalangan responden. Manakala S13 "Saya boleh menyelesaikan masalah yang timbul secara kreatif dalam pelbagai situasi." dan S16 "Saya dapat menggambarkan bagaimana kita boleh berhasil melaksanakan sesuatu." mempunyai sisihan piawai yang sedikit lebih tinggi 0.703 dan 0.735. Ini menunjukkan variasi yang sedikit lebih besar dalam pandangan responden mengenai kreativiti dalam menyelesaikan masalah. Data ini menunjukkan bahawa secara umum, responden merasakan bahawa mereka mematuhi etika kerja yang baik dan berkelakuan profesional, namun terdapat peluang untuk meningkatkan kreativiti dalam menyelesaikan masalah dan perancangan strategik.

4.3.5 Tahap pencapaian PEO 4

Seterusnya, PEO 4 mempunyai enam item soalan yang terkandung dalam instrumen kajian. Jadual 7 menunjukkan skor min dan sisihan piawai untuk PEO 4.

Jadual 7: Markah min dan sisih piawaian untuk PEO 4

No Item	Penyataan Item	Skor Min	Sisihan piawai
S17	Saya boleh menjadi usahawan.	3.81	.935
S18	Saya mampu memimpin organisasi perniagaan.	3.84	.908
S19	Saya mampu menyelesaikan masalah perniagaan.	3.87	.790
S20	Saya mampu menyediakan pengurusan kewangan untuk organisasi.	3.63	.945
S21	Saya mampu menyediakan perancangan perniagaan yang berdaya maju.	3.66	.891
S22	Saya memiliki kemahiran keusahawanan di tempat kerja.	3.82	.945

Jadual 7 menunjukkan skor min bagi S19 "Saya mampu menyelesaikan masalah perniagaan." mempunyai skor min tertinggi 3.87, menunjukkan bahawa responden merasa mereka agak berdaya dalam menyelesaikan masalah perniagaan. Seterusnya S20 "Saya mampu menyediakan pengurusan kewangan untuk organisasi." mempunyai skor min terendah 3.63, menunjukkan bahawa responden merasa sedikit kurang yakin dalam menyediakan pengurusan kewangan yang efektif. Seterusnya bagi Sisihan Piawai S20 dan S22 "Saya memiliki kemahiran keusahawanan di tempat kerja." mempunyai sisihan piawai tertinggi 0.945, menunjukkan nilai lebih besar dalam penilaian mengenai pengurusan kewangan dan kemahiran keusahawanan di tempat kerja. Data S19 mempunyai sisihan piawai terendah 0.790, menunjukkan bahawa penilaian mengenai keupayaan menyelesaikan masalah perniagaan adalah agak konsisten di kalangan responden. Data ini menunjukkan bahawa terdapat peluang untuk meningkatkan kemahiran dalam pengurusan kewangan dan perancangan perniagaan, sekaligus memperkukuh keupayaan dalam menyelesaikan masalah perniagaan. Program latihan atau bimbingan dalam bidang ini mungkin dapat membantu meningkatkan keyakinan dan kemahiran responden.

4.4 Tahap Keseluruhan PEO

Berdasarkan data skor min dan sisihan piawai yang telah diberikan untuk semua PEO, kesimpulannya mengenai tahap pencapaian keseluruhan responden.

Jadual 8: Markah min dan sisih piawaian untuk PEO

PEO	Penyataan PEO	Skor Min	Sisihan piawai
PEO 1	*Able to display critical knowledge-based understanding, coherent with highly developed technical skills projected in a polished attitude in tourism and hospitality industry.*	4.26	.765
PEO 2	*Communicate effectively and utilize excellent leadership, teamwork and social skills to fulfill industrial needs*	4.40	.694
PEO 3	*Apply critical thinking and problems solving skills professionally in dealing with various tourism and hospitality challenges.*	4.28	.844
PEO 4	*Able to apply management, entrepreneurship skills and adhere to the real of continues learning for successful career advancement*	4.26	.785

5. Perbincangan Dan Cadangan

Kesimpulannya kajian ini menunjukkan bahawa Politeknik Kota Kinabalu telah berjaya mencapai tahap pencapaian yang tinggi dalam semua objektif pendidikan program (PEO) untuk program Diploma Pengurusan Hotel (DHM). Skor min yang diperolehi menunjukkan skor yang melebihi sasaran KPI 3.80 dalam semua aspek PEO, menandakan bahawa objektif yang ditetapkan telah dicapai dengan cemerlang. Semua objektif PEO menunjukkan pencapaian yang tinggi, mencerminkan kejayaan dalam menyediakan kemahiran teknikal dan insaniah yang diperlukan oleh graduan. Ini menunjukkan bahawa Politeknik Kota Kinabalu berfungsi dengan efektif dalam memenuhi matlamat pendidikan dan latihan yang ditetapkan.

Justeru itu, hal ini menunjukkan bahawa Bahagian Kurikulum, JPPKK dan Politeknik Kota Kinabalu Sebagai salah satu institusi penyedia TVET yang memainkan peranan penting dalam menyediakan latihan dan pendidikan berkualiti kepada pelajar sebelum mereka memasuki pasaran kerja atau melanjutkan pengajian. Justeru itu, penekanan dalam penerapan dan penilaian kemahiran serta kurikulum telah membantu memastikan kejayaan program ini. Antara penambahbaikan yang boleh dilaksanakan adalah dengan memberi fokus tambahan kepada aspek keusahawanan seperti pengurusan kewangan dan perancangan perniagaan, untuk meningkatkan pencapaian dalam bidang ini.

Dapatan kajian ini penting untuk memastikan graduan memperoleh pengetahuan dan kemahiran yang relevan untuk menghadapi cabaran dalam pasaran kerja. Penambahbaikan berterusan dalam program

pendidikan adalah kunci untuk memastikan graduan dapat menyumbang dengan berkesan dalam industri mereka. Lantaran itu, dapatan kajian ini menegaskan bahawa Politeknik Kota Kinabalu telah mencapai kejayaan yang signifikan dalam mencapai objektif program pendidikan mereka. Walau bagaimanapun, tindakan penambahbaikan yang dinyatakan akan membantu dalam mengekalkan dan meningkatkan pencapaian program, memastikan keberkesanan dan relevansi pendidikan dalam jangka panjang.

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POLITEKNIK KOTA KINABALU

Mathematics Anxiety and Its Relationship with Student Achievement in Politeknik Muadzam Shah

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Abstract

This study aims to identify the extent of students' mathematics anxiety based on their department and examine the relationship between academic achievement and the level of mathematics anxiety at Politeknik Muadzam Shah, Pahang. The measured elements include the level of mathematics anxiety and its correlation with students' performance in the final examination. 92 students were selected as the sample for this quantitative study. The research instrument employed was a questionnaire containing 30 items related to the study's scope, adapted from the Mathematics Anxiety Rating Scale (MARS). The data were processed using SPSS (Statistical Packages for Social Science) version 27.0. The analysis was based on descriptive statistics, such as frequency, percentage, mean, standard deviation, and inferential statistics, including the t-test and Spearman's Rho correlation. The findings indicate that students' mathematics anxiety was at a moderate level with M = 3.417, and SD = 0.503. The t-test analysis revealed no significant difference between students from the Department of Information Technology and Communication (JTMK) and the Department of Mechanical Engineering (JKM) in terms of their mathematics anxiety levels ($t = 0.842$; $p > 0.05$). Correlation analysis showed no significant difference and a weak positive relationship between final examination achievement and students' mathematics anxiety ($r = 0.136$, $p > 0.01$).

Keywords: mathematics anxiety, mathematics achievement, students' mathematics anxiety scale and department

1. Introduction

The Malaysian education system has reached another significant milestone by launching the Malaysian Education Blueprint 2015-2025 (Higher Education). This plan stems from recognizing higher education's crucial role in realizing the nation's aspirations to become a high-income country. There are ten key shifts that public and private higher education institutions and technical and vocational education and training (TVET) pathways must achieve. Through this transformation plan, emphasis is also placed on mastering core subjects such as science and mathematics. Mathematics, in particular, is a vital skill in various fields of work, especially in engineering, information technology, business, and accounting. Therefore, mathematical knowledge is a priority for prospective graduates of higher education institutions. Additionally, TVET graduates are encouraged to master mathematical skills to ensure they are competitive and capable of functioning effectively in the job market.

1.1 Background of the study

The establishment of Polytechnics under the Ministry of Higher Education Malaysia (KPTM) aims to train semi-professional workers, primarily focusing on the growing needs of the industrial and service sectors. The programs offered by polytechnics cover technical, commerce, and service fields, where mathematical skills are essential for students to master. However, there is concern that many graduates struggle to apply the mathematical knowledge learned during their studies in the workplace (Zeynivandnezhad e t al., 2012). This issue is more apparent among TVET students, who tend to believe that mathematical skills are less relevant to their field of work than other, more specific technical skills. This perception may stem from a lack of awareness regarding the importance of mathematics in the technical and industrial sectors. More worrying is that TVET is often viewed as a second choice by students who cannot enter university or fail to achieve excellent results in the Malaysian Certificate of Education (SPM) (Aiezat Fadzell, 2014). This perception must be addressed urgently so that TVET graduates can function effectively in an increasingly competitive job market.

In Malaysia, students seeking to enroll in polytechnic programs must meet specific educational qualifications, primarily based on their Sijil Pelajaran Malaysia (SPM) results, which are equivalent to a high school diploma. Most diploma programs require students to have completed Form 5 and passed the SPM examination with a minimum of 3 credits (Grade C) in relevant subjects, such as Mathematics, Science, or technical fields, especially for programs like engineering or IT. For non-technical fields like Business Studies, Hospitality Management, or Accounting, credits in Mathematics and English are often required, with some programs asking for proficiency in subjects like Economics or Commerce. Sometimes, polytechnics may

accept students with two credits for certificate programs. Additionally, students with vocational qualifications, such as the Sijil Kemahiran Malaysia (SKM) Level 2 or 3, are eligible to apply for diploma programs and may receive credit exemptions, allowing them to advance more quickly in their studies.

1.2 Problem statement

This research is essential for academic and professional landscapes, particularly in higher education. The stigma surrounding mathematics, often viewed as a challenging and problematic subject, persists not only among school students but also within institutions of higher learning (Norziah Othman et al., 2014). This perception drives students away from higher-level mathematics courses and discourages them from pursuing careers heavily reliant on mathematical skills. According to Scarpello (2007), nearly 75% of Americans avoid careers involving mathematics due to the fear that poor performance in the subject will harm their overall academic results, especially in final examinations. Consequently, this avoidance leads to a significant gap where many graduates entering the workforce fail to apply the mathematical knowledge they acquired during their education.

The assumption that mathematical skills are secondary to other competencies in the job market is a misconception that could hinder the potential of graduates in technical and professional fields. Mathematics is a fundamental tool integrated into many aspects of professional life, particularly in engineering, information technology, and the sciences (Zeynivandnezhad et al., 2012). Mastering mathematical principles is beneficial for academic success and crucial for critical thinking, problem-solving, and analytical skills, which are essential in a knowledge-driven economy. By addressing mathematics anxiety and its impact on student performance, this study aims to provide valuable insights into how students perceive and engage with mathematics at the tertiary level.

At Politeknik Muadzam Shah (PMS), the situation is reflective of this broader issue, where students from the Department of Information and Communication Technology (JTMK) and the Department of Mechanical Engineering (JKM) are required to undertake mathematics subjects as part of their curriculum. However, based on the Course Review Report for the Session II: 2022/2023 final examination results, student performance in mathematics has been moderate, with only 56% of JTMK students and 52% of JKM students achieving satisfactory results. These figures underscore the need for a deeper understanding of students' barriers to mastering mathematics.

This study is therefore significant in that it explores the role of mathematics anxiety as one of the potential contributing factors to the moderate performance observed among PMS students. By investigating the relationship between mathematics anxiety and student achievement, this research aims to uncover the root causes of such anxiety and its influence on academic outcomes. In doing so, the study will not only provide a clearer understanding of the challenges faced by PMS students. However, it will also identify critical factors contributing to mathematics anxiety, such as teaching methods, assessment techniques, and learning environments.

Moreover, the findings from this study could have a broader application beyond PMS, offering insights that could benefit other higher education institutions facing similar challenges. By understanding the factors contributing to mathematics anxiety and implementing targeted interventions, educators can create more supportive learning environments that foster mathematical understanding and confidence among students. This could lead to improved academic performance, better preparation for the workforce, and a greater appreciation for the importance of mathematics in both personal and professional contexts.

Ultimately, this study's significance lies in its potential to impact how mathematics is taught and learned at PMS, leading to more effective teaching strategies and interventions that address mathematics anxiety. The results of this research could pave the way for future studies on the topic and inspire initiatives to enhance mathematics education in polytechnics and other institutions, ensuring that graduates are better equipped with the necessary mathematical skills to succeed in their chosen careers.

1.3 Research questions

i. Is there a difference in the level of mathematics anxiety among students based on departments at Politeknik Muadzam Shah?
ii. Is there a relationship between mathematics anxiety and students' performance in the final examination at Politeknik Muadzam Shah?

1.4 Objectives of the study

This study has the following objectives to be achieved:

i. To identify whether there are significant differences in the levels of mathematics anxiety based on departments at Politeknik Muadzam Shah, Pahang.
ii. To determine whether there is a relationship between students' achievements in the Final Examination and their levels of mathematics anxiety at Politeknik Muadzam Shah, Pahang.

1.5 Significance and limitations of the study

This study addresses students' challenges in understanding and learning mathematics in the classroom. Additionally, the study aims to assess the impact of mathematics anxiety on students' performance. It is hoped that the findings of this study will provide insights into the issues being examined and benefit all parties, especially lecturers at the polytechnic, in their efforts to help students overcome difficulties in mastering mathematical concepts.

The scope of this study is limited to second-semester students from Politeknik Muadzam Shah, Pahang, specifically from the Department of Information and Communication Technology (JTMK) and the Department of Mechanical Engineering (JKM). This study focuses on identifying the level of mathematics anxiety among students based on their departments and examining the relationship between the level of mathematics anxiety and students' performance in the subject of mathematics.

2. Literature Review

2.1 Mathematical anxiety

According to Marzita (2002), mathematics anxiety refers to feelings of stress and anxiety that arise when a person is faced with numbers or mathematics, whether in everyday problem-solving situations or while learning the subject. Ashcraft (2002) defines mathematics anxiety as tension, nervousness, and fear that is strong enough to interfere with the process of learning mathematics. He also stated that anxiety towards mathematics drives students to avoid situations that require them to use mathematics. The level of mathematics anxiety varies among individuals. It can be caused by negative experiences with mathematics, family pressure and expectations, the teacher's personality and teaching style, and the influence of family and peers (Marzita, 2002).

Mathematical anxiety is a significant factor that can influence both the daily lives and academic performance of students, often exacerbating stress levels. If not addressed, this condition can lead to long - term adverse outcomes (Shishigu, 2018). Research indicates that math anxiety affects students as early as the first grade, primarily impairing their working memory (Aosi et al., 2019). Moreover, mathematical anxiety has been identified as a detrimental factor for learning achievement and future career prospects. Students with higher levels of mathematical anxiety tend to exhibit lower socioeconomic status, weaker teacher-student relationships, reduced self-efficacy, and diminished problem-solving abilities compared to their peers with little or no anxiety (Zhou et al., 2020).

This negative correlation between mathematical anxiety and academic performance likely stems from students' tendency to avoid mathematics, which impairs their ability to solve complex mathematical problems (Ramirez et al., 2016). This avoidance behavior suggests the presence of cognitive barriers that inhibit the effective transfer of knowledge, making it difficult for students to comprehend mathematical concepts fully. A notable challenge in mathematics education is students' difficulty understanding abstract ideas, often linked to higher anxiety levels when encountering terms like "abstract" in problem statements (Levere & Kahlon, 2019). Addressing mathematical anxiety is crucial in mental health interventions to overcome learning obstacles and improve academic outcomes (Ardi et al., 2019).

2.2 Mathematical anxiety and gender

Comparisons between previous studies that examined the relationship between gender and the level of mathematics anxiety have yielded different findings. Several previous studies showed that female students had higher levels of anxiety compared to male students (Yuksel-Sahin, 2008; Karimi & Venkatesan, 2009). Devine et al. (2012) conducted a study on 433 students aged seven to nine years in Britain and found higher levels of anxiety among female students compared to males. Similarly, a study by Adamu (2013) on 148 engineering students at a polytechnic in Nigeria showed similar results. Some studies indicate a relationship between student achievement and mathematics anxiety levels among teachers across both student and teacher genders. Ramirez et al. (2013) conducted a study on 52 male and 65 female students and female teachers at an elementary school in the United States, focusing on anxiety levels, mathematics achievement, and gender. The results showed a negative correlation between mathematics anxiety levels among female teachers and the mathematics achievement of female students. Mathematics anxiety among female teachers was linked to the beliefs and attitudes of female students towards mathematics.

However, previous studies also present contrasting findings, where no significant difference in anxiety levels based on gender was observed. Alireza Pourmoslemi et al. (2013), who conducted a study on 275 students at a university in Iran, found no significant difference between mathematics anxiety levels and gender. This finding was also supported by other studies by Keshavarzi and Ahmadi (2012), Marzita and Siti Zaleha (2014), and Effendi et al. (2012).

2.3 Mathematical anxiety and achievement

Mathematics anxiety is often associated with student performance and is a significant predictor in assessing achievement in mathematics (Mohd Rustam et al., 2014). Tapia (2004) found that students who did not experience mathematics anxiety showed higher levels of learning motivation compared to those with high levels of anxiety towards mathematics. This finding suggests that an increase in mathematics anxiety can lead to a decline in academic achievement.

This finding was reinforced by a study by Effandi and Norazah (2008) involving 88 students at a matriculation center. The analysis of this study showed that matriculation students with high levels of mathematics anxiety tended to achieve lower mathematics performance. The study also found that students with high levels of anxiety were less motivated to engage in activities related to mathematics.

A study conducted by Marzita Puteh and Siti Zaleha (2016), involving 190 Form Four students in the Perak Tengah district of Malaysia, also confirmed the negative relationship between mathematics anxiety and mathematics achievement. Students who exhibited high levels of anxiety in mathematics were found to perform lower, and vice versa.

Arsaythamby (2010) also studied mathematics learning orientation and academic achievement involving 674 Form Four students from 16 schools. His study found a significant positive relationship between attitude, habits, problem-solving behavior, and the learning environment with mathematics performance. Furthermore, the study concluded a significant negative correlation between mathematics anxiety and students' academic performance, indicating that all aspects studied were significantly related to student achievement.

Putri et al. (2020) found that high levels of mathematical anxiety significantly impact students' math learning achievements. A longitudinal study suggested that low arithmetic performance can have far -reaching effects, including on future academic success, employment prospects, criminal behavior, mental health, and income. Mathematical underachievement is closely associated with many nations' social, cultural, and economic challenges. However, addressing this issue could lead to positive outcomes, reversing these negative trends.

A study conducted by Gonzalez-DeHass et al. (2024) examined math anxiety among undergraduate students, linking it to achievement goals and parental influence. It was found that students with higher anxiety tended to have lower academic performance in mathematics. The study also highlighted the role of mindset (fixed or growth) in moderating the effects of math anxiety on performance. Another study explored how math self-efficacy, mindset, and anxiety influence students' math and science achievement. It emphasized that a growth mindset can reduce the adverse effects of math anxiety, thereby improving academic performance.

Sari and Szczygieł (2023) conducted a comprehensive study involving 234 elementary and high school students in Turkey. The study focused on how math anxiety and students' mindsets, whether fixed or growth -oriented, can influence their academic performance. The findings revealed that high levels of math anxiety often act as a barrier to achieving academic excellence. However, interventions designed to foster a growth mindset believing that mathematical abilities can be improved through effort and effective s trategies significantly reduced anxiety. As a result, students experienced decreased math anxiety and notable improvements in their academic performance. This study has significant educational implications, particularly in developing more effective learning strategies to support students struggling with math anxiety.

3. Methodology

The methodology of this research is as follows.

3.1 Population and sampling

The researcher selected students from Politeknik Muadzam Shah, Pahang as the population for this study. The non-probability sampling method used was purposive sampling. This selection was made because the researcher sought respondents who met specific criteria relevant to the study's objectives. According to Lim (2007), this sampling technique is appropriate when everyone in the population does not have an equal chance of being selected as a sample. Therefore, this method was chosen as the study focuses on second-semester students at Politeknik Muadzam Shah, Pahang.

The sample for this study consists of second-semester students from Session 2: 2023/2024 from the Department of Information and Communication Technology (JTMK) and the Department of Mechanical Engineering (JKM). This selection was made because only these two departments have students enrolled in mathematics courses as part of their studies. These students also took the Final Examination in Session 2: 2023/2024. The total sample size for this study is 92 students, comprising 66 males and 26 females.

3.2 Research instruments

The methodology of this study employs a survey research approach to address the research questions and problem statements being investigated. This method was chosen because it is considered the most suitable and practical for obtaining relevant respondent feedback. The quantitative research design involves a current survey and a correlation study. The main instrument used is a questionnaire to collect data from respondents. The use of a questionnaire was selected as it is deemed more practical, effective, and time-saving, as noted by Syed Arabi (1992). Therefore, the research instrument was adapted from the Mathematics Anxiety Rating Scale (MARS) and tailored to meet the needs of the sample in this study.

This questionnaire consists of two sections: Section A and Section B. In Section A, respondents are asked to provide personal information such as registration number, gender, semester, and program. Meanwhile, Section B contains 30 questions related to the level of mathematics anxiety. These questions are constructed based on a Likert scale with 5 response options, ranging from 1 (Not at all) to 5 (Very much).

Table 1: Validity of the study (Cronbach's Alpha, α)

Scale	Pilot test	Actual study
Mathematics Anxiety	0.871	0.872

Before starting the main study, the researcher conducted a pilot study involving 30 students who were not part of the actual study sample. The pilot study ensured that the research instrument used had acceptable reliability. According to Table 1, the alpha coefficient for the pilot test instrument ($\alpha = 0.871$) and the actual study ($\alpha = 0.872$) is considered good, falling within the range of 0.88 to 0.91. According to Chua (2006), an alpha value between 0.80 and 0.89 is considered good and indicates a high ability of the instrument items to measure the variables being studied.

3.3 Data collection techniques

The researcher consulted with the Head of Department to obtain permission to conduct the study and to arrange a time slot after the teaching and learning sessions were completed. After teaching and learning ended, the researcher used a slot to explain the study. The questionnaire was distributed among the students, explaining the study's objectives and assuring the confidentiality of their responses. A brief briefing was provided on how to complete the questionnaire, and the researcher also assisted students who had difficulty understanding the questions. Discussion among students was discouraged. Students were given 25 minutes to complete the questionnaire.

To obtain information on student performance, the researcher accessed the results of the Final Examination for Session 2: 2023/2024 through the Course Outcome Review Report (CORR) data generated by the Polytechnic Management Information System (SPMP). The researcher could link and retrieve students' examination results using the registration numbers provided on the questionnaire.

3.4 Data analysis

The collected data was coded and analyzed using the Statistical Package for Social Science (SPSS) Version 27.0 software. Data analysis included descriptive analysis, such as frequency, percentage, mean, and standard deviation, and inferential analysis involving t-tests and Spearman Rho correlation.

4. Finding and Analysis

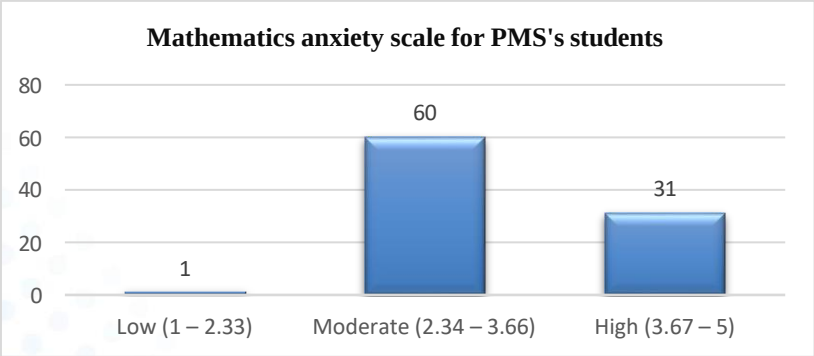
The findings of this research are as follows.

4.1 Research findings

Table 2: Frequency distribution by gender and department

Variable	Frequency	Percentage (%)
Gender		
Male	66	71.7
Female	26	28.3
Department		
JTMK		46.7
DIT	7	7.6
DDT	36	39.1
JKM		53.3
DMA	6	6.5
DRA	26	28.3
DRP	10	10.9
DTP	7	7.6

According to Table 2, the respondents comprised 92 students, with 66 (71.7%) male and 26 (28.3%) female. The respondents were selected from two departments: 43 (46.7%) from JTMK and 49 (53.3%) from JKM. Within JTMK, 7 (7.6%) students were enrolled in the Diploma in Information Technology (DIT) and 36 (39.1%) in the Diploma in Information Technology (Digital Technology) (DDT). Meanwhile, within JKM, 6 (6.5%) students were enrolled in the Diploma in Engineering (Automation) (DMA), 26 (28.3%) in the Diploma in Engineering (Automotive Design) (DRA), 10 (10.9%) in the Diploma in Engineering (Product Design) (DRP), and 7 (7.6%) in the Diploma in Engineering (Manufacturing) (DTP).



Graph 1: Graph of mathematics anxiety levels

Graph 1 shows the mathematics anxiety scale for students, divided into three categories: low, moderate, and high. The study found that most respondents, 60 individuals (65.2%) out of the total sample, had a moderate level of mathematics anxiety with a mean score of 3.417. Additionally, one respondent (1.1%) had a low level of anxiety, and 31 respondents (33.7%) exhibited a high level of mathematics anxiety.

4.2 Research Question 1

Is there a difference in the level of mathematics anxiety among second-semester students based on their department at Politeknik Muadzam Shah?

Table 3: t-test of mathematics anxiety levels based on department.

Variable	N	Mean	SD	*t-test*	sig-*t*(2 tailed)
Department				0.842	0.402
JTMK	43	3.46	0.587		
JKM	49	3.38	0.417		

The findings from Table 3 indicate no statistically significant difference in mathematics anxiety levels between students from the Department of Information and Communication Technology (JTMK) and the

Department of Mechanical Engineering (JKM) at Politeknik Muadzam Shah (PMS) ($t = 0.842$, $p > 0.05$). The close mean scores ($M = 3.46$ for JTMK, $M = 3.38$ for JKM) suggest that students from both departments experience comparable levels of anxiety, which are moderate overall. This similarity implies that the issue of mathematics anxiety is not specific to one discipline but rather a shared challenge across different fields of study. Such a finding points to common institutional or instructional factors, such as teaching methods or assessment styles, which may contribute to anxiety across the student body, regardless of their department.

Given this, institution-wide approaches to addressing mathematics anxiety could effectively reduce its impact on students from both departments. The moderate anxiety levels, while not extreme, still pose a risk to student engagement and academic performance if not properly managed. Therefore, interventions such as anxiety-reduction programs, improved teaching strategies, or peer support systems could be implemented across the polytechnic to benefit all students. Additionally, the lack of departmental differ ence suggests that factors like individual student experiences or the overall learning environment might play a more significant role in shaping anxiety levels, highlighting the need for further research into personal and contextual influences on mathematics anxiety.

4.3 Research Question 2

Is there a relationship between mathematical anxiety and student achievement in final examinations at Muadzam Shah Polytechnic?

Table 4: Correlation between the level of mathematical anxiety and students' mathematical achievement.

		Mathematical anxiety	**Mathematical achievement**
Mathematical anxiety	Spearman's Rho Correlation	1.000	0.136
	Sig (2-tailed)		0.195
	N	92	92
Mathematical achievement	Spearman's Rho Correlation	0.136	1.000
	Sig (2-tailed)	0.195	
	N	92	92

**Correlation is significant at the 0.01 level (2-tailed)

The results presented in Table 4 reveal a weak and non-significant positive correlation between mathematical anxiety and student achievement in the final examinations at Politeknik Muadzam Shah (PMS) for Semester 2: 2023/2024 ($r = 0.136$, $p > 0.01$). This indicates no strong relationship between student anxiety levels and their performance in mathematics exams. In other words, students with higher mathematical anxiety do not necessarily achieve lower grades, nor do those with lower anxiety consistently perform better. This outcome suggests that while anxiety may be present among students, it does not significantly impact their ability to perform in exams at PMS, at least in the sample studied.

These findings contrast with the research by Marzita and Siti Zaleha (2016), which found a more vital link between anxiety and lower achievement among Form 4 students in Perak. The difference in results may be attributed to varying sample characteristics, educational contexts, or assessment methods between the two studies. It highlights that the relationship between mathematical anxiety and achievement can vary depending on the student population being studied. Thus, the conclusions drawn from this study are specific to PMS students and may not necessarily be generalizable to other contexts. Further research could explore other variables, such as motivation or study habits, which may interact with anxiety to influence academic outcomes.

4.4 Discussion

The study's results show that the level of mathematical anxiety among PMS students is moderate. However, there is a significant difference between male and female students in terms of mathematical anxiety, which contrasts with previous studies. This finding contradicts studies by Keshavarzi and Ahmadi (2013), Marzita and Siti Zaleha (2014), and Effendi et al. (2012), which stated that there is no difference in the level of mathematical anxiety based on gender.

In addition, the study found a negative relationship between mathematical anxiety and mathematical achievement, indicating that higher levels of mathematical anxiety are associated with lower performance in mathematics. This finding aligns with the results of Marzita and Siti Zaleha (2016), Effandi and Norazah (2008), and Tapia (2004), which demonstrated a negative correlation between anxiety and achievement. Based on the study's results, although the correlation value from the analysis was not high, mathematical anxiety can

be a good predictor of student performance both inside and outside the classroom. This should raise awareness among educators to be more attentive to the differences in student achievement due to anxiety toward mathematics.

These findings highlight the importance of addressing mathematical anxiety to improve student learning outcomes. Recommendations include the early identification of students experiencing mathematical anxiety, targeted interventions, building student confidence, and creating a positive learning environment. Further research is needed to examine the root causes of mathematical anxiety and the effectiveness of various intervention strategies.

Educators need to be sensitive to the effects of math anxiety on students' performance based on gender. They should also create an engaging and enjoyable learning environment while delivering knowledge in the classroom. Cooperative learning techniques, such as group work, can be implemented to reduce students' anxiety about mathematics.

Tang's (1990) study also suggested several methods that educators can practice to help reduce students' anxiety, namely: (i) providing encouragement and praise to students so they can build confidence and positively motivate them, (ii) reducing threats by avoiding the use of threatening or intimidating language towards students, (iii) showing love, warmth, trust, empathy, and acceptance to students, and (iv) providing remedial support to low-achieving students.

5. Conclusion and Recommendations

Suggestions for future research include expanding the population of respondents by involving students from all polytechnics across the country and focusing more specifically on the various academic programs offered. Increasing the sample size is recommended to improve the accuracy and reliability of the data obtained. Additionally, a qualitative approach using instruments such as interviews can be considered to strengthen the findings from this quantitative study. An in-depth analysis of the factors contributing to students' anxiety towards mathematics is also highly relevant in identifying the root causes of the problems faced by students in the elements studied.

This research should be continued to understand students' strengths and weaknesses in mastering mathematics and to develop effective action research to address these challenges. Furthermore, longitudinal studies can be conducted to monitor the development of students' mathematical proficiency over time and to evaluate the effectiveness of interventions introduced in the long term. With this approach, future research findings are expected to significantly improve mathematics mastery among polytechnic students, strengthening their preparedness to face the increasingly competitive demands of the job market.

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POLITEKNIK KOTA KINABALU

The Implications of 20% Minimum Passing Marks Policy Towards Academic Dishonesty Among Students in Polytechnic Malaysia

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Abstract

Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) offers a range of diploma programs designed to equip students with practical skills and knowledge for various industries. There are currently 36 Polytechnics in Malaysia, each offering a variety of diploma programs across 15 departments. Assessments in these programs include both continuous assessments and final examinations, which are critical for evaluating student performance and ensuring the attainment of learning outcomes. Bahagian Peperiksaan dan Penilaian (BPN) is a division under JPPKK, responsible for the management and implementation of examinations and assessments in Polytechnics Malaysia. To enhance academic standards and standardize assessment criteria, BPN implemented a policy requiring a minimum passing mark of 20% for final examinations. This policy has been in effect for all programmes in Polytechnics Malaysia starting from academic session SII:2022/2023. This investigation focuses on the impact of the policy on the occurrence of academic dishonesty during final examinations among diploma students in Polytechnic Malaysia, focusing on the periods before and after the enforcement of the policy. Data are taken from three academic sessions, before the enforcement (SI:2022/2023) and after the enforcement (SII:2022/2023 and SI:2023/2024). The departments involved, which have reported academic dishonesty, include JKE, JKM, JKA, JKPK, JP, JTMK, JPH, and JAB. The results indicate an initial increase in dishonesty cases during final examination across most departments following the policy implementation, with a subsequent decline in the second session. These findings suggest that students eventually adapted to the new standards over time, hence showing positive impact of the policy. However, academic dishonesty during final exams is not solely due to policy changes but also influenced by student attitudes and behaviors. This study provides valuable insights for policymakers and educators in developing strategies to foster academic integrity.

Keywords: - JPPKK, Polytechnic, Academic Dishonesty, Examination, Passing Marks

1. Introduction

Academic dishonesty is a common issue in educational institutions worldwide, and this collective act undermines the integrity of academic achievements. Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) (Department of Polytechnic and Community College Education), which manage Malaysia's Polytechnic system, offers doper various diploma programs that lead to the attainment of knowledge and skills essential for pursuing career in different sectors. With a total of 36 Polytechnics countrywide, JPPKK plays a crucial role in overseeing Technical and Vocational Education and Training (TVET) in the country, ensuring they provide quality education and training in various technical and vocational fields.

Evaluation for student performance includes assessments such as continuous assessments and final examinations are critical to ensure the attainment of learning outcomes. Bahagian Peperiksaan dan Penilaian (BPN), a division under JPPKK, is responsible for the management and implementation of these examinations and assessments. To enhance academic standards and standardize assessment criteria, BPN implemented a policy requiring a minimum passing mark of 20% for final examinations, effective from the academic session SII:2022/2023. This policy was officially enforced through a letter from BPN dated February 18, 2023.

Despite efforts to enhance academic standards, the implementation of a minimum passing mark policy has raised concerns about its impact on academic dishonesty among students. This study examines the impacts of the 20% minimum passing marks policy on the incidence of academic dishonesty among diploma students during final examinations in Polytechnics Malaysia. This research intends to give insights into the effectiveness and unintentional consequences of the policy by investigating data from three academic sessions: before the enforcement (SI:2022/2023) and after the enforcement (SII:2022/2023 and SI:2023/2024).

1.1 Problem Statement

The implementation of minimum passing mark policy of 20% for final examinations by Bahagian Peperiksaan dan Penilaian (BPN) in Polytechnic Malaysia, effective from the academic session SII:2022/2023, aims to enhance academic standard and standardize assessment criteria. However, this policy has raised concerns regarding its impact on academic dishonesty among students, specifically cheating cases during final exams. Preliminary observations indicate a notable increase in cheating cases during the initial academic session following the policy's enforcement. This raises critical questions about the policy's effectiveness in promoting academic integrity and its potential unintended consequences. Therefore, it is essential to investigate the implications of this policy on the occurrence of academic dishonesty and to understand students' readiness and motivations during final examinations. This study seeks to address these concerns by inspecting data from multiple academic sessions to provide understanding on the implications of the policy and to deal better with future strategies for curbing academic dishonesty at Polytechnic Malaysia.

1.2 Objectives

The objectives of the study are:

i. To identify the number of cheating cases before and after the enforcement of the 20% minimum passing marks policy.
ii. to determine the differences in cheating cases between engineering and non-engineering department; and
iii. to investigate students' readiness towards the enforcement and reason for cheating during final examination.

1.3 Scope of study

This study involves data from academic departments across all Malaysian Polytechnics. 11 of 15 departments have reported at least one occurrence of cheating over the course of three academic sessions. This analysis includes eight departments, four of which are engineering departments and four of which are non-engineering. It focuses on departments with more than 1,000 diploma students taking final examinations, including both engineering and non-engineering departments. The departments involved are Jabatan Kejuruteraan Elektrik (JKE), Jabatan Kejuruteraan Awam (JKA), Jabatan Kejuruteraan Mekanikal (JKM), Jabatan Kejuruteraan Petrokimia (JKPK), Jabatan Perdagangan (JP), Jabatan Hospitaliti dan Pelancongan (JPH), Jabatan Teknologi Maklumat dan Komputer (JTMK), and Jabatan Agroteknologi & Bio-Industri (JAB).

This study adopted both quantitative and qualitative measures. The data was selected through purposive sampling involving all diploma students at Polytechnic from all over Malaysia. To ensure the authenticity of the data analysis findings, the investigation was carried out involving the student who had cheated during final examination.

1.4 Significance of the Study

Understanding the impact of the 20% minimum passing marks policy on academic dishonesty is crucial for developing effective strategies to enhance assessment standards while maintaining academic integrity. This study provides essential strategic planning inputs for improving the quality of learning outcomes in polytechnic and community college programs. The findings offer valuable insights for policymakers, educators, and administrators to enhance assessment practices and foster a culture of honesty and inte grity among students.

1.5 Conclusion

This paper is structured as follows: Section 2 reviews the literature on academic dishonesty, Section 3 describes the methodology, Section 4 presents the results and analysis, Section 5 discusses the findings and Section 6 conclude the implications and future recommendations.

2. Literature Review

Cheating during exams has become one of the unethical practices at higher education institutions across the world. This literature review aims to investigate the contributing factors of academic dishonesty, the impact of assessment policies and the factors that limit student cheating.

A number of studies identified the main reasons for students participating in cheating. Salehi and Gholampour (2021) have stated that lack of preparation, ineffectiveness of learning material, and desire for

higher marks were considered as primary contributing factors to cheating behaviours of students. Additionally, the causes of stress and other pressures from the external environment are also considered an important reason that leads to academic dishonesty (Anderman et al., 2007).

According to research, exam design is also a factor that contributes to cheating behaviour. Hammoudi and Benzerroug (2021) reported that 90 per cent of students agreed that exams are mainly testing memory rather than comprehension are the main reason of cheating. Additionally, the study implies that educators could unintentionally contribute to the problem by failing to accommodate students' diverse learning styles and intelligences in the design of exam assessment. This might lead to exam anxiety, the survival instinct to cheat might kick in, and it might be done without conscious intent (Hammoudi & Benzerroug, 2021).

Recent studies have provided valuable insights into the factors contributing to academic dishonesty among students. Benson and Enstroem (2023) propose a model for preventing academic dishonesty whereby they argue that well-designed academic integrity modules can reduce cheating. According to their findings, such approaches can reduce cheating by up to 78 per cent when the intervention provides a comprehensive academic dishonesty intervention. Researchers Baran and Jonason (2020) investigated links between academic dishonesty among university students and psychiatric measures like psychopathy, motivation and self-efficacy. Overall, they wrote, 'our findings suggest that cheating is more common among students who are higher in psychopathy and lower in self-efficacy.' Wang and Zhang (2022) propose that there are also links between attitudes relating to rules regarding academic dishonesty. They mention that their research suggests that personality traits such as low conscientiousness can increase the likelihood of cheating. Söylemez (2023) discusses the impact of social factors, achievement motivation, and institutional policies on academic dishonesty, emphasizing the need for supportive environments to reduce cheating.

Cheating behavior in academic settings is a complex phenomenon influenced by various individual, social, and contextual factors. A new study by Allen and Kizilcec (2023) emphasises the importance of a holistic approach to academic integrity by classifying a variety of tools and tactics for cheating detection and prevention. This approach incorporates technological tools, policy changes, and educational initiatives to create a comprehensive framework for reducing academic misconduct. The study highlights tha t academic cheating is often driven by the actions of their peers and the broader educational environment, and that this becomes an important frame for understanding and addressing individuals' decisions to cheat. The study utilises game theory to predict the group-level effects on students and offers faculty practical guidelines for identifying institutional barriers to curbing cheating. It incorporates the best concepts from pedagogy, conflict management and organisational psychology in recommending a broad range of practical strategies for lowering the students' opportunity, motivation and rationalization to cheat. These include building trusting relationships between students and faculty, developing assessments that reduce the student's temptation to cheat, and cultivating an academic culture that values integrity. Additionally, policy changes that articulate standards of academic integrity and consequences for breach of the code are essential. Educational programs that promote academic integrity, such as training sessions and seminars, help to create a culture that discourages dishonest activity. By combining these components, the systemic model offers an impactful success in preventing academic dishonesty and cultivating academic integrity in educational institutions.

A study on academic dishonesty and academic adjustment among students found that while the number of reported cases of academic integrity violations has increased, there is also a trend towards a better understanding and reduced occurrence of severe forms of plagiarism. Clinciu, Cazan, and Ives (2021) emphasize the need for continuous education on academic integrity to help students adjust to academic expectations and reduce dishonest behaviors.

The literature on academic dishonesty highlights the complexity of the matter and the variety of variables that influence cheating behaviors. Effective assessment policies, coupled with supportive measures for students, are essential for fostering an environment of integrity in higher education. Addressing the root causes of cheating, which include exam anxiety, lack of preparation, and perceived unfairness, can help reduce the incidence of academic dishonesty and promote a culture of honesty and integrity among students. These studies offer a comprehensive viewpoint on the issue of academic dishonesty, highlighting cultural, psychological, and systemic factors that contribute to this behavior.

3. Methodology

This paper investigates the effect of this policy on the occurrence of academic dishonesty, specifically on cheating incidents among diploma students during final exams. This study adopted both quantitative and qualitative measures. Three academic sessions were involved in this study, before the policy enforcement (SI: 2022/2023) and after the enforcement (SII: 2022/2023 and SI: 2023/2024).

Data were collected from academic departments from 36 Malaysian Polytechnics. 11 from 15 departments has reported at least one occurrence of cheating over the course of three academic sessions. Only departments with more than 1,000 students taking the final exam were considered in this study. Eight academic departments were involved, encompassing both engineering and non-engineering fields. The number of cheating cases that occurred during final exams in each departments involved was collected to analyze the trend in the number of cheating cases and to identify the impact of the policy.

This investigation includes eight (8) departments, four of which are engineering departments and four of which are non-engineering. The departments that are involved are: Jabatan Kejuruteraan Elektrik (JKE), Jabatan Kejuruteraan Awam (JKA), Jabatan Kejuruteraan Mekanikal (JKM), Jabatan Kejuruteraan Petrokimia (JKPK), Jabatan Perdagangan (JP), Jabatan Hospitaliti dan Pelancongan (JPH), Jabatan Teknologi Maklumat dan Komputer (JTMK), and Jabatan Agroteknologi & Bio-Industri (JAB).

The qualitative data were collected by interviews with students who were caught cheating during final exams. These samples included students from all departments, including engineering and non-engineering. The investigation was carried out to identify reasons why students cheat during examinations. Questions concerning the purpose and reason of cheating during exams were posed to the research participants. The interview questions included: 'What made you engage in cheating activities during examinations?' and 'What motivates you to go above and beyond to pass the subject?'

The interviews were recorded and transcribed verbatim. Thematic analysis was used to analyze the data, with codes assigned to significant statements and grouped into broader themes. The transcripts were read multiple times to identify recurring themes. Codes were assigned to significant statements, which were then grouped into broader themes.

Ensuring the confidentiality of participants is paramount in this study. All data collected from the interviews were anonymized to protect the identity of the students. Each participant was assigned a unique code, and no personal identifiers were used in the analysis or reporting of the data. Additionally, any published results were presented in aggregate form to prevent the identification of individual participants. Informed consent was obtained from all participants prior to the interviews.

4. Findings and Analysis

The data on cheating cases during the final examination, both before the enforcement (SI:2022/2023) and after the enforcement (SII:2022/2023 and SI:2023/2024), was descriptively analysed to summarize and aggregate the collected information. Following this, a comparison of the number of cheating cases between each department was presented by session.

Table 1: Number of Cheating Cases Before and After the Enforcement

Department	Before enforcement	After enforcement	
	SI:2022/2023	SII:2022/2023	SI:2023/2024
JKA	7	9	3
JKE	14	17	14
JKM	11	15	10
JKPK	0	2	0
JP	20	44	32
JTMK	3	7	8
JPH	1	6	0
JAB	2	9	10

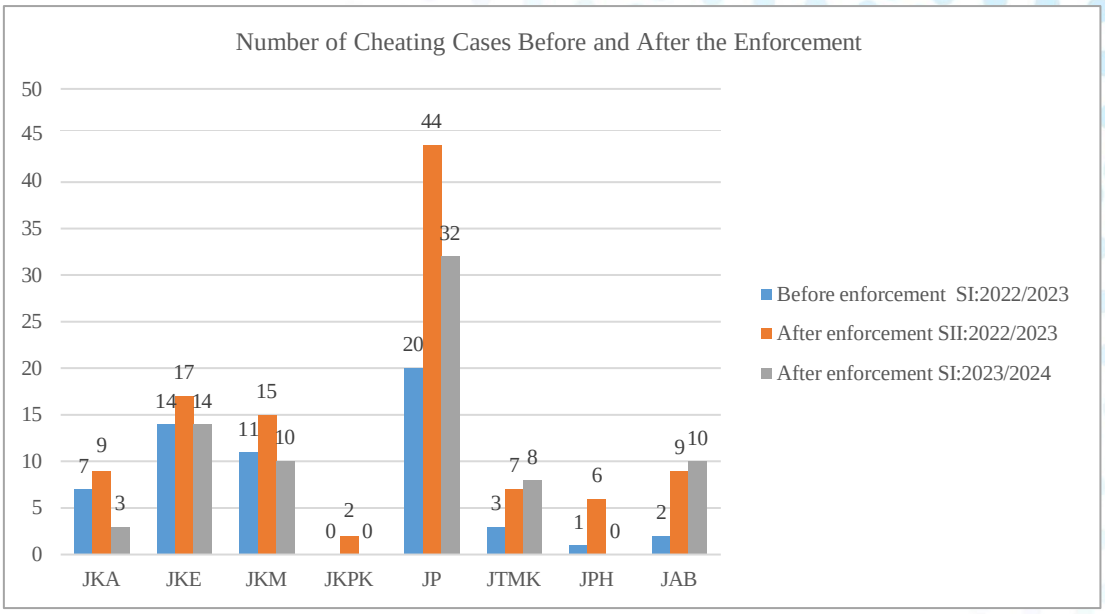

Figure 1: Number of Cheating Cases Before and After the Enforcement

Table 1 depicted the number of cheating cases during final examination before and after the enforcement of the 20% final examination passing marks policy. The number of cheating cases during final examination after the policy enforcement in SII:2022/2023 shows a significant increase compared to the previous session (SI:2022/2023) as illustrated in Figure 1. Cheating cases in JKA increased from 7 to 9 cases by 28.6%, cases in JKE increased from 14 to 17 cases (21.4%), while JKM showed an increase from 11 to 15 cases (36.4%). Cheating cases in JP rose by 120%, from 20 to 44 cases, JTMK increased from 3 to 7 cases (133%), and JAB showed a 350% increase, from 2 to 9 cases. JKPK reported 2 new cheating cases after the passing marks enforcement. Among all eight departments, JPH showed the highest increase in cheating cases with a 500% rise, from 1 to 6 cases.

Cheating cases during the final examination in the following session (SI:2023/2024), which is the second semester after the enforcement, were analysed and compared to the previous session (SII:2022/2023). The findings show a decline in the number of cheating cases for all departments except JTMK and JAB, both of which show an increase of 1 case each. According to the collected data, JPH and JKPK reported zero cases in SI:2023/2024. JKA shows the greatest reduction in cheating cases, with a 66.7% reduction from 9 to 3 cases. JKE decreased from 17 to 14 cases (17.7%), JKM decreased by 5 cases (33.3%), and JP decreased by 12 cases (27.3%).

To determine if there is a significant difference in the cheating cases, a t -test analysis was conducted. A Paired Samples T-Test was used in this study's analysis. The result for the Paired Samples T-Test for the session before (SI:2022/2023) and after (SII:2022/2023) the enforcement is shown in Table 2. The mean number of cheating cases increased by 6.375 from SI:2022/2023 to SII:2022/2023. Since the p -value (0.043) is less than 0.05, this result is statistically significant. This indicates that there is a significant difference in the number of cheating cases before and after the enforcement of the policy.

Table 2: Paired-Samples T-test result for session before (SI:2022/2023) and after (SII:2022/2023) the enforcement

Mean		Mean differences	t-statistic	Significance, p
Before enforcement (SI:2022/2023)	**After enforcement (SII:2022/2023)**			
7.25	13.63	-6.375	-2.467	0.043

The result for the Paired Samples T-Test for two sessions after the policy enforcement is shown in Table 3. The mean number of cheating cases decreased by 4.00 from SII:2022/2023 to SI:2023/2024. Since the p - value (0.033) is less than 0.05, this result is also statistically significant. This indicates that there is a significant difference in the number of cheating cases between the two sessions after the enforcement of the policy. There is a significant reduction in cheating cases between the two sessions after the policy enforcement, suggesting that the policy's impact continued to be effective over time.

Table 3: Paired-Samples T-test result for two sessions after the policy enforcement

Mean		Mean differences	t-statistic	Significance, p
After enforcement (SII:2022/2023)	After enforcement (SI:2023/2024)			
13.63	9.625	4.00	2.646	0.033

4.1 Analysis on Number of Cheating Cases Before and After the Enforcement among Engineering Departments

Table 4 displays the number of cheating cases before and after the enforcement of the 20% minimum passing mark for final examinations among engineering departments in Polytechnics Malaysia. On average, the cheating cases reported before the enforcement (SI: 2022/2023) are 40.7% lower than after the policy enforcement, increasing from 32 cases to 45 cases. Conversely, the cases decreased by 40% (from 45 cases to 27 cases) in the subsequent session (SI: 2023/2024). Among these engineering departments, JKE shows the highest average number of cheating cases reported during final examinations per session with 15 cases, followed by JKM with an average of 12 cases, JKA with 6 cases, and JKPK with 1 case as illustrated in Figure 2.

Table 4: Number of Cheating Cases Before and After the Enforcement among Engineering Departments

Department	Before enforcement	After enforcement	
	SI:2022/2023	SII:2022/2023	SI:2023/2024
JKA	7	9	3
JKE	14	17	14
JKM	11	15	10
JKPK	0	2	0

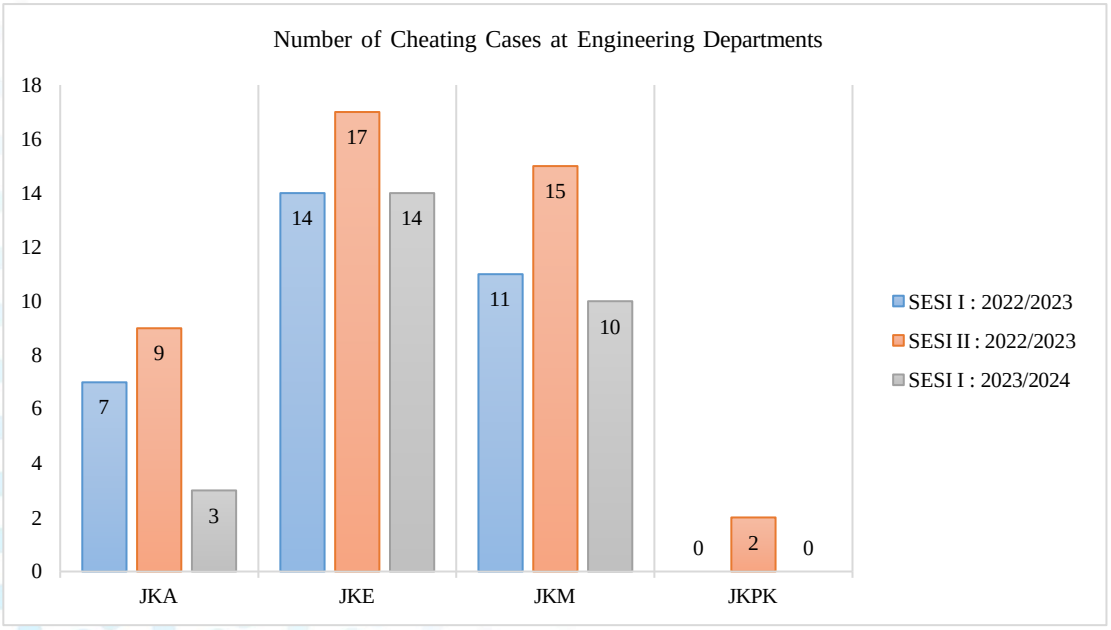

Figure 2: Number of Cheating Cases Before and After the Enforcement among Engineering Departments

As illustrated in Figure 3, the number of cheating cases is significantly influenced by the total number of students taking final exams. Jabatan Kejuruteraan Elektrik (JKE) department, which has the highest number of students, also reported highest number of cheating cases. This correlation suggests that the large student population contributes to the higher incidence of academic dishonesty, as a larger student body increases the likelihood of encountering individuals who may resort to cheating. Conversely, the Jabatan Kejuruteraan

Petrokimia (JKPK) department, despite having a lower number of students, shows fewer cheating cases.

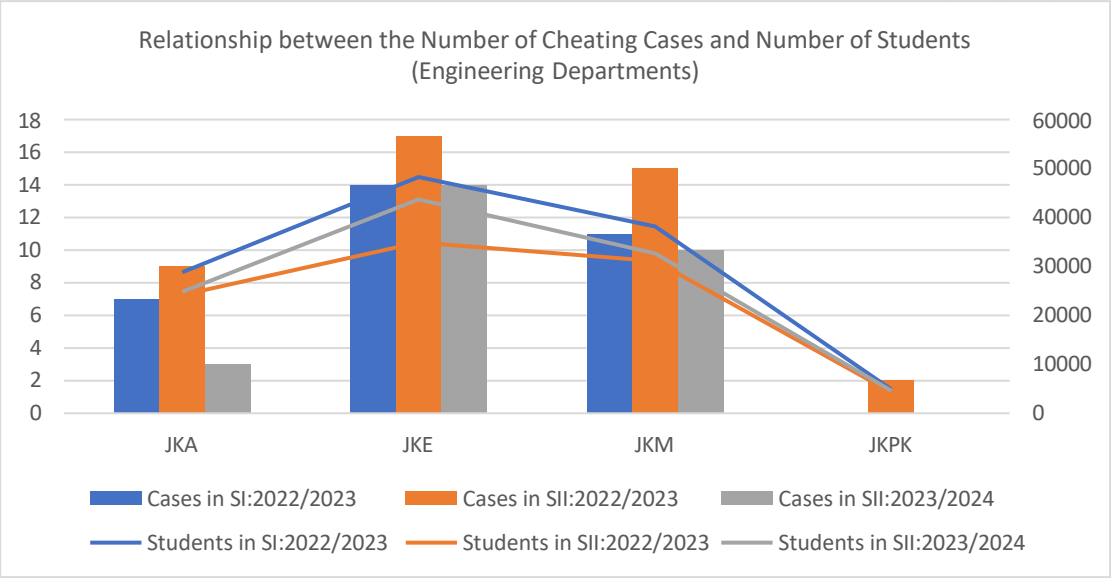

Figure 3: Number of Cheating Cases Before and After the Enforcement among Engineering Departments

4.2 Analysis on Number of Cheating Cases Before and After the Enforcement among Non-Engineering Departments

Table 5 displays the number of cheating cases before and after the enforcement of the 20% minimum passing mark for final examinations among non-engineering departments in Polytechnic Malaysia. On average, the cheating cases reported before the enforcement (SI: 2022/2023) are 157.69% lower than after the enforcement (SII: 2022/2023), increasing from 26 cases to 67 cases. Conversely, the cases decreased by 25.37% (from 67 cases to 50 cases) in the subsequent session (SI: 2023/2024). Among these non-engineering departments, JP shows the highest average number of cheating cases reported during final examinations with 32 cases, followed by JAB with an average of 7 cases, JTMK with 6 cases, and JPH with 2 cases as illustrated in Figure 4.

Table 5: Number of Cheating Cases Before and After the Enforcement among Non-Engineering Departments

Department	Before enforcement	After enforcement	
	SI:2022/2023	SII:2022/2023	SI:2023/2024
JP	20	44	32
JTMK	3	7	8
JPH	1	6	0
JAB	2	9	10

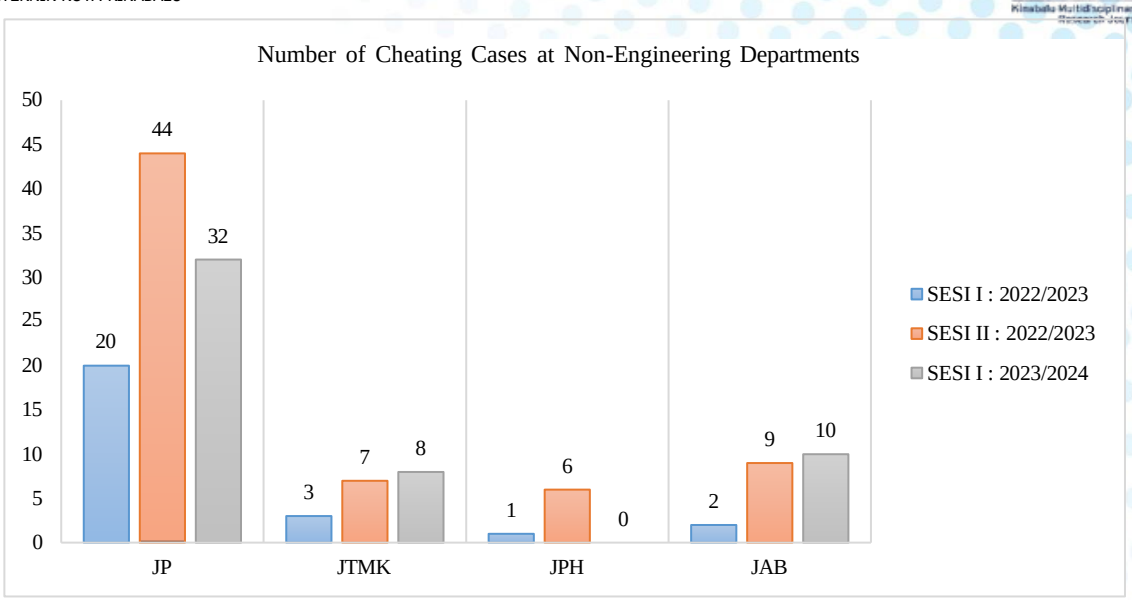

Figure 4: Number of Cheating Cases Before and After the Enforcement among Non-Engineering Departments

As illustrated in Figure 5, the number of cheating cases is shown to be significantly influenced by the number of students taking final exams. The Jabatan Perdagangan (JP) department, which has the highest number of students, also reports the highest number of cheating cases. This correlation suggests that the sheer volume of students contributes to the higher incidence of academic dishonesty, as a larger student body increases the likelihood of encountering individuals who may resort to cheating. Conversely, the Jabatan Agroteknologi & Bio-Industri (JAB) department, despite having a lower number of students, shows a relatively high number of cheating cases. This anomaly indicates that while the number of students is a critical factor, it is essential to consider other underlying causes such as departmental culture, exam difficulty, or specific student challenges that contribute to in influencing cheating behavior within different departments. Therefore, it is essential to consider both the student population size and other underlying causes when addressing academic dishonesty.

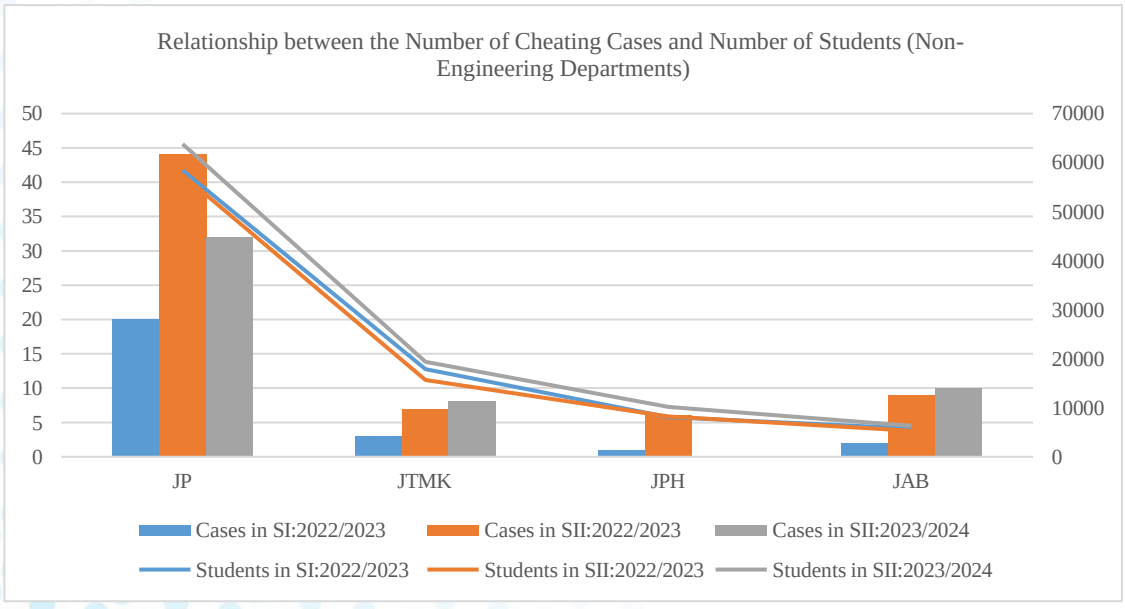

Figure 5: Number of Cheating Cases Before and After the Enforcement among Non-Engineering Departments

4.3 Analysis on students' interviews and direct observations

The purpose of this analysis is to explore the reasons behind students' cheating behavior during exams. The qualitative data were collected from all involved institutions, including direct observations and face -to- face interviews with students who are caught cheating to gain insights into their motivations. From the observations, students have been using various methods to cheat during exams, such as carrying notes and hiding them under clothes or beneath the exam script, concealing notes under thighs or using mobile phones hidden in

the toilet. The information obtained from these incidents shows a consistent pattern in the methods used across all institutions.

Based on the interviews, students have expressed several reasons for their cheating behavior. Three main themes emerged from the interviews which are fear of failing, lack of confidence, and exam anxiety. Many students expressed fear of not passing the course due to new passing marks requirement as a primary reason for cheating. One student stated, "I cheat because I'm afraid I won't pass the course." Additionally, students with low coursework marks often lacked confidence in their ability to pass the final exam. Another student mentioned, "I don't think I can pass without cheating." High levels of exam anxiety and low expectations of success were also a significant factor. A student shared, "The pressure of the final exam makes me so anxious that I feel I have to cheat."

Other than that, special students whose classified as slow learners also mentioned that they face additional pressure to meet the passing criteria for the final exam. This pressure leads them to cheat as a coping mechanism. The fear of failing was a significant factor driving students to cheat, indicating a need for better support systems.

5. Discussion

The results of this study show that the implementation of the 20% minimum passing marks policy had a significant impact on academic dishonesty among diploma students in Polytechnics Malaysia. The data revealed a significant increase in cheating cases during the first academic session after the policy was implemented (SII:2022/2023) compared to the previous session (SI:2022/2023). This initial spike suggests that the policy may have increased pressure on students, leading to more instances of academic dishonesty. The initial increase in cheating cases suggests that students may experience heightened anxiety and pressure when faced with stricter assessment criteria. This aligns with previous research indicating that exam anxiety and fear of failure are major contributors to academic dishonesty (Salehi & Gholampour, 2021; Anderman et al., 2007).

Conversely, there was an overall decrease in incidents of dishonesty in most departments in the following session (SI:2023/2024), indicating that students may have adapted to the new policy over time. This adaptation could be attributed to increased familiarity with the policy and improved coping mechanisms, such as better study habits and time management skills. This finding aligns with the literature on students developing better coping mechanisms and study habits (Hammoudi & Benzerroug, 2021). The decrease in cheating incidents suggests that while the initial implementation of stricter policies may cause a spike in academic dishonesty, students can adapt and develop strategies to cope with the increased pressure.

The investigation also revealed that non-engineering departments, such as JP and JTMK, experienced a higher increase in cheating cases compared to engineering departments like JKE and JKM. This implies that students in non-engineering fields may have faced more challenges adapting to the new policy, likely because non-engineering fields have more comprehensive final exams. The higher increase in cheating cases in non - engineering departments suggests that the nature of assessments in these fields may exacerbate the pressure on students, leading to more instances of academic dishonesty. This aligns with previous research indicating that different academic environments and departmental cultures can influence cheating behavior (Allen & Kizilcec, 2023).

Qualitative data from student interviews indicated that the major reasons for cheating are fear of failing, lack of confidence, and exam anxiety. The qualitative findings align with previous studies by Baran and Jonason (2020) and Wang and Zhang (2022), highlighting low self-confidence as key factors contributing to academic dishonesty. The consistency between the qualitative data and previous studies underscores the importance of addressing psychological factors such as self-confidence and exam anxiety to reduce academic dishonesty.

Besides that, special cases involving slow learners showed that additional pressure to meet the passing criteria led to cheating. The persistent pressure on slow learners highlights the need for targeted support for this group to ensure they can meet the passing criteria without resorting to cheating. Söylemez (2023) emphasizes the need for supportive environments to reduce cheating, including addressing social factors and achievement motivation. Educational institutions could provide peer mentoring for stu dents and confidence- building workshops to help students develop a positive view of themselves as students, resulting in less of a need for cheating behaviour. Benson and Enstroem (2023) propose that well-designed academic integrity modules can significantly reduce cheating.

6. Conclusion

This study explored the impact of the 20% minimum passing marks policy on academic dishonesty among diploma students in Polytechnic Malaysia. The analysis covered three academic sessions: before the enforcement (SI:2022/2023) and after the enforcement (SII:2022/2023 and SI:2023/2024). The findings showed a significant increase in cheating cases during the first session after the policy was implement ed. However, there was a general decline in dishonesty cases in the following session, indicating an initial adjustment period followed by adaptation to the new policy.

The initial rise in academic dishonesty suggests that students may feel more anxious and pressured when faced with stricter assessment criteria. This highlights the need for comprehensive support systems to help students adapt to new policies. Educational institutions should consider implementing additional measures such as academic counseling, workshops on study skills, and clear communication about the importance of academic integrity.

While the policy initially led to an increase in academic dishonesty, the subsequent decline in cheating cases suggests that students eventually adapted to the new standards. This adaptation indicates that the policy has a positive impact over time, as students learn to cope with the new requirements. It is important to note that academic dishonesty during final exams is not solely due to policy changes but also influenced by student attitudes and behaviors. Continuous efforts to support students and promote a culture of honesty and integrity are essential for the sustained success of such policies.

Future research should explore the long-term effects of the 20% minimum passing marks policy on academic dishonesty and student performance. It would be beneficial to conduct qualitative studies to gain deeper insights into students' perceptions and experiences regarding the policy. Additionally, analyzing students' performance before and after the policy change would also offer valuable insights into the policy's impact on academic performance and integrity.

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POLITEKNIK KOTA KINABALU

Kesahan dan Kebolehpercayaan Instrumen Soal Selidik Kompetensi Pensyarah Politeknik Dalam Pendidikan STEM

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Abstrak

Kajian ini bertujuan untuk menilai kesahan dan kebolehpercayaan instrumen soal selidik kompetensi pensyarah politeknik dalam pendidikan STEM. Kesahan instrumen dalam kajian ini melibatkan kesahan muka dan kesahan kandungan dimana seramai 7 orang pakar yang terdiri daripada ahli akademik terlibat untuk menyemak dan menilai setiap item berdasarkan skala dikotomi 'setuju' atau 'tidak setuju'. Nilai peratusan persetujuan pakar, indeks kesahan kandungan item (I-CVI) dan indeks kesahan kandungan skala (S-CVI) diperolehi. Seterusnya, kajian rintis melibatkan seramai 63 orang pensyarah politeknik dijalankan bagi menguji kebolehpercayaan soal selidik dan data dianalisis menggunakan perisian SPSS versi 25.0. Proses kesahan dan kebolehpercayaan instrumen melibatkan 67 item soal selidik yang terdiri daripada empat konstruk. Dapatan kajian bagi kesahan muka mencatatkan peratusan persetujuan pakar yang tinggi iaitu 94%. Dapatan kajian bagi kesahan kandungan pula mencatatkan indeks kesahan kandungan item (I-CVI) dan indeks kesahan kandungan skala (S-CVI) yang tinggi untuk setiap konstruk iaitu antara 0.98 hingga 1. Manakala nilai indeks kebolehpercayaan bagi konstruk kompetensi pensyarah, profesionalisme, pembangunan profesional dan efikasi pensyarah menunjukkan nilai pekali kebolehpercayaan Alpha Cronbach adalah tinggi iaitu berada diantara nilai 0.814 sehingga 0.903. Keseluruhannya, instrumen soal selidik menunjukkan kesahan dan kebolehpercayaan yang tinggi dan sesuai untuk digunakan oleh pensyarah politeknik untuk kajian seterusnya iaitu menjalankan kajian analisis confirmatory factor Analysis (CFA) dan analisis kesepadanan model (SEM).

Kata kunci:- Kesahan, kompetensi pensyarah, profesionalisme, pembangunan profesional, efikasi

1. Pengenalan

Pelaksanaan pendidikan Sains, Teknologi, Kejuruteraan, dan Matematik (STEM) di Malaysia merupakan inisiatif penting dalam usaha negara untuk meningkatkan daya saing di peringkat global. Di Malaysia, pendidikan STEM bukan sahaja dianggap sebagai satu keperluan untuk memenuhi keperluan industri, tetapi juga sebagai satu langkah strategik untuk mempersiapkan graduan dengan kemahiran abad ke-21. Sistem pendidikan politeknik, sebagai institusi pengajian teknikal dan vokasional (TVET), memainkan peranan penting dalam melahirkan tenaga kerja yang berkemahiran tinggi serta bersedia menghadapi cabaran dunia pekerjaan yang semakin berubah dan dinamik. Pensyarah di politeknik berperanan penting dalam memastikan pelaksanaan pendidikan STEM yang berkesan. Kompetensi pensyarah merangkumi pelbagai aspek seperti profesionalisme, pembangunan profesional, dan efikasi pensyarah dalam proses pengajaran dan pembelajaran. Kajian terdahulu menunjukkan bahawa tahap kompetensi pensyarah boleh memberi kesan langsung kepada kualiti pendidikan STEM yang disampaikan kepada pelajar (Noor & Siraj, 2024). Walaupun pelbagai kajian telah menekankan kepentingan kompetensi pensyarah dalam pendidikan, terdapat kekurangan kajian yang khusus untuk menilai kompetensi pensyarah politeknik dalam konteks pelaksanaan pendidikan STEM. Kebanyakan instrumen sedia ada bersifat umum dan tidak mengambil kira cabaran khusus yang dihadapi oleh pensyarah di politeknik, terutamanya dalam pendidikan teknikal dan vokasional (TVET). Kajian terdahulu banyak menumpukan pada penilaian kompetensi di peringkat sekolah atau universiti, namun tiada instrumen yang telah disahkan untuk menilai kompetensi pensyarah yang terlibat secara langsung dalam pendidikan STEM di politeknik. Kebanyakan soal selidik sedia ada bersifat umum dan tidak disesuaikan secara khusus dalam konteks politeknik dan Pendidikan STEM, yang menyebabkan keputusan kajian mungkin tidak tepat atau mewakili situasi sebenar. Jurang ini menimbulkan cabaran dalam memastikan kualiti pengajaran STEM yang konsisten di politeknik, kerana tanpa instrumen yang sah dan boleh dipercayai, sukar untuk menilai tahap sebenar kompetensi pensyarah dalam konteks tersebut. Oleh itu, kajian ini bertujuan untuk membangunkan instrumen penilaian yang khusus, yang akan dapat mengukur dengan tepat tahap kompetensi pensyarah politeknik dalam pelaksanaan pendidikan STEM. Penilaian yang tepat ini bukan sahaja akan memberi manfaat kepada pensyarah dalam meningkatkan profesionalisme mereka, tetapi juga membantu institusi pendidikan

dalam merangka program pembangunan profesional yang lebih berkesan. Selain itu, kekurangan soal selidik yang boleh dipercayai menimbulkan kesukaran dalam menilai kompetensi pensyarah, sekali gus menyukarkan pihak pengurusan politeknik untuk merangka program pembangunan profesional yang berkesan. Justeru, terdapat keperluan untuk membangunkan dan mengesahkan soal selidik yang boleh mengukur dengan tepat tahap kompetensi pensyarah politeknik dalam pendidikan STEM. Penyelidik telah membangunkan instrumen soal selidik yang merupakan adaptasi dan ubahsuai daripada kajian yang lepas.

Kesahan dan kebolehpercayaan instrumen soal selidik adalah sangat penting demi untuk memastikan data yang dikumpulkan adalah tepat dan bermakna dalam kajian. Menurut Adam & Lawrence (2019), keupayaan alat ukur untuk mengukur elemen yang sepatutnya diukur dipanggil sebagai kesahan instrumen. Manakala kebolehpercayaan pula adalah satu proses untuk menguji ketekalan alat yang diukur terhadap instrumen kajian yang digunakan (Othman et al. 2020). Instrumen soal selidik dalam kajian ini merupakan adaptasi dan ubahsuai dari kajian terdahulu. Oleh itu, adalah penting untuk penyelidik menjalankan proses penilaian kesahan muka dan kesahan kandungan serta kebolehpercayaan instrumen soal selidik. Kesahan muka merujuk kepada satu peringkat dimana ujian dilihat mengukur apa yang sepatutnya diukur (Azizi et al., 2010; Allen et al., 2023). Kesahan kandungan dijalankan untuk memastikan bahawa item-item dalam soal selidik boleh mengukur konsep laten dengan betul dalam sesuatu kajian dan juga boleh menentukan sejauh mana item-item dalam setiap soalan dapat menjawab soalan kajian yang dibentuk. Kesahan kandungan penting untuk memastikan setiap item dalam soal selidik benar-benar mewakili konsep yang dikaji (Creswell, 2014). Ini bermakna, setiap soalan harus berkaitan langsung dengan objektif kajian dan dapat membantu menjawab soalan-soalan kajian yang ditetapkan. Proses ini melibatkan pakar atau penyelidik untuk menilai sama ada item-item tersebut sesuai dan relevan dengan konsep yang ingin diukur. Kesahan kandungan membantu menjamin bahawa instrumen pengukuran adalah tepat dan boleh dipercayai. Kesahan muka dan kesahan kandungan melibatkan penilaian daripada pakar yang menunjukkan dapatan yang subjektif namun begitu ianya relevan untuk dijadikan sebagi bukti kesahan dalam kajian yang dilaksanakan kerana pakar perlu menilai instrumen tersebut dan memberi satu keputusan maklum balas sama ada instrumen yang akan digunakan dalam kajian adalah relevan, perlu diubahsuai dan menepati konstruk serta sub-konstruk yang diperlukan. Maklum balas yang diterima daripada pakar membolehkan pengkaji menambah baik instrumen (Polit & Beck, 2006; Rubio et al., 2003). Instrumen yang didapati mempunyai kesahan muka dan kesahan kandungan yang rendah boleh menjejaskan kebolehpercayaan dan dapatan kajian (Kamaluddin & Nasir, 2019; Layth, 2022; Allen et al.,2023). Maka, tujuan kajian ini adalah untuk menguji kesahan dan kebolehpercayaan instrumen soal selidik model kompetensi pensyarah politeknik dalam pendidikan STEM.

2. Sorotan Kajian

Jabatan Pengajian Politeknik dan Kolej Komuniti (JPPKK) melalui politeknik, sebagai peneraju Pendidikan dan Latihan Teknikal dan Vokasional (TVET) di Malaysia, kekal komited dalam menyokong agenda Kementerian Pendidikan Malaysia (KPM) untuk memperkukuhkan komponen STEM menerusi Pelan Pembangunan Pendidikan Malaysia 2013-2025 dan Pelan Transformasi Politeknik 2023-2030. Antara isu dan cabaran yang dinyatakan dalam Pelan Transformasi Politeknik 2023-2030 ialah berkaitan dengan kompetensi pensyarah politeknik. Terdapat keperluan untuk mengkaji kompetensi pensyarah politeknik khususnya dalam pendidikan STEM. Kompetensi pensyarah ialah kompetensi yang diperlukan dan digunakan untuk menjalankan tugas sebagai pensyarah semasa proses pengajaran dan pembelajaran sedang berlangsung (Mohammad Miyan 2004; Simandjuntak 1984). Kompetensi pensyarah dalam ppendidikan STEM merangkumi aspek pengetahuan pedagogi STEM, Kemahiran pedagogi dan penilaian serta sikap pensyarah terhadap pendidikan STEM. Kajian mengenai kompetensi pensyarah telah mendapat perhatian yang meluas dalam konteks pendidikan, terutama dalam usaha memastikan kualiti pengajaran yang tinggi. Kompetensi pensyarah bukan sahaja melibatkan pengetahuan dan kemahiran dalam subjek yang diajar tetapi juga merangkumi aspek pedagogi, komunikasi, dan keupayaan untuk menggunakan teknologi dalam proses pengajaran (Rahman, 2020). Kajian terdahulu menunjukkan bahawa pensyarah yang memiliki tahap kompetensi yang tinggi mampu mempengaruhi pencapaian akademik pelajar secara signifikan, terutamanya dalam bidang yang mencabar seperti STEM (Novianty et al., 2020; Vicki et al., 2024). Oleh itu, penilaian terhadap kompetensi pensyarah adalah penting bagi memastikan kualiti pendidikan yang disampaikan.

Faktor profesionalisme, pembangunan profesional dan efikasi pensyarah dilihat antara faktor yang turut mempengaruhi kompetensi pensyarah politeknik. Kekurangan profesionalisme dalam diri pensyarah boleh menjejaskan suasana pengajaran dan pembelajaran, di mana pelajar mungkin hilang hormat terhadap pensyarah dan kurang bersemangat untuk belajar (Samsul et al., 2022; Elyakim et al., 2023). Sekiranya isu ini tidak ditangani, ia akan menyebabkan penurunan kualiti pendidikan, menjadikan pelajar tidak bersedia un tuk memenuhi tuntutan industri yang semakin mencabar, khususnya dalam bidang STEM. Pada akhirnya, politeknik mungkin menghadapi kesukaran dalam mengekalkan reputasi dan daya saing mereka dalam menyediakan graduan yang kompeten. Selain itu, potensi yang tidak mencukupi menghalang kemampuan

pensyarah untuk merancang, melaksanakan, dan menilai pembelajaran dengan berkesan. Perkara ini menjadikannya sukar untuk menyesuaikan diri dengan tuntutan standard pendidikan yang sentiasa berkembang (Nuraeni et al., 2023). Kajian oleh Rosmaladewi et al., (2020) pula menyatakan bahawa walaupun program pembangunan profesional diiktiraf sangat penting untuk meningkatkan pengetahuan, kemahiran, dan kepakaran pensyarah, namun begitu pelaksanaannya sering tidak konsisten dan tidak mencukupi. Justeru itu, pembangunan profesional menerusi kursus dan bengkel adalah perlu bagi memastikan pensyarah tidak hanya mahir dalam bidang pengkhususan tetapi juga dalam aspek lain yang menyokong kecemerlangan akademik dan profesionalisme mereka.

Efikasi kendiri mempunyai peranan yang penting di dalam pendidikan kerana ia mempengaruhi pembawakan dan jati diri seseorang individu berdasarkan tahap efikasi yang dimiliki. Pensyarah yang mempunyai tahap efikasi yang tinggi juga percaya akan keupayaan mereka untuk melaksanakan tugasan- tugasan profesional yang diamanahkan (Fives & Buehl, 2009; James et al., 2022). Secara keseluruhannya, kajian-kajian terdahulu telah menyediakan asas yang kukuh untuk memahami kepentingan kompetensi pensyarah dalam pelaksanaan pendidikan STEM. Namun, kebanyakan kajian ini dijalankan dalam konteks pendidikan umum iaitu sekolah, dan hanya sedikit yang memberi tumpuan khusus kepada konteks politeknik, terutama dalam bidang STEM. Jurang pengetahuan ini menunjukkan wujud keperluan untuk meneliti secara mendalam kompetensi pensyarah politeknik dalam bidang STEM, termasuk faktor yang mempengaruhinya seperti profesionalisme, pembangunan profesional, dan efikasi pensyarah. Kajian ini bukan sahaja bertujuan untuk mengisi jurang tersebut, tetapi juga untuk membangunkan instrumen soal selidik yang boleh mengukur tahap kompetensi pensyarah dengan tepat dalam konteks politeknik. Instrumen yang dibangunkan ini akan memberikan sumbangan penting kepada bidang pendidikan teknikal dan vokasional (TVET) di Malaysia, sekaligus membantu dalam usaha memperkukuhkan agenda Kementerian Pendidikan Malaysia untuk memperkasakan pendidikan STEM di politeknik. Oleh itu, kajian ini diharap dapat memberikan panduan yang lebih jelas dalam memahami peranan kompetensi pensyarah dalam pendidikan STEM, serta menawarkan cadangan yang relevan untuk meningkatkan kualiti pendidikan di politeknik melalui pembangunan instrumen penilaian yang sah dan boleh dipercayai.

4. Metodologi

Kaedah kuantitatif dengan menggunakan tinjauan deskriptif digunakan dalam kajian rintis ini dan melibatkan kesahan muka dan kesahan kandungan serta kebolehpercayaan instrumen soal selidik. Jumlah sampel keseluruhan yang ditetapkan untuk tujuan kajian lapangan sebenar ialah seramai 624 orang (berdasarkan Krejcie dan Morgan 1970), maka bagi tujuan kajian rintis yang bertujuan untuk menguji kebolehpercayaan soal selidik, pengiraan jumlah responden adalah juga berdasarkan penentuan sampel Krejcie dan Morgan (1970) dan sepertimana saranan oleh Cann et al. (2008) serta Treece dan Treece (1982) iaitu pada kadar 10% daripada sampel sebenar (624 x 10% = 62.4). Oleh itu, bilangan responden untuk kajian rintis ditetapkan kepada 63 orang di mana responden dipilih secara rawak mudah dari 3 buah politeknik berhampiran. Pemilihan kaedah rawak mudah adalah sesuai untuk kajian ini kerana ia tidak memerlukan pembahagian populasi kepada strata tertentu, dan proses pengumpulan data dapat dilaksanakan dengan lebih efisien dalam tempoh masa yang ditetapkan. Bilangan sampel untuk kajian rintis adalah 10% daripada sampel sebenar adalah sepertimana saranan oleh Cann et al. (2008) serta Treece dan Treece (1982). Bagi tujuan menentukan kesahan instrumen, bilangan pakar ialah 7 orang yang dipilih melalui teknik persampelan bertujuan, di mana mereka dikenal pasti sebagai berkelayakan untuk menjadi penilai dalam proses semakan item soal selidik dengan lebih terperinci dan mempunyai pengalaman dalam bidang STEM. Penyelidik memilih dua jenis pakar seperti yang dicadangkan oleh Berliner (2004), Darusalam & Hussin (2020), Davis (1992), dan Lynn (1986), iaitu pakar profesional dan pakar lapangan. Antara kriteria pakar profesional ialah memiliki kelayakan akademik Doktor Falsafah, bergiat aktif dalam penulisan, penerbitan dan pengajaran serta mempunyai pengalaman sekurang-kurangnya sepuluh tahun dalam bidang mereka. Kriteria bagi pakar lapangan perlu mempunyai sekurang-kurangnya Ijazah Sarjana, aktif dalam penulisan dan pengajaran serta pengalaman lebih dari sepuluh tahun dalam bidang yang relevan. Selain itu, persetujuan penuh daripada pakar untuk terlibat dalam kajian ini adalah wajib. Pada peringkat awal, pakar-pakar dihubungi melalui telefon untuk mendapatkan persetujuan serta menjelaskan tujuan dan prosedur kajian. Semua pakar yang terlibat diberikan surat lantikan yang disediakan oleh pihak universiti dan diberi tempoh dua minggu bagi menyemak instrumen. Jadual 1 dibawah menunjukkan senarai pakar yang terlibat.

Jadual 1: Senarai pakar yang terlibat.

No.	Senarai Pakar	Institusi
1.	Doktor Falsafah	Universiti Malaysia Sabah
2.	Doktor Falsafah	Jabatan Pengajian Politeknik & Kolej Komuniti
3.	Doktor Falsafah	Politeknik Sultan Salahuddin Abdul Aziz Shah
4.	Doktor Falsafah	Politeknik Ungku Omar
5.	Doktor Falsafah	Politeknik Ibrahim Sultan
6.	Doktor Falsafah	Politeknik Kuching Sarawak
7.	Pensyarah	Politeknik Kota Kinabalu

Pengkaji memastikan nilai I-CVI (*Item Content Validity Index*) yang diperolehi adalah bersesuaian dengan bilangan pakar. Jadual 2 menunjukkan jumlah pakar dan kesesuaian nilai CVI yang boleh diterima. Menurut Davis (1992), nilai I-CVI yang diterima ialah 0.80 untuk sekurang-kurangnya dua orang pakar. Polit & Beck (2007) menyatakan bahawa bagi jumlah pakar tiga hingga lima orang, nilai I-CVI yang diterima ialah 1. Sementara itu, untuk jumlah pakar enam hingga lapan orang, nilai I-CVI yang diterima ialah 0.83.

Jadual 2: Jumlah pakar dan nilai I-CVI yang diterima

Jumlah pakar	Nilai I-CVI yang diterima	Rujukan
2 orang	0.80	Davis (1992)
3 hingga 5 orang	1	Polit & Beck., (2007)
6 hingga 8 orang	0.83	Lynn (1986), Polit & Beck., (2007)

Kesahan muka dan kesahan kandungan dan dinilai menggunakan skala dikotomi 'Setuju' dan 'Tidak Setuju' (Guttman). Kesemua 67 item soal selidik diubah suai dan diadaptasi daripada kajian terdahulu. Jadual 3 menunjukkan taburan item mengikut konstruk dalam instrumen soal selidik. Kesemua konstruk dan sub konstruk mencerminkan aspek utama dalam kerangka konseptual kajian yang dibina oleh penyelidik dan pemilihan konstruk diadaptasi daripada model kompetensi pensyarah sedia ada (Norhayati, 2018; Zuraimi, 2017; Wan Noraini, 2011).

Jadual 3: Konstruk, Taburan Item dan Jumlah Item Dalam Instrumen Soal Selidik

Konstruk	Taburan item	Jumlah item
Kompetensi Pensyarah	1 - 22	22
Profesionalisme	23 - 37	15
Pembangunan profesional	38 - 51	14
Efikasi pensyarah	52 - 67	16

Kriteria kesahan muka adalah berdasarkan Oluwatayo (2012), yang meliputi penerimaan format instrumen, kejelasan arahan, penggunaan perkataan yang tepat, penggunaan font yang sesuai, ejaan yang betul, tatabahasa yang baik, serta penggunaan istilah yang bersesuaian. Panel pakar juga diminta untuk memberikan komen dan cadangan penambahbaikan sekiranya ada (Wynd & Schaefer, 2002). Kaedah pengiraan kesahan muka dilakukan dengan menggunakan kaedah peratusan persetujuan pakar berdasarkan formula yang dikemukakan oleh Jamaluddin (2008). Formula untuk mengira peratus kesahan muka ialah jumlah semua pakar yang bersetuju pada item aspek dibahagikan dengan jumlah pakar dan didarabkan dengan 100. Kaedah pengiraan kesahan kandungan ialah menggunakan indeks kesahan kandungan (CVI). CVI sering digunakan dalam kajian perubatan oleh pakar perubatan dan jururawat untuk mengukur maklumat pesakit (Polit & Beck, 2006). Nilai I-CVI akan digunakan untuk menilai kesahan setiap item, dengan nilai kritikal yang perlu dicapai adalah 0.8 3 bagi memastikan item tersebut relevan dan tidak digugurkan dari soal selidik (Polit & Beck, 2007). Bagi mengukur jumlah persetujuan pakar adalah dengan mengira jumlah semua pakar yang bersetuju pada setiap item. Dalam kajian ini, nilai dan min I-CVI, nilai persetujuan universal (UA), nilai S-CVI dan nilai S-CVI/Ave telah dikira. Kaedah untuk mengira I-CVI ialah dengan mengira jumlah persetujuan pakar pada item tertentu dibahagikan dengan jumlah Pakar. Bagi mengira nilai persetujuan umum (UA), nilai CVI akan dibahagi dengan jumlah pakar dan untuk mengira kadar persetujuan releven (S-CVI), jumlah nilai persetujuan umum (UA) dibahagi dengan jumlah item. Seterusnya bagi mengira nilai S-CVI/Ave, jumlah kadar persetujuan releven akan dibahagi dengan jumlah pakar. Bagi mendapatkan indeks kebolehpercayaan soal selidik, penyelidik menggunakan pekali Alpha Cronbach untuk mendapatkan Nilai pekali Alpha (α). Item-item soal selidik mempunyai kebolehpercayaan yang tinggi jika nilai Alpha Cronbach menghampiri angka 1. Men urut Hair et al. (2010), nilai kebolehpercayaan instrumen menunjukkan bahawa responden menjawab soalan-soalan tersebut dengan konsisten. Indeks kebolehpercayaan bagi sesuatu instrumen yang hendak digunakan mestilah mempunyai nilai Alpha antara 0.65 hingga 0.95 (Chua 2009). Ketidakupayaan item-item instrumen untuk

mengukur konsep-konsep yang dikaji dalam kajian dapat ditunjukkan melalui nilai yang terlalu rendah. Dalam kajian ini penyelidik menggunakan nilai Alpha Cronbach iaitu ≥ 0.7 untuk memastikan kebolehpercayaan yang baik bagi instrumen yang digunakan. Jadual 3.10 menunjukkan Nilai Alpha Cronbach bagi pengujian kebolehpercayaan instrumen.

Jadual 3.10: Saiz Jarak Nilai Alpha Cronbach

Jarak Alpha Cronbach	Kekuatan Kebolehpercayaan
< 0.6	Lemah
0.6 < 0.7	Sederhana
0.7 < 0.8	Baik
0.8 < 0.9	Sangat Baik
>0.9	Terbaik

Diadaptasi daripada Hair et.al. (2010)

5. Dapatan dan Analisis

Dapatan kajian menunjukkan seramai 6 orang pakar merupakan pakar profesional dan seorang pakar lapangan terlibat dalam membuat penilaian kesahan instrumen. Lima orang pakar profesional mempunyai kelayakan akademik Doktor Falsafah, serta aktif dalam penulisan, penerbitan dan pengajaran dalam bidang STEM sementara seorang lagi pakar profesional yang memiliki kelayakan akademik Doktor Falsafah merupakan pakar kurikulum di JPPKK. Hanya seorang pakar lapangan yang terlibat dalam kajian ini dan memiliki ijazah Sarjana, aktif dalam penulisan dan pengajaran dalam bidang STEM serta pengalaman lebih dari sepuluh tahun dalam bidang yang relevan. Kesemua panel mempunyai pengalaman antara 13 sehingga 30 tahun dalam bidang mereka. Jadual 4 menunjukkan analisis data bagi kesahan muka. Bagi setiap aspek kesahan muka yang dinilai, julat purata skor pakar adalah antara 0.86 sehingga 1 dengan peratus persetujuan keseluruhan ialah 94%. Nilai peratusan ini adalah tinggi dan menunjukkan bahawa terdapat konsensus yang signifikan antara pakar mengenai relevansi sesuatu item.

Jadual 4: Analisis Data Bagi Kesahan Muka

Aspek	Pakar 1	Pakar 2	Pakar 3	Pakar 4	Pakar 5	Pakar 6	Pakar 7	Purata Skor pakar	Peratus persetujuan
Format instrumen boleh diterima.	1	1	1	1	1	1	0	0.86	86
Arahan yang diberi jelas.	0	1	1	1	1	1	1	0.86	100
Perkataan lazim digunakan.	1	1	1	1	1	1	1	1.00	100
Font yang sesuai digunakan.	1	1	1	1	1	1	1	1.00	100
Ejaan adalah tepat.	1	1	1	1	1	1	1	1.00	100
Tata bahasa yang baik.	1	1	0	1	1	1	1	0.86	86
Istilah digunakan bersesuaian.	1	1	0	1	1	1	1	1.00	100
							Purata	6.58	94

Indeks kesahan kandungan (CVI) merupakan kesahan kandungan yang sering digunakan dalam kajian perubatan oleh pakar perubatan dan jururawat untuk mengukur maklumat pesakit (Polit & Beck, 2006). Namun dalam kajian social, nilai kesahan ini turut digunakan oleh pengkaji untuk mengukur persepsi oleh responden (Baharuddin et al., 2020). CVI mampu memberikan nilai pada setiap item yang diukur serta kemudian boleh mengukur skala pada setiap item (SCVI). Nilai I-CVI menunjukkan persetujuan pakar manakala nilai S-CVI /AVE adalah nilai persetujuan yang relevan daripada semua pakar (Denise F. Polit et al., 2007). Dalam kajian ini penyelidik menganalisis setiap item mengikut nilai I -CVI dan menganalisis S- CVI untuk menunjukkan bahawa konstruk dan item itu sesuai untuk kajian seterusnya. Jadual 5 sehingga 8 menunjukkan dapatan keseluruhan yang diperolehi untuk mengukur kesahan kandungan bagi setiap konstruk. Dapatan kajian ini menunjukkan bahawa instrumen soal selidik yang dibangunkan memiliki kesahan muka dan kesahan kandungan yang tinggi, dengan nilai Indeks Kesahan Kandungan Item (I-CVI) dan Indeks Kesahan Kandungan Skala (S-CVI) melebihi 0.83, seperti yang disarankan oleh Polit dan Beck (2007).

Jadual 5: Dapatan Keseluruhan Kesahan Kandungan (CVI) Bagi Kompetensi Pensyarah

Item	Pakar 1	Pakar 2	Pakar 3	Pakar 4	Pakar 5	Pakar 6	Pakar 7	Persetujuan Pakar	I-CVI	UA
1	1	1	1	1	1	1	1	7	1.00	1
2	1	1	1	1	1	1	1	7	1.00	1
3	1	1	1	1	1	1	1	7	1.00	1
4	1	1	1	1	1	1	1	7	1.00	1
5	1	1	1	1	1	1	1	7	1.00	1
6	1	0	1	1	1	1	1	6	0.86	0
7	1	1	1	1	1	1	1	7	1.00	1
8	1	1	1	1	1	1	1	7	1.00	1
9	1	1	1	1	1	1	1	7	1.00	1
10	1	1	1	1	1	1	1	7	1.00	1
11	1	1	1	1	1	1	1	7	1.00	1
12	1	1	1	1	1	1	1	7	1.00	1
13	1	1	1	1	1	1	1	7	1.00	1
14	1	1	1	1	1	1	1	7	1.00	1
15	1	1	1	1	1	1	1	7	1.00	1
16	1	0	1	1	1	1	1	6	0.86	0
17	1	1	1	1	1	1	1	7	1.00	1
18	1	1	1	1	1	1	1	7	1.00	1
19	1	1	1	1	1	1	1	7	1.00	1
20	1	0	1	1	1	1	1	6	0.86	0
21	1	1	1	1	1	1	1	7	1.00	1
22	1	1	1	1	1	1	1	7	1.00	1
Kadar Persetujuan	1	0.86	1	1	1	1	1	Nilai Min I-CVI	0.98	
								S-CVI	0.86	
								S-CVI / Ave	0.98	

Jadual 6: Dapatan Keseluruhan Kesahan Kandungan (CVI) Bagi Profesionalisme Pensyarah

Item	Pakar 1	Pakar 2	Pakar 3	Pakar 4	Pakar 5	Pakar 6	Pakar 7	Persetujuan Pakar	I-CVI	UA
23	1	1	1	1	1	1	1	7	1.00	1
24	1	1	1	1	1	1	1	7	1.00	1
25	1	1	1	1	1	1	1	7	1.00	1
26	1	1	1	1	1	1	1	7	1.00	1
27	1	1	1	1	1	1	1	7	1.00	1
28	1	1	1	1	1	1	1	7	1.00	1
29	1	1	1	1	1	1	1	7	1.00	1
30	1	1	1	1	1	1	1	7	1.00	1
31	1	1	1	1	1	1	1	7	1.00	1
32	1	1	1	1	1	1	1	7	1.00	1
33	1	1	1	1	1	1	1	7	1.00	1
34	1	1	1	1	1	1	1	7	1.00	1
35	1	1	1	1	1	1	1	7	1.00	1
36	1	1	1	1	1	1	1	7	1.00	1
37	1	1	1	1	1	1	1	7	1.00	1
Kadar Persetujuan	1	1	1	1	1	1	1	Nilai Min I-CVI	1.00	
								S-CVI	1.00	
								S-CVI / Ave	1	

Jadual 7: Dapatan Keseluruhan Kesahan Kandungan (CVI) Bagi Pembangunan Profesional

Item	Pakar 1	Pakar 2	Pakar 3	Pakar 4	Pakar 5	Pakar 6	Pakar 7	Persetujuan Pakar	I-CVI	UA
38	1	1	1	1	1	1	1	7	1.00	1
39	1	1	1	1	1	1	1	7	1.00	1
40	1	1	1	1	1	1	1	7	1.00	1
41	1	1	1	1	1	1	1	7	1.00	1
42	1	1	1	1	1	1	1	7	1.00	1
43	1	0	1	1	1	1	1	6	0.86	0
44	1	1	1	1	1	1	1	7	1.00	1
45	1	1	1	1	1	1	1	7	1.00	1
46	1	1	1	1	1	1	1	7	1.00	1
47	1	1	1	1	1	1	1	7	1.00	1
48	1	1	1	1	1	1	1	7	1.00	1
49	1	1	1	1	1	1	1	7	1.00	1
50	1	1	1	1	1	1	1	7	1.00	1
51	1	1	1	1	1	1	1	7	1.00	1
Kadar Persetujuan	1	0.93	1	1	1	1	1	Nilai Min I-CVI	0.99	
								S-CVI	0.93	
								S-CVI / Ave	0.99	

Jadual 8: Dapatan Keseluruhan Kesahan Kandungan (CVI) Bagi Efikasi Pensyarah

Item	Pakar 1	Pakar 2	Pakar 3	Pakar 4	Pakar 5	Pakar 6	Pakar 7	Persetujuan Pakar	I-CVI	UA
52	1	1	1	1	1	1	1	7	1.00	1
53	1	1	1	1	1	1	1	7	1.00	1
54	1	1	1	1	1	1	1	7	1.00	1
55	1	1	1	1	1	1	1	7	1.00	1
56	1	1	1	1	1	1	1	7	1.00	1
57	1	1	1	1	1	1	1	7	1.00	1
58	1	1	1	1	1	1	1	7	1.00	1
59	1	1	1	1	1	1	1	7	1.00	1
60	1	1	1	1	1	1	1	7	1.00	1
61	1	1	1	1	1	1	1	7	1.00	1
62	1	1	1	1	1	1	1	7	1.00	1
63	1	1	1	1	1	1	1	7	1.00	1
64	1	1	1	1	1	1	1	7	1.00	1
65	1	1	1	1	1	1	1	7	1.00	1
66	1	1	1	1	1	1	1	7	1.00	1
67	1	1	1	1	1	1	1	7	1.00	1
Kadar Persetujuan	1	1	1	1	1	1	1	Nilai Min I-CVI	1.00	
								S-CVI	1.00	
								S-CVI / Ave	1	

Jadual 9 menunjukkan ringkasan dapatan bagi kesahan kandungan dalam kajian. Dapatan menunjukkan bahawa nilai I-CVI untuk semua item adalah pada jumlah 0.98 hingga 1. Nilai I-CVI bagi konstruk profesionalisme dan efikasi pensyarah masing-masing adalah 1. Ini menunjukkan kesemua pakar bersepakat bahawa kesemuan item adalah sangat penting dalam mengukur konstruk tersebut dan dikekalkan dalam instrumen. Sementara nilai I-CVI bagi konstruk kompetensi pensyarah dan pembangunan profesional masing- masing mencatatkan nilai 0.99. Walaupun dapatan ini menunjukkan jumlah yang tinggi namun terdapat 5 item yang perlu diberi perhatian oleh penyelidik dan perlu dimurnikan dari segi struktur ayat agar jelas dan menepati objektif kajian. Namun begitu, pemurnian item bukan hanya melibatkan lima item sahaja tetapi pemurnian turut melibatkan semua item berdasarkan komen para panel agar item-item tersebut dapat disusun

dengan lebih sistematik dan mencapai maksud yang jelas dalam kajian. Secara keseluruhannya, ketujuh-tujuh pakar berpendapat bahawa item dalam instrumen soal selidik adalah sesuai untuk digunakan dalam kajian.

Jadual 9: Ringkasan Dapatan Keseluruhan Kesahan Kandungan

Konstruk	**Bilangan Item**	**I-CVI (> 0.83)**	**S-CVI / Ave (≥ 0.90)**
Kompetensi Pensyarah	22	0.98	0.98
Profesionalisme	15	1	1
Pembangunan Profesional	14	0.99	0.99
Efikasi Pensyarah	16	1	1

Dalam kajian ini penyelidik menggunakan ≥ 0.7 untuk memastikan kebolehpercayaan yang baik bagi instrumen yang digunakan. Jadual 10 menunjukkan dapatan ujian kebolehpercayaan alpha cronbach. Nilai kebolehpercayaan bagi konstruk kompetensi pensyarah adalah 0.89, profesionalisme ialah 0.83, pembangunan profesional ialah 0.90 dan efikasi pensyarah ialah 0.81. Nilai *Cronbach Alpha* adalah tinggi dan sangat baik bagi kesemua konstruk yang dikaji. Oleh itu, kajian yang seterusnya akan dilaksanakan ialah analisis *confirmatory factor analysis* (CFA) dan analisis kesepadanan model (SEM).

Jadual 10 : Dapatan Ujian Kebolehpercayaan

Konstruk	**Nilai *Alpha Cronbach***
Kompetensi Pensyarah	0.89
Profesionalisme	0.83
Pembangunan Profesional	0.90
Efikasi Pensyarah	0.81

Keputusan kajian ini berpotensi memberi kesan yang signifikan terhadap pendidikan STEM di politeknik, khususnya dalam menilai dan mempertingkatkan kompetensi pensyarah. Dengan adanya instrumen yang sah dan boleh dipercayai, pihak pengurusan politeknik dan KPT kini mempunyai alat yang berkesan untuk mengukur tahap kompetensi pensyarah secara objektif. Ini membolehkan mereka merancang program pembangunan profesional yang lebih tepat dan disesuaikan dengan keperluan pensyarah, seterusnya meningkatkan kualiti pengajaran dan pembelajaran dalam bidang STEM dalam melahirkan graduan berkualiti dan lebih bersedia untuk memenuhi keperluan industri dalam era Revolusi Perindustrian Keempat (IR 4.0). Walaupun kajian ini memberikan sumbangan penting dalam membangunkan instrumen yang sah dan boleh dipercayai, terdapat beberapa batasan kajian yang wujud. Maklumat yang diperoleh menjurus kepada responden yang dikaji dan tidak boleh digeneralisasikan kepada populasi lain yang berada di luar institusi politeknik Malaysia. Kepelbagaian demografi dan institusi TVET yang pelbagai boleh menyebabkan perbezaan dalam tahap kompetensi dan keperluan pembangunan profesional pensyarah. Oleh itu, kajian masa depan boleh dijalankan dengan saiz sampel yang lebih besar dan melibatkan pensyarah dari pelbagai institusi TVET.

5. Kesimpulan

Tujuan utama kajian ini adalah bagi menentukan kesahan dan kebolehpercayaan instrumen soal selidik model kompetensi pensyarah politeknik dalam pendidikan STEM. Keseluruhannya, instrumen soal selidik menunjukkan kesahan dan kebolehpercayaan yang tinggi dan sesuai untuk digunakan oleh pensyarah politeknik untuk kajian seterusnya iaitu menjalankan kajian *confirmatory factor analysis (CFA)* dan analisis kesepadanan model (SEM).

Penghargaan

Setinggi-tinggi penghargaan kepada para panel pakar dan pensyarah politeknik yang terlibat kerana meluangkan masa untuk membuat penilaian kesahan instrumen soal selidik dalam kajian ini. Semoga dapatan kajian ini dapat memberi manfaat kepada pihak-pihak yang terlibat.

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Investigating the Impact of LEW's Method on Student Motivation and Learning Outcomes in Solving Systems of Equations

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Abstract

Systems of equations play a crucial role in fields such as computer science, engineering, and commerce. Despite their importance, students often perceive solving systems of equations as a tough and demanding problem, needing numerous algebraic operations to reach a solution. This raises the question of whether the current pedagogy of solving systems of equations is too complicated, and should a different method that is easier and simpler be necessary as an alternative to teaching systems of equations? Past literature has demonstrated that transformation errors and process errors are the most common mistakes made by students in solving systems of equations. In light of this, we design and propose LEW's Method, which simply requires basic number operations. The objectives are to boost the students' motivation and performances. A group of 46 students who enrolled in the Business Mathematics course at Politeknik Kuching Sarawak were employed as subjects. The action research design was employed to investigate the impact of LEW's method on students' motivation and performance via questionnaires and formative assessment. The findings indicate that LEW's Method significantly boosts motivation and learning outcomes, suggesting its potential benefits for mathematics curriculum developers, educators, and students in improving understanding and problem-solving strategies for systems of equations.

Keywords: - Innovative Mathematics Pedagogy; Mathematics Education; System of Equations

1. Introduction

All students enrolled in Polytechnic Malaysia's business program are required to take Business Mathematics. Since this course heavily relies on the students' previous math knowledge from their secondary school, Polytechnic lecturers have a difficult time lecturing to a class of students with varying knowledge levels—students who received grades ranging from A+ to D on their public Sijil Pelajaran Malaysia (SPM) examination. The COVID-19 epidemic made inequality worse, particularly for students from disadvantaged socio-economic backgrounds, who underperformed significantly since schools were closed for some time in 2021–2022 due to the Malaysia Movement Control Order (MCO), and online learning was adopted. Many students regard mathematics as an enigmatic topic. This is due to a less fascinating and difficult-to-learn presentation style, which causes pupils to become bored and underperform in class. They viewed mathematics as an abstract, theoretical subject with difficult and complicated symbols and concepts. A prevalent issue observed in students is their inability to solve systems of equations in an efficient manner. They perceive systems of equations questions and problems as challenging and demanding, requiring multiple steps and algebraic processes to get to a solution (Johari & Shahrill, 2020). The complex and varied character of systems of equations, particularly the system with three variables, intimidates students when they attempt to fully understand them. Rather than thinking of it as something that is still not completely understood, they see it as a highly challenging subject. Their insufficient comprehension typically causes them to make common mistakes and misconceptions along the way, which makes their studies even more difficult. Due to this, students have shown a bad attitude, lost interest, and paid less attention in class when topics involving systems of equations were being taught, which has resulted in poor examination results.

Teaching mathematics in the classroom involves more than just imparting computational information; it also involves choosing and communicating mathematical concepts in a way that facilitates their learning and application (Saadati & Celis, 2023). Learning approaches that are less diversified and tend to limit students' creativity in expressing their thoughts lead to a lack of enthusiasm for learning mathematics, resulting in subpar learning outcomes. Given the intricacy of simultaneous linear equations, it would seem that although students may find solving linear equations with a single unknown variable to be relatively simple, solving simultaneous equations presents a greater challenge to them even though they had been taught four methods for solving systems of equations, namely the substitution method, elimination method, graph method, and matrices, during secondary education. Mathematics lecturers are thus faced with the challenge of deciding which approach to teach while students continue to struggle with this compounded difficulty. While teachers

struggle to find a solution to address students' anxiety about comprehending simultaneous equations, students view the issue as one of how to comprehend the intricacy of these equations (Kolawole & Ojo, 2019). To ensure effectiveness in mathematics teaching and learning, the type and calibre of instructional materials, as well as the way in which they are presented, are essential. Indeed, there is an urgent need to deploy pedagogical resources, instructional tactics, and procedures that are significantly more effective than previous methods of getting students to respond effectively. Hence, this study aims to provide evidence on how innovative instructional strategies can boost students' motivation towards learning systems of equations, ultimately improving their learning outcomes.

2. Literature Review

Mathematics education is a foundation for academic success and a vital driver of economic and social progress. Mathematical literacy is essential as it enables individuals to draw informed conclusions and make decisions needed as constructive, engaged, and thoughtful citizens of the 21st century (OECD, 2023). Systems of equations are a fundamental component of algebra and are required for most mathematical disciplines as well as other 21st-century study areas like computers, sciences, engineering, and even commerce. However, it is often seen as a tough and demanding problem to deal with, needing numerous algebraic operations to reach a solution (Hasanah & Rosyidi, 2023; Wahyuni et al., 2023). One of the key challenges students face is cognitive overload, which can hinder learning. Cognitive overload occurs when students are presented with more information than they can process at once, leading to the impediment of learning and may even cause frustration and disengagement among students. (Evans et al., 2023). This is further supported by Evans et al. (2024), who reveal that students' motivation decreases when faced with extraneous load, whereas it improves when it is reduced. Lower extraneous cognitive load was linked to higher autonomous motivation —reasons for participation in class that are self-regulated, more volitional, aligned with students' interests, and enjoyable (Wang et al., 2022). In view of this, load reduction instruction strategies have emerged and gained popularity as they reduce cognitive load and foster motivation and engagement. (Evans & Martin, 2023; Martin et al., 2023).

The past literature demonstrates that transformation errors and process errors are the most common mistakes made by students in solving systems of equations (Pebriyani et al., 2020; Hadi, 2021; Sundary et al., 2022; Govender & Machingura, 2023; Setyorini & Hw, 2023). Because it is so heterogeneous, most students have little to no interest in studying or even tackling the question during their examination. The extraneous cognitive load may alter motivational beliefs, notably cost assessments, due to the incr eased effort required in subsequent interactions with learning activities (Feldon et al., 2019), as well as self-efficacy views (Feldon et al., 2018). The factors that cause such difficulties are the low reasoning ability and the students' weaknesses in mathematical ability. Students' inability to understand variables, a lack of comprehension of the fundamentals of algebra, a failure to convert into equations, and errors in number operations are all indicators of major difficulties (Sundary et al., 2022). This is further supported by Setyorini & Hw (2023), who demonstrate that students have difficulties identifying the calculation operations utilised to solve the system of equations questions. As a result, this raises the question of whether the current techniques of solving systems of equations are too complicated and should a different method that is easier and simpler be necessary as an alternative to teaching systems of equations.

3. Innovation of LEW's Method

In mathematics education, methods and tools for simplifying complicated concepts are critical in moulding students' learning experiences and outcomes. The LEW's Method, which simply requires basic number operations (+, -, x, and ÷) in solving the system of equations, is designed and proposed. This method emphasises simplicity and efficiency to help improve students' motivation and learning outcomes. The motivation of students in learning mathematics has been reported to exert positive impact on their performance (Yusuf, 2021). Hence, the design of LEW's Method aims to activate the three components proposed by Self - Determination Theory (SDT) (Deci & Ryan, 1985), namely autonomy, competence and relatedness.

The easy-to-master and simplified steps embedded in LEW's Method for solving system of equations fosters the student's perceived autonomy as they are able to perform the task and achieve the learning goals. The satisfaction secured from the achievement leads to higher competence which stems from the belief that their efforts will be effectual in realising their academic success. By actively taking part in the learning process where every student is able to carry out the task, it is our hope that LEW's Method instils the feeling of relatedness as no one is left behind in class. It fosters the feelings of effectiveness and builds confidence in achieving the learning goals of the class.

LEW's Method is also in support of Cognitive Load Theory (Sweller, 1988; Sweller et al., 2011). Sweller

et al. (2011) postulated that cognitive overload occurs when students are exposed to learning process that does not match with their prior knowledge. When the working memory resources required is greater than the available working memory resources they possess, the learning process becomes difficult to comprehend, slow and ineffective and intimidating the transfer of knowledge into long-term memory. Hence, it is vital that teaching method is tailored to the student's ability to enhance knowledge acquisition. This is especially true in mathematics education where prior knowledge is required to acquire new learning task.

By performing basic mathematical operations without complex algebra techniques, LEW's Method enables students to stay focus at the precise level. This is effective in reducing the cognitive load of students, especially the underperformed, who do not have sufficient fundamental of algebra. By eliminating the irrelevant cognitive load which is the requirement of mastery of algebra, students are able to stay focus on the understanding of solving the system of equations. Besides, the LEW's Method breaks the steps of solving into parts so that it is easier to master. We also embed the visual information by linking the numbers with colour lines and incorporate colour boxes that facilitate the auditory information. This demonstration makes the steps clearer and enhance the student's memory ability in processing and storing the information for long term.

3.1 LEW's Method in Solving System of Equations with Two Variables

The illustration of LEW's Method in solving system of equations with two variables is shown below:

Example 1. Solve the value of x and y:

$3x + 2y = 7$

$5x - 3y = -1$

To find the value of x, three steps are involved:

(1) copy the coefficients of x and y and the constant and arrange them in three columns as shown in Figure 1.
(2) link the numbers as shown.
(3) compute the product of each line, for instances, the product of numbers linked by red line is 2 multiplies -1 = -2 while the product of numbers linked by green line is 7 multiplies -3 = -21.
(4) substitute the product of each line into the relevant coloured box and compute the value of x.

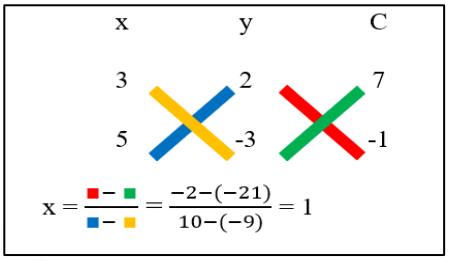

Figure 1: Solving x in system of equations with two variables

To find the value of y, similar steps are involved:
(1) copy the coefficients of y and x and the constant and arrange them in three columns as shown in Figure 2. (2) link the numbers as shown.
(3) compute the product of each line
(4) substitute the product each line into the relevant coloured box and compute the value of y.

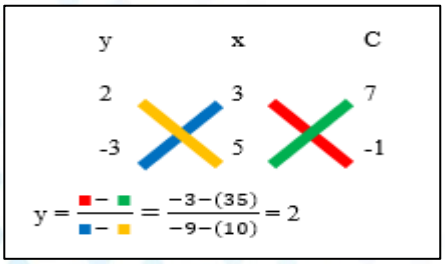

Figure 2: Solving y in system of equations with two variables

3.2 LEW's Method in Solving System of Equations with Three Variables

The system of equations in three variables is regarded as more difficult as it is more complex than a system of equations in two variables since it is an extension of the latter. The issue arises when executing algebraic calculations with fairly large steps (Hasanah & Rosyidi, 2023; Wahyuni et al, 2023). However, the complexity is greatly mitigated by using LEW's Method which only requires basic number operations.

Example 2. Solve the value of x, y and z:

$$3x + 2y - z = 9$$
$$2x + 3y - 2z = 9$$
$$5x + y + 3z = 8$$

To find the value of y, five steps are involved:
(1) copy the coefficients of x, y, z and the constant in columns as shown in Figure 3.
(2) add one column and paste the data from the first column.
(3) add two rows and paste the data from the first two rows.
(4) link the numbers as shown.
(5) Compute the product of each line, sum up product of the same colour lines and get the value of y.

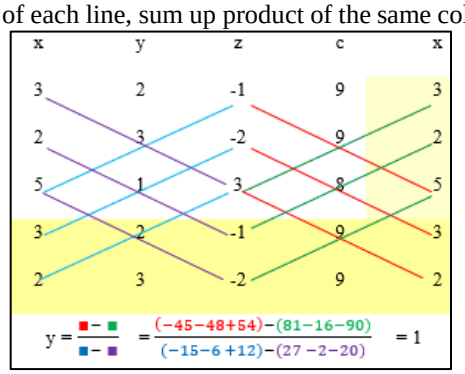

Figure 3: Solving y in system of equations with three variables

To find the value of x, switch the columns as follows, and the subsequent steps are similar to finding y.

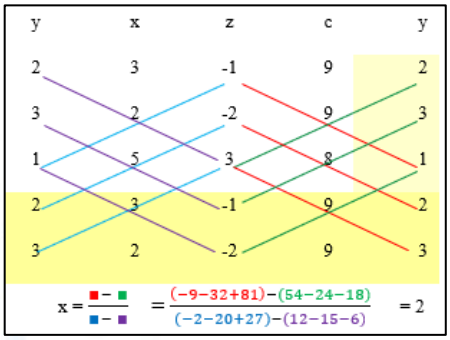

Figure 4: Solving x in system of equations with three variables

To find the value of z, switch the columns as follows, and the subsequent steps are the same.

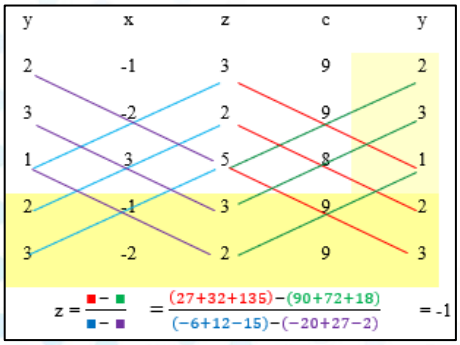

Figure 5: Solving z in system of equations with three variables

4. Methodology

A group of 46 students from the Diploma in Business Studies Program who enrolled in the Business Mathematics course at Politeknik Kuching Sarawak were employed as subjects. Prior to participating, each student gave their consent and was made aware of this study's objectives. Their identity and confidentiality were upheld throughout the study, and their participation will not have an impact on their academic standing.

The Mathematics Motivation Questionnaire (MMQ) (Fiorella et al., 2021), a validated instrument with sound validity and reliability that assesses different dimensions of student motivation towards mathematics, was adapted to assess students' motivation to learn the system of equations. The MMQ integrates well-known theories of academic motivation (Bandura, 2001; Pintrich, 2003; Ryan & Deci, 2017; Wigfeld et al., 2016) to emphasize the multidimensional nature of motivation, including intrinsic worth, self-regulation, self-efficacy, utilitarian value, and test anxiety. These five constructs reveal what motivates students towards learning and are measured via 19 instruments with a five-point scale from (1) never to (5) always that had been validated based on Standards for Educational and Psychological Testing (AERA, APA, & NCME, 2014). Hence, the feasible measures in MMQ are adapted in this study to capture the student's motivation to learn mathematics, particularly the system of equations after they were introduced to the LEW's Method.

At the beginning of the study, the MMQ was administered via Goggle Form to the 46 students in order to gauge their initial levels of motivation in learning the system of equations. This provides baseline data on students' intrinsic worth, self-regulation, self-efficacy, utilitarian value, and test anxiety in relation to completing systems of equation-based problems. After the LEW's Method was introduced (an intervention phase consisting of two sessions), the MMQ was administered again to the same group of s tudents. Using descriptive analysis, this post-test will capture any shifts in their levels of motivation after applying LEW's Method.

In order to investigate the impact of LEW's Method on the learning outcomes, the first formative test was given before the LEW's Method was introduced. The respondents answered the test by applying conventional methods like the substitution method, elimination method or matrices. The second formative test was given after the LEW's Method was introduced. Two questions were tested in both the formative tests, one on a system of equations with two variables and another on a system of equations with three variables. Besides, the time taken by the students to submit the answer sheet was also recorded in both formative tests. The results are then compared via descriptive analysis to test the effectiveness and efficiency of LEW's method in improving the students' learning outcomes.

5. Finding and Analysis

The results of the Mathematics Motivation Questionnaire (MMQ) before and after the adoption of LEW's Method are exhibited in Table 1. The difference between the scores is also exhibited to capture the shifts in respective dimensions of motivation. Based on the results, it is noteworthy to highlight that a remarkable proliferation in students' motivation in learning systems of equations is revealed when the results before and after the application of LEW's Method are compared. All the 19 items have shown remarkable increments in mean scores. The overall average upsurges from 2.07 to 4.73, indicating the student's motivation has been successfully fostered after applying the LEW's Method.

Table 1: Mean score of the Mathematics Motivation Questionnaire (MMQ).

Construct	Item	Before	After	Difference
Intrinsic value	I find learning the system of equations interesting.	1.96	4.57	2.61
	I find learning the system of equations enjoyable.	1.96	4.57	2.61
	I like doing challenging problems, which involves a system of equations.	1.96	4.57	2.61
Average		1.96	4.57	2.61
Self-regulation	I put sufficient effort in studying the system of equations.	1.98	4.65	2.67
	I find out reason if I have trouble in solving the system of equations.	2.07	4.65	2.58
	I ensure I master the solving of system of equations well.	2.07	4.65	2.58
	I prepare well for assessment, which involves a system of equations.	1.96	4.57	2.61
Average		2.02	4.63	2.61

Self-efficacy	I am confident to perform well on assignment, which involves a system of equations.	2.28	4.74	2.46
	I am confident to perform well on test, which involves a system of equations.	2.24	4.87	2.63
	I can master the knowledge and skills in solving the system of equations.	1.98	4.87	2.89
	I can earn a grade of "A" in the assessment, which involves a system of equations.	1.96	4.74	2.78
Average		2.12	4.81	2.69
Utility value	The system of equations I learn will be helpful to me.	2.07	4.83	2.76
	I will use the system of equations that I learn.	2.07	4.83	2.76
	Learning a system of equations can help me get a good job.	2.24	4.83	2.59
	Learning a system of equations can help my career.	2.24	4.83	2.59
Average		2.16	4.83	2.68
Test anxiety	I am not anxious when having a test, which involves a system of equations.	1.96	4.65	2.69
	I am not nervous about how I will do on the test, which involves a system of equations.	1.96	4.65	2.69
	I am not worried about failing the test, which involves a system of equations.	2.07	4.87	2.80
	I am not concerned that the other students are better in solving problem which involves a system of equations.	2.28	4.87	2.59
Average		2.07	4.76	2.69
Overall Average		2.07	4.73	2.66

The construct of intrinsic value rises from 1.96 to 4.57. As students experience success and improve their skills in solving systems of equations, they perceive themselves as more competent and capable, which enhances their intrinsic motivation. This sense of accomplishment can make students feel more capable in their learning, increasing the intrinsic value they place on the task and leading to a more engaging and enjoyable learning experience. Students' sense of intrinsic joy and personal fulfilment are enhanced by this mastery, which highlights how important the learning task is to them. Students find it enjoyable when they successfully complete the task and this sparks their intention to further explore the challenging application questions of systems of equations in business. This is in line with past findings that emphasize on meaningful learning processes (Deci & Ryan, 2000) in increasing students' interest in learning (Santos-Trigo, 2020). In support, Jamileh et al. (2022) show that intrinsically driven students are prompt to try the harder and more complex questions because they enjoy the challenges once they are competent and possess the intention to deepen the subject-matter knowledge.

Students are more capable of planning and managing their learning with a method that is tailored to their learning needs. This is shown by the increase in the construct of self-regulation from 2.02 to 4.63. LEW's Method simplifies complex equation operations into manageable steps in which students merely need to perform basic mathematical operations in completing the tasks. This clear and easy-to-master instruction instills a sense of self-regulation in students where they put in sufficient effort and find out the mistakes they made in solving of system of equations. This is consistent with the concept of self-regulated learning (Ghania et al., 2024; Zimmerman, 2002), which shows that when students are given clear strategies, they are more likely to control their learning better.

Self-efficacy and test anxiety have shown the greatest improvement; both recorded an increase in average score by 2.69. Successfully solving systems of equations by using a straightforward method like LEW's Method instills a sense of accomplishment, which can enhance students' self-efficacy. This is supported by the theory of self-efficacy by Bandura (1997), who postulates that consistent experience of success in assignments increases students' confidence to solve more complex problems. The Lew method provides this mastery experience by solving large problems into simpler operations, thus increasing students' belief in their ability to solve systems of equations. With higher academic self-efficacy, students demonstrate greater problem-solving abilities that lead to better academic achievement (Fatemah & Mohammadreza, 2023).

By reducing the cognitive loads in learning, it ultimately increases the student's confidence, which leads

to lesser test anxiety. When students find that they can solve problems more easily, it reduces test anxiety and stress, leading to a more relaxed and controlled approach to the process of learning. LEW's Method successfully mitigates the uncertainty and anxiety typically associated with complex mathematical problems (Cassady & Johnson, 2002). By reducing the cognitive loads in learning, it ultimately increases the student's confidence, which leads to lesser test anxiety. When students find that they can so lve problems more easily, it reduces test anxiety and stress, leading to a more relaxed and controlled approach to the process of learning. It is essential to note that when a student perceives an exam as threatening, it strengthens their negative cognitions (Akin et al., 2024) and triggers the maladaptive coping behaviours that increase test anxiety. Further, students with test anxiety tend to have more negative thoughts than others, which impedes the learning processes (Jolly et al., 2021).

In addition, the confidence gained can be transferred to other areas of study, and this will also spark their interest to apply it to solving application problems. This is shown by the score of utility-value which increases from 2.16 to 4.83. For a student to engage in mathematics learning, it is vital that he believes he is math- capable (i.e., expectations for success), and he must enjoy and recognize the rewards of being good at mathematics (i.e., task values). Eccles & Wigfield (2002) suggest that students who are able to see the practical value in what they learn are more motivated to continue learning. LEW's Method fills the gaps in solving systems of equations by offering the intervention of utility value. After adopting the Lew Method, students can see how this mathematical method can be applied directly in real-life situations, instilling their perception of the importance of such learning. This is important as utility-value interventions have been reported to be positively associated with increased interest, engagement and achievement in learning (Hulleman & Harackiewicz, 2021) and indeed, this mathematical literacy—the practical application of mathematical concepts to real-world problems—is one of the most essential elements to become the citizens of the 21st century (OECD, 2023).

The learning outcomes are also found to have increased substantially when the results of the first formative test are compared with the second formative test (Table 2). In the second formative test, the number of students who answered correctly the question with 2 variables increased from 16 to 45, while the number increased from 7 to 42 for the question with 3 variables. This remarkable performance indicates the effectiveness of LEW's Method in helping students solve the questions as compared with traditional methods. Additionally, the mean score of the second formative test nearly doubled the first formative test, suggesting a remarkable improvement in the average performance of the group. This is supported by Fauzi et al. (2024) who demonstrate that students who participate actively in materials they are learning perform better and achieve higher academic levels.

Table 2. The Mean Score of Formative Test

Formative Test	**Number of Students Who Answered Correctly**		**Mean Score**	**Standard Deviation**
	System with 2 variables	**System with 3 variables**		
1	16	7	48.9	32.5
2	45	42	94.8	5.8

The time taken by the students to submit their answer sheets was also recorded to test the efficiency of LEW's Method. Table 3 exhibits a significant improvement in terms of time taken by the students in completing the tests. Despite a higher number of students answering correctly in the second formative test, the average time taken to answer decreased substantially, while the standard deviation also decreased in the second formative test, indicating a more consistent and efficient performance among the students. This implies that students were able to answer questions more efficiently by applying LEW's Method as compared with traditional methods.

Table 3. Time Taken to Answer Formative Test

Formative Test	Time Taken to Answer All Questions		Mean Time	Standard Deviation
	Shortest	Longest		
1	11m50s	35m46s	33m27s	18.3
2	7m6s	18m33s	11m21s	3.6

6. Conclusion

LEW's Method is a promising teaching and learning pedagogy in capturing the needs of diverse students, especially the underperformed group. This is in line with the Malaysian educational policy aims and UNESCO's global educational objectives, in which inclusivity and addressing performance gaps have become the main agenda (UNESCO, 2020). This study shows that a simpler and easy-to-master method like LEW's Method, is effective in fostering the students' motivation and enhancing their learning outcomes. As compared with the traditional methods in solving the system of equations, LEW's Method stands out in bridging the gap between

procedural and conceptual comprehension, reducing the cognitive load which is intimidating to the students. The ease and simplicity enable students to solve the problems more easily an d faster. This makes the learning process more enjoyable and stress-free, which ultimately boosts their confidence and interest. However, several limitations of this study should be noted. The size of the subjects may limit the generalisability of the findings, and the motivational changes are tested in short-term effect. Hence, it is suggested that the future study can address these limitations in order to provide more comprehensive results.

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'Teamwork Makes the Dream Work': A Collaborative Effort in Designing and Developing Academic Writing Materials

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Abstract

A preliminary review of the English language courses (ELC) and Public Administration Diploma (PAD) courses in Universiti Teknologi MARA (UiTM) Sabah branch found a mismatch between the English language courses and the specific writing needs of the Diploma in Public Administration (DPA) students. Therefore, there was a need for a solution to the problem or gap. The study, first of all, identified the specific academic writing needs of the DPA students. Based on the findings in the needs analysis stage, academic writing materials were designed and developed via design-based research to respond to the DPA students' areas of greatest need in academic writing. The final part of the study evaluated the usefulness of the academic writing materials and writing workshops. This study involved various data sources: students, subject instructors, an experienced materials developer and documents. The quantitative and qualitative data are collected concurrently. This mixed methods study addressed the academic writing needs of the DPA students and the evaluation of the academic writing materials, which was designed to meet the identified writing needs. Real writing needs were identified in the needs analysis stage. In the evaluation of the academic writing materials, the subject instructors and students found the writing workshops and materials designed useful and were able to meet the student's needs with regard to academic writing. This study has also shown that a collaborative partnership between the researcher, students, subject instructors and experienced materials developer, a senior lecturer at Kings College London, plays a vital part in designing and developing teaching and learning materials.

Keywords: Needs Analysis: Design-Based Research: Academic Writing Materials

Introduction

Many studies (e.g., Abudhahir et al., 2015; Chiuh, 2015; Dwisusila et al., 2023) have suggested that it is crucial to identify the needs of the students in order to provide them with the necessary courses. Needs analysis is essential in language teaching and material development for English for Specific Purposes (ESP) courses (Brown, 2016; Pranoto & Suprayogi, 2020). Need analysis helps assess students' skills, desired improvements, and learning objectives. Brown (2016) defines need analysis as the process of collecting and analysing data concerning the academic English language needs of a specific group of learners. In other words, need analysis involves gathering information about students' needs, preferences, and viewpoints to guide course design, which is vital for creating effective learning systems and meeting program goals. As a valuable data collection method, needs analysis enables teachers to pinpoint students' critical requirements and adapt curricula to align with their interests. ESP instructors use need analysis to identify students' key needs and determine the English skills they should focus on for future success.

Several studies (e.g., Ramzan et al., 2023; Umar et al., 2023) found that ESL students have problems in academic writing which implies a lack of training in academic writing and arouses accusations of plagiarism in their writing. In theory, needs analysis is a first step conducted before a course so that a course outline, materials and other resources can be in place before teaching begins. Without proper needs analysis, stakeholders, such as institutions and language instructors, may rely on assumptions about the language needs of their learners. These assumed needs may not be the real needs of these students.

In an attempt to employ triangulation in identifying the academic writing needs of the EAP students on the UiTM Sabah campus and to test the feasibility of the present study, a study was conducted by Chiuh & Lee (2012). This study was done in the final week of the EAP course to identify the academic writing needs of the EAP students. The objectives of the study were to identify the academic writing skills undergraduate students need for the satisfactory completion of their programmes in UiTM Sabah and to identify the difficulties faced by UiTM undergraduate students when preparing written assignments for their le cturers. This study and the preliminary review of the English language courses (ELC) and PAD (Public Administration Diploma) courses in Universiti Teknologi MARA (UiTM) Sabah branch discovered a mismatch between the writing skills required in the PAD courses and the writing skills offered in ELC. Through this preliminary document analysis, it was found that there was a mismatch between the English language courses and the specific writing needs of the Diploma in Public Administration (DPA) students. Thus, the study, first of all, aimed to identify the

specific academic writing needs of the DPA students in UiTM Sabah branch. Based on the findings in the needs analysis stage, academic writing materials were designed and developed via DBR (design-based research) to respond to the DPA students' area of greatest needs in writing through design- based research methodology. The final part of the study was the evaluation of the usefulness of the writing materials and the writing workshops.

2. Literature Review

Adzmi, Bidin, Ibrahim and Jusoff (2009) in their studies of the academic English language needs of Industrial Design students in UiTM Kedah, Malaysia, reported a high failure rate in the students' English courses, in particular, among the Industrial Design students. Their poor performance in English has affected their performance in their specialised courses. The contributing factor could be the mismatch between what was offered in the English language courses and what was required by their specialised courses. The English language courses offered to this group of students and to other specialised programmes are general in nature. The students are taught the four language skills: writing, reading, listening and speaking. On the other hand, these students need specific language skills to cater for the demands of their specific programme. Hence, to tackle this issue, Adzmi et al. (2009) emphasised the importance of considering the program needs. Nik, Sani, Kamaruzaman, Wan Chik and Hasbollah (2010) supported this by stating that lecturers need to be aware of their students' different needs and wants, hence the need for lecturers to review and reflect on their approach to teaching writing. Adzmi et al. (2009) also highlighted the lack of collaboration between su bject specialists and English language instructors, which they believed contributed to the problem mentioned earlier.

Studies on needs analyses and academic difficulties in higher institutions of learning have implications for the present study; it aimed at investigating the academic writing needs of first -year students of Diploma in Public Administration (DPA) students in Sabah MARA University of Technology (UiTM Sabah branch). The DPA program and PAD (Public Administration Diploma) courses were selected because these programs and courses require students to do numerous writing tasks compared to other programmes and courses offered in the UiTM Sabah branch. The identified needs of these students then formed the basis for designing academic writing materials which aimed to meet the real academic writing needs of the DPA students. Materials design focuses on creating pedagogical resources reflecting language skills, content, and contexts relevant to diverse English-speaking communities (mckja et al., 2022). Designing academic writing materials should encompass learning objectives, engaging content, and tasks with clear instructions and outcomes. Designers must consider social practices, participants, events, and communicative purposes across different contexts when selecting texts. Topics should encourage the inclusion of diverse cultural and linguistic communities. Furthermore, they should also align with students' learning objectives and experiences.

Design-based research (DBR) methodology was utilised in designing context-sensitive and culturally appropriate materials for language learning. It is crucial to design context-sensitive and culturally appropriate materials for language learning, utilising the DBR approach towards needs analysis and materials development. These materials, which took into account the specific needs of the DPA students and their PAD courses, could be used to supplement the existing English courses offered to this particular group of students in UiTM.

In the process of designing and developing the academic writing materials, the researcher cooperated with DPA students, subject instructors and a materials designer and writer. The students and subject instructors were the same people who were involved in the needs analysis stage. This collaborative partnership is crucial and established from the initial problem identification, through literature review, to intervention design and construction, implementation, assessment, and the creation and publication of theoretical and design principles (Design-based research collective, 2003; Wang and Hannafin, 2005; Anderson & Shattuck, 2012).

In the process of identifying the writing needs of the students and designing and developing the materials, the researcher collaborated with DPA students and PAD instructors and Dr Wingate regarding the attachment at King's College London. The students and instructors provided the researcher with essays and assisted in selecting relevant journal articles. Dr Wingate, a senior lecturer in Language in Education at King's College London, was involved in this study. In line with her research interests in academic literacy, she has developed and evaluated various approaches to teaching writing in mainstream higher education. She has also been involved in developing sets of writing resources for post-graduate students across academic disciplines at King's College London.

Hence, the research questions of the research are 1) What are the needs in academic writing of DPA students in UiTM Sabah branch when preparing written assignments in the courses of their diploma programme? 2) What aspects of designing, developing and evaluating of academic writing materials that would help students meet their identified academic writing needs? and 3.How useful are the DBR-based academic writing materials and writing workshops (the intervention)?

3. Methodology

3.1 Participants

The participants in this study were first-year Diploma in Public Administration (DPA) students in UiTM Sabah branch (N=110). Since the academic writing materials designed and developed as part of the study were discipline-specific, the study was delimited to students from the Faculty of Public Administration and Policy Studies. The subjects were chosen from one programme only − the Diploma in Public Administration − because the gathered data on these subjects were used as the basis for designing and developing discipline-specific academic writing materials.

The instructors chosen as respondents for this study were those who taught PAD courses to the DPA students. Six out of seven DPA instructors were involved in the needs analysis stage and out of these six instructors, only three of them were available for the evaluation of the writing materials. Their experience in teaching DPA students in UiTM ranged from one year to more than 10 years. These instructors taught PAD courses, namely PAD180/214 (Public Personnel Administration) and PAD120/130 (Introduction to Political Science) to the students under study. These instructors were intentionally selected to provide data for the needs analysis stage and to contribute to the designing and developing of the academic writing materials.

3.2 Data Collection Method

3.2.1 Needs Analysis Stage

Four focus groups and two key informant group interviews were carried out for the needs analysis stage. The key informant group interviews comprised two instructors for one group and three for the other group. The focus groups consisted of two groups with six students each, one group of seven students, and one group with eight students.

A questionnaire was utilised in the study to analyse Target Situation Analysis (TSA) and Present Situation Analysis (PSA) (Dudley-Evans and St John, 1998: p138). The questionnaire used in the study was adapted from Rosenfeld et al. (2001) research. It contained reading, writing, speaking and listening tasks considered to be important for the competent academic performance of undergraduate and graduate students. The questionnaire was modified to suit the objectives of the study. The modified questionnaire consisted of five sections: (1) the respondent's background information (2) the importance of writing tasks for academic performance, (3) an assessment of ability in writing tasks, (4) difficulty in performing writing tasks, and (5) comment on whether additional help was needed. The instructors' questionnaire contained the same categories, but the item stems read 'How important is it for your students...', 'How well can your students...' and 'How difficult is it for your students...' instead of 'How important is it for you...', 'How well can you...' and 'How difficult is it for you...'.

3.2.2 Stages in Designing and Development of Academic Writing Materials

Prior to the designing and development of the academic writing materials (TAWM), the researcher reviewed literature and existing design principles guiding Design-Based Research (DBR), materials design and development in general, and Jolly and Bolitho's materials design model. The researcher also discussed with Dr Wingate the principles guiding her academic writing materials since the researcher adapted her design. As the study involved these four elements, the researcher took into account their underlying principles to guide the design and development of TAWM. Tomlinson (2003d) reported that many frameworks in the literature on materials development failed to provide theoretical justification for their stages and sequences in developing the materials.

Based on the researcher's discussion with her and the review of previous studies on materials design and development conducted by Dr Wingate and team, the researcher concluded that: (1) materials should take into account the learners' level of English language proficiency, (2) materials should expose learners to subject-specific texts and activities, (3) materials should be delivered through a media which is suitable to the learners, (4) materials should give learners opportunities: (a) to "find answers independently and construct their own knowledge through engaging in meaningful learning activities" (Biggs, as cited in Wingate & Dreiss, 2009: A-16), (b) to "experience problems, reflect on them, and find and try out solutions" (Kolb, as cited in Wingate & Dreiss, 2009: A-16), and (c) to learn knowledge and skills in "contexts that resemble real life" (Brown, as cited in Wingate & Dreiss, 2009: pA-17), (5) materials should involve subject instructors, and (6) materials should have underlying teaching and learning principles. Wingate's course design incorporated the following Academic Literacies principles listed by Lea (as cited in Wingate, 2012: p29): (1) taking account of students'previous literacy practices, (2) recognising 'the gaps between students' and tutors' expectations and understanding of the texts involved in learning', and (3) recognising 'issues of identity'. Thus, TAWM has also incorporated these principles since they underlie Wingate and Dreiss' design.

In DBR, Wang and Hannafin (2005: p15) have identified nine principles central to planning and implementing TELE design-based research: (1) Principle One: Support design with research from the outset, (2) Principle Two: Set practical goals for theory development and develop an initial plan, (3) Principle Three: Conduct research in representative real-world settings, (4) Principle Four: Collaborate closely with participants, (5) Principle Five: Implement research methods systematically and purposeful, (6) Principle Six: Analyse data immediately, continuously, and retrospectively, (7) Principle Seven: Refine designs continually, (8) Principle Eight: Document contextual influences with design principles, and (9) Principle Nine: Validate the generalizability of the design.

Thus, the academic writing materials (TAWM) incorporated stages in the needs analysis process (Jordan, 1997), materials design and development (Jolly and Bolitho Model, 2011; Wingate and Dreiss, 2009) and evaluation (Tomlinson, 2003c; Wingate and Dreiss, 2009). The principles of DBR, materials design and development, and materials design models were all important in the development of TAWM. The settings, needs of the learners and teaching and learning theories were taken into account in selecting the principles for the development of TAWM. This careful selection of principles led to the development of draft principles to guide the design of the intervention (TAWM). The draft principles were: (1) materials should take into account the learners' level of English language proficiency, (2) materials should expose learners to subject - specific texts and activities, (3) materials should be delivered through a media which is suitable to the learners, (4) materials should give learners opportunities: (a) to "find answers independently and construct their own knowledge through engaging in meaningful learning activities" (Biggs, as cited in Wingate and Dreiss, 2009: A-16), (b) to "experience problems, reflect on them, and find and try out solutions" (Kolb, as cited in Wingate and Dreiss, 2009: A-16), and (c) to learn knowledge and skills in "contexts that resemble real life" (Brown, as cited in Wingate and Dreiss, 2009 A-17), 5) materials should involve subject lecturers, (6) materials should have underlying teaching and learning principles, (7) materials should take into account students' previous literacy practices, (8) materials should recognise 'the gaps between students' and tutors' expectations and understanding of the texts involved in learning', (9) materials should recognise 'issues of identity', (10) materials should achieve impact, (11) materials should help learners to feel at ease, (12) materials should help learners to develop confidence, (13) what is been taught should be perceived by learners as relevant and useful, (14) learners must be ready to acquire the points being taught, (15) materials should expose the learners to language in authentic use, (16) the learners' attention should be drawn to linguistic features of the input, (17) materials should not rely too much on controlled practice, (18) materials should be supported by research from the outset, (19) practical goals for theory development and develop an initial plan should be set, (20) research in representative real-world settings should be conducted, (21) collaborate closely with participants, (22) research methods should be systematically and purposeful implemented, (23) data should be analysed immediately, continuously, and retrospectively, and (24) designs should be designed continually.

3.2.3 Evaluation of the Usefulness of TAWM and Writing Workshops

Two focus groups were conducted to evaluate the usefulness of the academic writing materials and the quality of the workshops. Each focus group comprised three students who were involved in writing workshops one and two. They were asked to comment on the two writing workshops. The focus groups were conducted in the UiTM Sabah branch campus. In these focus groups, there were only three students in each group because the students worked on the materials in the workshops in a group of three. Although there were only three members in these two focus group interviews, the researcher was able to capture a variety of perspectives from the members.

The questionnaire to evaluate the usefulness of the newly-designed academic writing materials and the quality of the workshops was adapted from Wingate's research with her permission. Before adapting the instrument, the researcher discussed the suitability of the questionnaire for the study with her. The questionnaire was then modified to suit the writing materials in this study. The student's questionnaire consisted of closed-ended and open-ended questions. The total number of rateable statements was 10 for workshop one and eight for workshop two. There were three open-ended questions for workshop one and three for workshop two. Since the DPA instructors were not involved in the workshops, the instructor's version did not contain the section which required respondents to evaluate the academic writing workshops. In the questionnaire for workshop one, five statements were rateable and there were three open -ended questions. As for workshop two, the questionnaire consisted of five rateable statements and three open-ended questions.

3.2.4 Document Analysis

In this study, document analysis was used in combination with focus groups, key informant group interviews, and questionnaires as a means of triangulation. The documents, students' essays, were analysed to discover the students' actual performances with regard to academic writing skills and to corroborate findings from questionnaires and other qualitative methods employed in this study. Apart from being analysed for identifying students' writing needs, these documents (e.g., students' essays and journal art icles) were also analysed and used for the development of the writing materials.

3.2.5 Multiphase Design of Mixed Methods Approach

The multiphase design of mixed methods of qualitative and quantitative research approach was employed in this study. The problem of the present study had to be studied through multiple phases of research that include multiple types of methods, hence the multiphase nature of the design. The quantitative technique (questionnaire) and the qualitative technique (focus groups, document analysis and interviews) were conducted concurrently. The multiphase concurrent mixed methods design was created to suit the n ature of the study. In the context of the present study, these multiple phases are tied to phases for needs analysis, designing and developing of the academic writing materials, and evaluation of the designed and developed writing materials. The purpose of this design is to address three overarching research questions pertaining to the writing needs of the students, the design and development of writing materials, and the usefulness of the writing materials. Therefore, the multiphase concurrent mixed methods design was employed. Figure 1 shows the multiphase design of mixed methods approach.

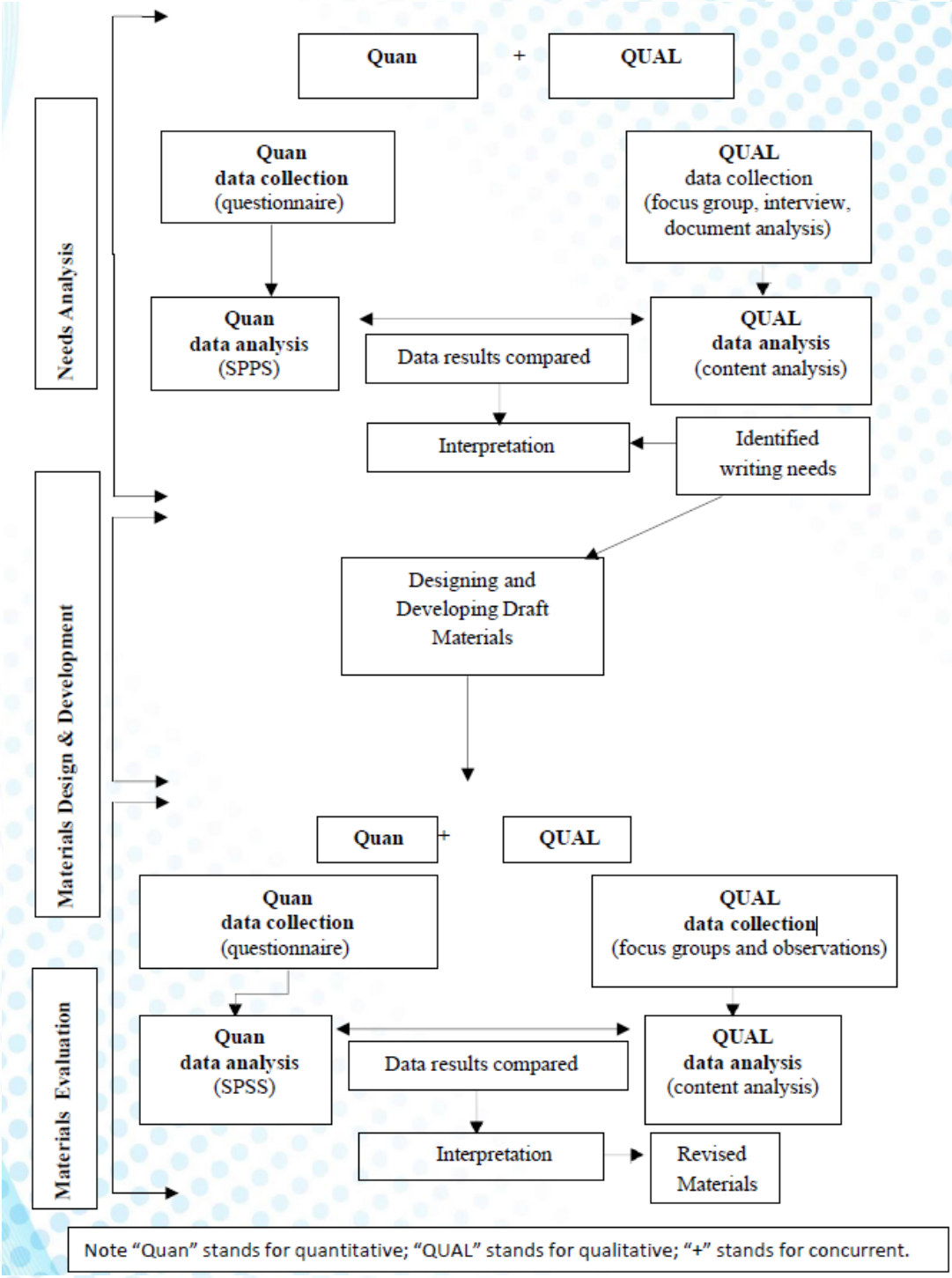

Figure 1: Multiphase Design of Mixed Methods Approach

4.0 Findings and Analysis

The discussion on the findings and analysis are presented in such a way to follow the sequence of the design-based research approach: (1) needs analysis, (2) the design and development of the academic writing materials, and (3) the evaluation of the usefulness of the academic writing materials. The identified academic writing needs formed the basis of the designing of academic writing materials. The evaluation was then conducted to evaluate the usefulness of the academic writing materials and workshops.

Data were gathered from multiple methods and sources. The questionnaires were administered to students and instructors to identify the academic writing needs of the students. Additionally, focus groups and key informant group interviews were conducted to collect data on the academic writing needs of the students. Documents analysis was conducted to further identify the academic writing needs of the students. Therefore, the data analyses which are presented here are based on the data gathered from these multiple methods and sources. The findings are presented based on the objectives and stages of the study.

4.1 Identified Writing Needs

This section presents the findings of the needs analysis stage of the research, namely, the important writing skills for students, the writing skills students identify as needing additional help, and the difficulties in writing.

To assist in understanding the findings, a list of the writing categories and their related writing skills is presented in table 1. The list of categories and writing skills were taken from the questionnaire.

Table 1: Writing Categories and Related Writing Skills

WRITING SUB-CATEGORIES	**RELATED WRITING SKILLS**
Content	Write in response to an assignment and stay on topic without excessive wordiness. Write in response to an assignment and stay on topic without repetition in expression. Use sources appropriately to support ideas. Summarise information from secondary sources − information gathered by researchers and recorded in books, articles, and other publications. Paraphrase information from secondary sources. Synthesise information from secondary sources (combining relevant information from secondary sources).
Organisation	Write thesis statement, topic sentences and supporting details. Organise writing to convey main and supporting ideas. Use appropriate transitions to connect ideas and information.
Development	Use relevant reasons and examples to support a position or idea. Write an outline of an academic text. Draft an academic text. Revise an academic text. Edit an academic text.
Language	Write in correct grammar. Write in correct sentence structure. Use appropriate subject-specific vocabulary.
Documentation	Acknowledge sources of information using in-text citations and references (e.g., APA style)

The various results of the needs analysis stage of the study are presented in the following tables namely, Tables 2, 3, 4, 5 with corresponding functions and explanations. The tables answered research question one.

Important Writing Skills for Students

This section presents the answer to the following research question:

What writing skills are important for students when preparing written assignments in the courses of their diploma programme?

Table 2 shows the writing tasks rated 4.0 and above (‘very important’) by DPA students. Under this, the DPA students rated three writing tasks as ‘very important’ with the mean of 4.23, 4.19 and 4.00.

Table 2: Writing Tasks Rated 4.0 and Above (‘Very Important’) by DPA Students

Writing tasks	***Mean***	***SD***
Writing tasks	Mean	SD
1 Write in correct grammar	4.23	.964
2 Write in correct sentence structure	4.19	.943
3 Use relevant reasons and examples to support a position or idea	4.00	.824

Note: N = 110

DPA students rated three writing tasks as ‘very important’ (table 2), while the DPA instructors rated ten as ‘very important’ (table 3). When comparing the writing tasks rated as ‘very important’ by both groups of

respondents, only one writing task was shared by them, which was 'use relevant reasons and examples to support a position or idea'.

Table 3 Writing Tasks Rated 4.0 and Above ('Very Important') by DPA Instructors

Writing tasks	*Mean*	*SD*
1 Acknowledge sources of information using in-text citations and references (e.g., APA style)	4.83	.408
2 Use sources appropriately to support ideas	4.83	.408
3 Use relevant reasons and examples to support a position or idea	4.50	.548
4 Paraphrase information from secondary sources	4.50	.548
5 Organise writing in order to convey main and supporting ideas	4.33	.816
6 Synthesise information from secondary sources	4.17	.753
7 Write in response to an assignment and stay on topic without excessive wordiness	4.17	.753
8 Write thesis statement, topic sentences and supporting details	4.00	.894
9 Summarise information from secondary sources	4.00	.894
10 Write in response to an assignment and stay on topic without repetition in expression	4.00	.894

Note: $N = 6$

In the focus groups (DPA students) and key informant group interviews (DPA instructors), respondents were asked about the writing abilities or skills students needed in order to complete their assignments in English.

What types of writing abilities or skills do you need to complete your assignments in English?

What types of writing abilities or skills do your students need to complete their assignments in English?

a. Language

Language was mentioned in all the focus groups as a skill needed to complete assignments in English. The specific writing skills mentioned by the students were writing in correct grammar, writing in correct sentence structure, using appropriate subject-specific vocabulary, understanding the meanings of words and spelling words correctly. Among the writing skills mentioned by the students were:

One instructor responded English proficiency was the writing skill the students needed. She stated that students who were good at English could write well, which she thought could be due to their good understanding of terms. Another instructor agreed with her.

b. Content

A student mentioned 'to be able to synthesise' as a writing ability or skill he needed to complete his assignments. Another mentioned 'ability to go straight to the points, not repeat the points', while one instructor stated 'use source appropriately to support ideas by citing scholars'.

c. Development

Only one student mentioned 'use relevant reasons for the assignments and give good examples' as a writing skill needed for completion of assignments.

d. Organisation

The writing skill with regard to organisation was mentioned by one student.

Writing Skills Students and Instructors Identified as Needing Additional Help

This section presents the answer to the following research question:

What academic writing skills do students and instructors identify as needing additional help?

Table 4 and table 5 illustrate the writing tasks rated below 2.0 suggesting tasks which the students and instructors identified as needing help. The DPA students and instructors rated all 18 writing tasks below 2.0. This suggests they perceived that the students need help or support in all the writing tasks. Among the top- three writing tasks that the students and instructors reported as needing help, the one writing task shared by them is 'to acknowledge sources of information using in-text citations and references'.

Table 4: Writing Tasks Rated Below 2.0 by DPA Students

Writing tasks	Mean	SD
1 Write in response to an assignment and stay on topic without excessive wordiness	1.64	.554
2 Acknowledge sources of information using in-text citations and references (e.g., APA style)	1.66	.639
3 Write in response to an assignment and stay on topic without repetition in expression	1.68	.557
4 Use appropriate subject-specific vocabulary	1.68	.716
5 Paraphrase information from secondary sources	1.71	.564
6 Draft an academic text	1.72	.665
7 Synthesise information from secondary sources	1.73	.589
8 Write in correct grammar	1.74	.659
9 Edit an academic text	1.75	.693
10 Write an outline of an academic text	1.81	.642
11 Revise an academic text	1.83	.705
12 Write in correct sentence structure	1.84	.657
13 Use appropriate transitions to connect ideas and information	1.88	.646
14 Summarise information from secondary sources	1.89	.580
15 Write thesis statement, topic sentences and supporting details	1.91	.698
16 Organise writing in order to convey main and supporting ideas	1.92	.654
17 Use relevant reasons and examples to support a position or idea	1.95	.661
18 Use sources appropriately to support ideas	1.96	.709

Note: N = 110

Table 5: Writing Tasks Rated Below 2.0 by DPA Instructors

Writing tasks	*Mean*	*SD*
1 Acknowledge sources of information using in-text citations and references (e.g., APA style)	.33	.516
2 Paraphrase information from secondary sources	.83	.753
3 Revise an academic text	.83	.408
4 Edit an academic text	.83	.408
5 Summarise information from secondary sources	1.00	1.265
6 Write an outline of an academic text	1.00	.632
7 Draft an academic text	1.00	.632
8 Synthesise information from secondary sources	1.17	.753
9 Write thesis statement, topic sentences and supporting details	1.17	.753
10 Use appropriate transitions to connect ideas and information	1.17	.753
11 Use sources appropriately to support ideas	1.33	.816
12 Write in correct grammar	1.33	.516
13 Write in correct sentence structure	1.33	.516
14 Write in response to an assignment and stay on topic without repetition	1.50	.548
15 Use relevant reasons and examples to support a position or idea	1.50	.548
16 Use appropriate subject-specific vocabulary	1.50	.548
17 Write in response to an assignment and stay on topic without excessive wordiness	1.67	.516
18 Organise writing to convey main and supporting ideas	1.83	.408

*Note: *N* = 6

In the last section of the questionnaire, the DPA students and instructors were required to indicate whether the students need additional help in order to develop their academic writing skills aside from their English course(s) in UiTM. 83.6% of 110 students indicated that they needed additional help to develop their academic writing skills and 5.5 % of 110 students indicated otherwise. As for the instructors, five out of six responded to the question. All five indicated that their students needed additional help with their writing skills.

In the focus group interviews and key informant interviews, the DPA students and instructors were also asked the following questions with regard to additional help needed with regard to writing assignments.

Besides the English language course offered in UiTM this semester, do you need additional help with

regard to writing assignments using the English language? If yes, what additional help do you need?

Besides the English language course offered in UiTM this semester, do you think your students need additional help with regard to writing assignments using the English language? If yes, what additional help do you suggest?

Through the interviews, it was found that the additional help the students needed as perceived by the students and instructors were 1) language, specifically in grammar, spelling and vocabulary, 2) writing course or workshop as suggested by the instructors, 3) writing practice or exercise, 4) language to help them deliver the content, 5) writing in proper ways especially when using other scholars' ideas, and 6) using citations and references.

Difficulties in Writing

This section presents the answer to the following research question:

What are the writing difficulties of the DPA students?

The students and instructors were asked to rate how difficult it is for students to perform the writing tasks in order to complete their courses in the undergraduate programme. The DPA students and instructors judged all writing tasks above 2.00, which they perceived all the 18 writing tasks as difficult. The DPA students and instructors agreed on one task which is 'acknowledge sources of information using in-text citations and references (e.g., APA style)' as being one of the most difficult writing tasks.

DPA students and instructors were also asked whether students had difficulties in writing their assignments using the English language in the focus groups with students and key informant group interviews with instructors. The analyses presented here are based on the comments and feedback given by the respondents in the member check sessions. Thus, the analyses discussed in the following sub-headings are the results from four focus groups and two key informant group interviews on the academic writing needs of the students. The following questions were taken from the focus group with the DPA students and key informant interviews with the DPA instructors.

Based on your experience, did you find difficulties in completing the writing assignments using the English language? If yes, what were the difficulties?

Based on your observation, did your students find difficulties in completing the writing assignments using the English language? If yes, what were the difficulties?

Focus groups with the students and key informant group interviews with instructors confirmed the results from the questionnaires with regard to writing difficulties. The students had difficulties with four sub - categories of writing, namely content, organisation, language and documentation.

a. Writing Difficulties in Content

With regard to content, the students indicated difficulties with summarizing, paraphrasing and synthesising from secondary sources. These difficulties were mentioned in all four focus groups with the students. One student mentioned that he had difficulties in summarizing due to difficulty in finding the main ideas in a passage. The following statement was made by the student:

b. Writing Difficulties in Organisation

As for organisation, according to two instructors, their students had difficulties in completing their assignments due to unfamiliarity with answering questions in English and ways to write essays. This led to whole lifting from sources. The following quotes are the statements by the two instructors:

c. Writing Difficulties in Language

Difficulties in language were mentioned in all focus groups and key informant group interviews. The students stated language difficulties in sentence structure, spelling, grammar, specific words or vocabulary, pronunciation and translation.

As for the instructors, they identified language difficulties which included understanding subject -specific terms, grammar, spelling, unable to use their own words to explain their ideas, and unable to understand English words in textbooks. The following are some of their comments when asked what the writing difficulties of their students were:

d. Writing Difficulties in Documentation

Two students mentioned they had difficulty in quoting and two instructors mentioned their students had difficulty in using citations and references.

Apart from identifying writing difficulties through questionnaires and interviews, students' actual written work or essays were also analysed to identify writing difficulties.

What are the writing difficulties identified in the DPA students' actual written work?

Twenty-three tutorial essays were thoroughly checked with software called 'whitesmoke'. It is a software that provides grammar, spelling, punctuation and style checks. The software reported an incidence of repetitions of words or stems in the essays, which indicated difficulties with content, specifically redundancy or repetitions in expression. Language mistakes were detected in all 23 students' tutorial essays. The mistakes were on grammar, sentence structure, spellings and vocabulary. Figure 4.2 shows another example of an analysis on a student's essay using this software.

Apart from the students' tutorial essays, 17 students' marked essays were also analysed to identify writing difficulties encountered by the students. Writing difficulties in content and development were highlighted by the instructors. Though the instructors did not mention difficulties with regard to content in the key informant group interviews, they identified difficulties with content in the students' essays. The essays indicated difficulties in content, for example, the instructors who marked the students' essays gave comments such as 'low level of understanding' and 'points – not accurate'.

The needs analysis revealed a number of shortcomings and lacks the English courses for first-year students in relation to the identified needs of the students. It was therefore felt supplementary writing materials in the form of workshops should be provided. In doing so, it was hoped the shortcomings can be addressed, thereby increasing the relevance and effectiveness of the current course vis-à-vis the needs of the learners. In meeting these needs or in other words to solve the problems identified through the thorough needs analysis, design-based research was thought to be the best methodology to address the problem. The need for supplementary writing materials was also identified through the review of ELC courses and PAD courses for first-year students of Diploma in Public Administration in UiTM Sabah and the needs analysis conducted through various sources and methods. Through the analysis, it was found that there was a mismatch between the writing needs of DPA students and the course content of ELC courses. The ELC textbooks and supplementary online materials were prescribed and generic. The needs analysis found that the students needed practice on particular writing skills which were not provided in the ELC courses. There was also a need for subject-specific materials.

4.3. The Design And Development Of The Academic Writing Materials

In the preceding section, it is apparent then that needs analysis was indeed crucial in identifying the real writing needs of the DPA students. In the needs analysis stage of the study, data were gathered from multiple sources and methods. The academic writing problems or needs of the DPA students were able to be identified via these multiple sources and methods. These multiple methods and sources have provided useful data for the purpose of analysis. Using multiple methods and sources required a substantial amount of time, energy, discipline and commitment, but the outcome was definitely worth it. The section also highlighted the importance of employing triangulation of sources, methods and needs analysis approaches. The section showed that needs analysis did not stop at just identifying needs; data obtained from multiple sources and methods was triangulated to validate the data which leads to the credibility of the interpretations of the data. The identified academic writing needs then formed the basis of the designing and development of subject-specific academic writing materials in this study.

The researcher has adapted Wingate and Dreiss' (2009) method of designing and developing subject-specific writing materials. Permission was granted by Dr Wingate personally to the researcher during the researcher's attachment to King's College London. As in Wingate and Dreiss' study, the design and development of the materials were unpinned by constructivist, situated, and experiential learning theories. Discipline-specific writing instruction method was used. Different from Wingate and Dreiss' method, the writing materials in the present study included handouts to further assist the students in attempting the tasks in the writing materials. The researcher thought handouts were necessary considering the English level of the students.

Barnard and Zemach stated that "selection of appropriate language, responding to the needs and wishes of the students, paying attention to effective learning strategies; all these elements are vitally important when preparing ESP materials" (chapter in Tomlinson, 2003a: p315). Accordingly, the objectives, content and tasks in the writing materials were based on the identified writing needs in the needs analysis stage. The sequence of the components is shown in table 6 and table 7.

Table 6: Structure of TAWM One

LANGUAGE, CONTENT AND STRUCTURE IN ACADEMIC TEXTS
1. Problems with essay writing
2. The criteria for average and good essays in Public Administration course. What does a DPA lecturer expect?
3. Applying the criteria
4. Practising some skills
4.1 Shortening sentences
4.2 Use relevant reasons and examples to support an idea
4.3 Transition signals/signpost words
4.4 Grammar and sentence structure

Problems with essay writing

In this section, students were presented with the findings of difficulties faced by their peer group in writing essays in their programme. Examples of the writing difficulties were 'writing in correct grammar', 'writing in correct sentence structure', 'using relevant reasons for the assignments and give good examples', 'acknowledge sources of information using in-text citations and references (e.g., APA style)', 'synthesise information from secondary sources', 'write in response to an assignment and stay on topic without excessive wordiness', and 'write in response to an assignment and stay on topic without repetition in expression'. These findings were obtained from interviews with four groups of Diploma in Public Administration students in UiTM and questionnaires completed by the same groups. After having read the findings, the students were asked to reflect on their own difficulties in writing essays in their programme.

The criteria for average and good essays in Public Administration course.

What does a DPA lecturer expect?

After reflecting on their own difficulties in writing essays, the students were presented with samples of good and average students' essays which were analysed by a language instructor and commented by DPA instructors. Marks awarded by the DPA instructors were also included in the essays. From these essays, students were able to identify the criteria for the appropriate writing of essays in their DPA courses. In other words, students were given the opportunity to figure out the criteria of average and good essays by discussing in small groups the essays with reference to the analysis and comments given by the instructors.

There were four texts or essays in the academic writing materials for workshop one. Text 1a and 1b were examples of good essays with analysis and comments given by an English instructor and a DPA instructor with regard to content and structure, while Text 2 was an example of an average essay. For texts 1a, 1b and 2, the students were required to review the text and discuss the essays with reference to the analysis and comments given. After completing tasks 1a, 1b and 2, the next task (task 3) required students to compare the three texts and discuss the different marks awarded to the three texts or essays. Text 3 was an example of a student's essay with analysis and comments given by an English instructor with regard to language (grammar and sentence structure). The students were asked to discuss the essay with reference to the analysis given by an English instructor. Texts 1a, 1b, 2 and 3 are found on pages 2 -8 of the academic writing materials of workshop one.

Applying the criteria

After being exposed to the criteria of good and average essays, the students applied the criteria in commenting on the content, structure and language in text 4. Text 4 was an essay also written by a DPA student. After reading the essay, the students were asked to make comments on the content, structure and language of the essay. Next, they compared their comments with the instructors' analyses and comments in the answer keys provided.

Practising some skills

In the last section of the writing materials for workshop one, students practised some writing skills with the knowledge they have constructed in the earlier sections. They also referred to the handouts provided if they needed to. This section included topics, namely 'shortening sentences', 'use relevant reasons and examples to support an idea', 'transition signals/signpost words', 'grammar' and 'sentence structure'.

After the students completed the tasks, they checked their answers against the answer key provided. The students worked in small groups throughout the workshop.

Table 7: Structure of TAWM Two

ACKNOWLEDGE SOURCES AND INFORMATION USING IN-TEXT CITATIONS	
1.	Scenario
2.	Citing and summarising
3.	Synthesising from secondary sources
4.	Writing a reference list

Scenario

In this section, students were given a scenario of problems in citing in two essays written by students. The students discussed in groups the problems with citation in the essays. This section gave students opportunity to review and reflect on problems with citation done by students in their programme.

Citing and summarising

The students were given examples of correct ways of citing, as shown in a journal article in this section. They were first asked to identify sections in the article in which the writer acknowledged sources and information taken from other authors. Next, they highlighted or underlined several citations in the article. They were then asked to look at the citations they highlighted or underlined, identify the different ways the writer acknowledged sources and information from other authors. They then explained why they were written in different ways. Next, they came up with two reasons why a writer needs to acknowledge sources and information in his or her article or academic paper. Finally, in this section, they did a summary from the citations given and did quotations. This task encouraged students to discover the correct ways of citing on their own.

Synthesising from secondary sources

Students were given an example of a synthesis from secondary sources taken from an article where the writer combined the information he obtained from the journal articles and form the information into one continuous text in his own words. Next, the students read the extracts from two articles and discussed the synthesis of the extracts. Finally, they wrote their synthesis from the two articles given and cited the sources they used.

Writing a reference list

Students looked at the reference lists written by DPA students and discussed the comments given by the instructor. They then referred to the list of references in two articles and studied how the references were written. Finally, they identified mistakes in the references and corrected them and checked their answers.

Two paper-based writing materials were produced for workshops one and two respectively. The font was 11 Times Roman and used landscape mode as the page orientation. The researcher prepared the two writing materials and showed them to Dr Wingate, and made necessary changes to the presentation based on her suggestions. Later in the pilot study of the writing materials, the researcher asked the respondents to comment on the presentation of the materials. They were satisfied with the layout, type size and visuals of the materials, and no changes were necessary. They also liked the idea of using symbols in the materials; they commented that these made the materials even more interesting.

The academic writing materials were presented in two separate writing workshops. Each writing workshop lasted for around two hours. Writing workshop one included three components: language, content and structure in academic texts. While writing workshop two was on citing, summarising, synthesising and writing a reference list. The designing, development, implementation and evaluation of the academic writing materials were carried out in two cycles. The first cycle involved pilot studies or prototyping ph ase and the second cycle was the actual use of the academic writing materials or the implementation stage. The iterative cycles are presented in the next chapter which forms the third phase of DBR. Four pilot studies were carried out which comprised two initial piloting by a small group of three DPA students and two final piloting by two

DPA instructors. These DPA students and instructors were similar to the population under study as they were all from the first-year DPA programme; hence, it was not necessary to involve the whole population. Necessary changes were made to the writing materials based on the evaluation of the pilot study.

The revised writing materials were then used in two separate workshops. The researcher conducted the two workshops separately with 22 and 21 students respectively. In the workshops, the students worked on the materials in small groups of three. Each workshop lasted for about two hours. At the beginning of the workshop, the researcher briefed the participants on the materials, and they worked on the materials in their groups with minimum guidance from the researcher.

4.4 The Evaluation of The Usefulness of the Academic Writing Materials (TAWM)

This section reports the results and findings of the evaluation of the usefulness of the Academic Writing Materials (TAWM) and the writing workshops. It answers the following research question:

How useful are the DBR-based academic writing materials and writing workshops (the intervention)?

According to Tomlinson (2003c), materials evaluation "is a procedure that involves measuring the value (or potential value) of a set of learning materials" (p. 15). He listed several aspects of the materials measured in the evaluation process. Among the aspects in the list were the learners' and teachers' perceptions of the value of the materials, which were evaluated in the present study.

Of the 110 students involved in the needs analysis stage, twenty-two of them were involved in academic writing workshop one and twenty-one from the same group participated in workshop two. The students who participated in the two workshops evaluated the usefulness of the academic writing materials and workshops. As for the instructors, three DPA instructors evaluated the writing materials. They were among the six DPA instructors who completed the questionnaire in the needs analysis stage of the study. These instructors taught PAD courses to the students under study.

Apart from evaluating the materials, the participants in this study also evaluated the quality of the workshops, which were the media used in presenting the materials. Hence, this chapter presents the data analysis of the evaluation of the usefulness of the academic writing materials and the quality of the writing workshops. Even though the writing materials in this study were piloted and evaluated by the participants in the pilot study, they were evaluated again after use in the workshops. Barnard and Zemach (as cited in Tomlinson, 2003a) maintained that evaluating piloted materials after use was necessary "because the learning environment is continually changing" (p. 321).

The evaluation was carried out by (1) a questionnaire delivered to participants immediately after participating in the workshops, (2) a questionnaire delivered to DPA instructors after going through the workshop materials, (3) analysis of focus groups, and (4) analysis of audio-recorded group discussions by participants during the workshops. The researcher used three different methods and two different sources in order to cross-reference the results obtained and arrive at weighted results.

a. Usefulness of the Academic Writing Materials and Workshop One

In the questionnaire for the academic writing materials in workshop one, the students were required to rate the usefulness of the different sections of the academic writing materials one and the quality of the workshop. The rankings are from 1 ("not at all useful") to 5 ("very useful"). The DPA students rated the usefulness of the four sections in workshop one above 4.0 (useful). The average mean for the question 'How useful do you think the materials are for helping you write your assignments?' was 4.73.

The students were also asked to evaluate the whole workshop one from 1 ("strongly disagree") to 5 ("strongly agree"). The students rated 4.59 and 4.41 for two aspects of the workshop 'lecturer's explanation was useful' and 'working in groups was useful', suggesting that they regarded the two aspects useful. Both students and instructors agreed on all the criteria in the materials as being useful

b. Usefulness of the Academic Writing Materials and Workshop Two

Like workshop one, the students were required to rate the usefulness of the different sections of the academic writing materials two and the quality of workshop two. Through questionnaire, the students regarded the three aspects of the materials in workshop two useful.

The average mean for the question, "How useful do you think the materials are for helping you write your assignments?" was 4.71, which suggesting that the students found the materials useful in helping them write their assignments.

In the questionnaire for the academic writing materials in workshop two, three instructors evaluated the

usefulness of the different sections of the materials. The average mean for question one, 'How useful do you think the materials are for helping your students write their assignments?', was 5.0 ('very useful').

The respondents in the two focus groups mentioned that they have benefited from the two workshops in term of content, documentation, language and organisation. Some of them stated that they were able to find their own weaknesses in the students' sample essays in the workshops writing materials and learned from the sample essays.

5. Conclusion

The need for supplementary writing materials was identified through the review of ELC courses and PAD courses for first-year students of Diploma in Public Administration in UiTM Sabah branch and the needs analysis conducted through various sources and methods. Through the analysis, it was found that there was a mismatch between the writing needs of DPA students and the course content of ELC courses. The ELC textbooks and supplementary online materials were prescribed and generic. The needs analysis found t hat the students needed practice on particular writing skills which were not provided in the ELC courses. There was also a need for subject-specific materials and materials which promote constructivist, experiential and situated learning.

Through the needs analysis stage, the needs of the students were explored. These identified needs were used to decide on the objectives and content of the writing materials. The content comprised language, skills, authentic texts and tasks. Apart from the identified needs with regard to content, in the needs analysis, both students and their instructors suggested writing practice specifically through writing course or workshop.

Many studies (e.g., Amiel & Reeves, 2008; Class & Schneider, 2014; Foster & Shah, 2015; Holmberg, 2014; Mckay & Simpson, 2013; Richey et al., 2004) stressed the importance of a collaborative partnership among practitioners and researchers, given the nature of DBR being firmly grounded in real-world settings. In their studies on 18 projects, Ormel et al. (2012) found that close collaboration was prominent in all the projects. This shows how important it is for a collaborative partnership between various stakeholders, particularly practitioners and researchers, in contributing their expertise, for example, to design the intervention.

Being aware of the importance of collaborative partnership in a design-based research, the present study involved the researcher, practitioners, materials developer and students. The researcher worked closely with these stakeholders from the initial identifying of problems in the field to designing and developing an intervention (e.g., the Academic Writing Materials), implementation, and finally, the evaluation of the intervention.

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POLITEKNIK KOTA KINABALU

Kit Pembelajaran ReTimer sebagai Media Pembelajaran Teknikal bagi Kursus Programmable Logic Controller (PLC)

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Abstract

Kit pembelajaran ReTimer ini dibangunkan dengan tujuan utama untuk memberi pendedahan dan juga meningkatkan pemahaman pelajar sekali gus dapat mencapai hasil pembelajaran yang telah ditetapkan dalam kursus DEJ40033 Programmable Logic Controller (PLC) & Automation yang melibatkan keupayaan untuk membina, mengesan kerosakan dan membuat selenggaraan terdawai keras *(hardwire)* dalam sistem PLC. Kit ini dilengkapi dengan geganti *double pole double throw (DPDT), geganti four pole double throw (4PDT)* dan pemasa. Kit pembelajaran ini telah mula digunakan oleh pelajar Jabatan Kejuruteraan Elektrik (JKE) pada tahun 2022. Terdapat dua kaedah untuk menentukan tahap keberkesanan penggunaan kit pembelajaran ReTimer iaitu melalui edaran soalan pra & pasca dan edaran soal selidik kepada pelajar. Soalan pra dan pasca telah diberikan kepada 28 orang pelajar JKE, Politeknik Tuanku Syed Sirajuddin (PTSS) untuk mengukur pencapaian hasil pembelajaran sebelum dan selepas menggunakan kit pembelajaran ini. Hasil analisa mendapati min markah pelajar telah meningkat dari 43% (pra) kepada 88% (pasca). Hasil daripada soal selidik pula mendapati bahawa min bagi ketiga-tiga pembolehubah adalah tinggi iaitu minat (min=4.86), kesesuaian (min=4.78) dan kefahaman (min=4.86). Min keseluruhan adalah 4.83. Kesimpulannya, keberkesanan penggunaan Kit Pembelajaran ReTimer dalam kursus DEJ40033 adalah tinggi dalam meningkatkan pemahaman pelajar bagi mencapai hasil pembelajaran teknikal yang ditetapkan.

Keywords: - Geganti, pemasa, hardwire, pembelajaran teknikal

1. Pengenalan

Kursus DEJ40033 PLC & Automation merupakan salah satu kursus yang ditawarkan di JKE, PTSS. Salah satu amali yang mesti dilaksanakan adalah melibatkan topik 2 iaitu *logical sensor* and *actuator*. Amali yang dilaksanakan dengan menggunakan kit pembelajaran bukan sahaja dapat meningkatkan kefahaman dan kemahiran pelajar dalam pembelajaran praktikal, malahan ia juga dapat menarik minat pelajar menjalankan aktiviti amali. Hasilnya penambahbaikan kualiti pengajaran dan pembelajaran (PdP) dapat ditingkatkan selaras dengan Pelan Pembangunan Pendidikan Malaysia (PPPM) 2015 -2025 (Pendidikan Tinggi), lonjakan ke-4 yang memberi penekanan dalam melahirkan graduan Pendidikan dan Latihan Teknikal dan Vokasional (TVET) yang berkualiti. Seiring itu, pembangunan kit pembelajaran yang sesuai adalah perlu dalam memastikan ianya memenuhi kehendak pendidikan dan industri masa kini.

Kit pembelajaran ReTimer merupakan kombinasi geganti dan pemasa untuk penyambungan litar secara *hardwire*/ konvensional. Terdapat dua jenis geganti yang digunakan iaitu DPDT dan 4PDT . Kit pembelajaran ini dibangunkan untuk kemudahan pelajar dalam usaha memahami konsep pensuisan menggunakan geganti, cara membuat pendawaian *Relay Logic* serta kawalan DC *(Direct Current)* motor dengan menggunakan pemasa.

1.1 Pernyataan masalah

Idea untuk membangunkan kit pembelajaran ReTimer adalah berdasarkan faktor kesukaran melaksanakan amali, penggiliran peralatan dan kedudukan peralatan yang sukar dipindahkan yang boleh mempengaruhi hasil pembelajaran praktikal bagi kursus DEJ40033 PLC & Automation, topik 2 iaitu *logical sensor* and *actuator*. Sebelum kit ini dibangunkan, aktiviti pembelajaran teknikal yang melibatkan amali berkaitan *Relay Logic* menggunakan pemasa terpaksa dilaksanakan di bengkel Jabatan Kejuruteraan Mekanikal (JKM). Hal ini disebabkan ketiadaan peralatan tersebut untuk dilaksanakan di JKE. Selain itu, bilangan peralatan yang terhad memerlukan pengiliran peralatan semasa amali dilaksanakan di JKM. Peralatan yang sedia dipasang pada *workbench* juga menyukarkan aktiviti pinjaman peralatan.

1.2 Objektif kajian

Kit pembelajaran ReTimer dibangunkan bagi mencapai beberapa objektif iaitu:

i. Melaksanakan pendawaian ReTimer secara *hardwire*/ konvensional bagi meningkatkan hasil pembelajaran praktikal.
ii. Menghapuskan penggiliran penggunaan peralatan bagi aktiviti pendawaian *hardwire* pada setiap komponen *Relay Logic*.
iii. Mewujudkan peralatan boleh pindah bagi memudahkan pengujian masalah dalam litar *Relay Logic* dilaksanakan di mana-mana makmal/ bengkel.

1.3 Persoalan kajian

Di antara beberapa persoalan untuk mengukur tahap keberkesanan penggunaan kit pembelajaran ReTimer adalah:

i. Adakah penggunaan kit pembelajaran ReTimer dapat mempengaruhi minat pelajar terhadap pembelajaran praktikal?
ii. Adakah kit pembelajaran ReTimer sesuai digunakan bagi aktiviti pendawaian *hardwire* pada setiap komponen *Relay Logic*?
iii. Adakah kit pembelajaran ReTimer dapat meningkatkan kefahaman pelajar terhadap pembelajaran praktikal?

2. Kajian Literatur

Kits pembelajaran merupakan peralatan yang sangat penting dalam melancarkan pelaksanaan proses pengajaran dan pembelajaran suatu kursus. Melalui kit pembelajaran, ianya dapat memudahkan pelaksanaan amali yang menjurus kepada hasil pembelajaran yang tepat. Banyak kajian terdahulu membincangkan tentang pembangunan dan penggunaan kit pembelajaran dalam pembelajaran teknikal. Terdapat juga kajian berkaitan keberkesanan kit pembelajaran dalam PdP. Antaranyanya seperti dalam jadual 1.

Jadual 1: Kajian literatur terdahulu

Bil	Pengkaji/ pembangun kit pembelajaran	Hasil Kajian/ dapatan
1	Kamble et al.,(2023)	Pemasa dan geganti adalah komponen asas dalam pengaturcaraan PLC. Pemasa membenarkan kawalan berasaskan masa bagi proses, membolehkan tindakan ditangguhkan atau dilaksanakan untuk tempoh tertentu, manakala geganti berfungsi sebagai suis dikendalikan oleh kuasa elektrik yang mengawal pelbagai peranti. Memahami komponen ini adalah penting untuk pelajar, kerana ia digunakan secara meluas dalam automasi industri. Penyelidikan menunjukkan bahawa memasukkan pemasa dan geganti ke dalam kit latihan meningkatkan pemahaman pelajar tentang logik kawalan dan proses automasi.
2	Pratama, Azman, Zakaria, & Khairudin (2022)	Menguji kesan kit PLC pada pencapaian pelajar vokasional dalam kursus kawalan motor elektrik. Implikasi kajian ini telah menghasilkan satu bahan bantu mengajar yang boleh dijadikan templat oleh guru untuk supaya pelajar bermotivasi untuk berinovasi dalam pembelajaran.
3	Sivapriyan, Ajay, & Ashwath Koorse (2020)	Membangunkan *low-cost power converter learning kit* yang membantu pelajar mempelajari dan mengawal semua jenis litar penukar kuasa asas seperti pencincang, penyongsang, pengawal voltan AC dan penerus. Keberkesanan penggunaan kit tersebut dinilai melalui maklum balas daripada pelajar.

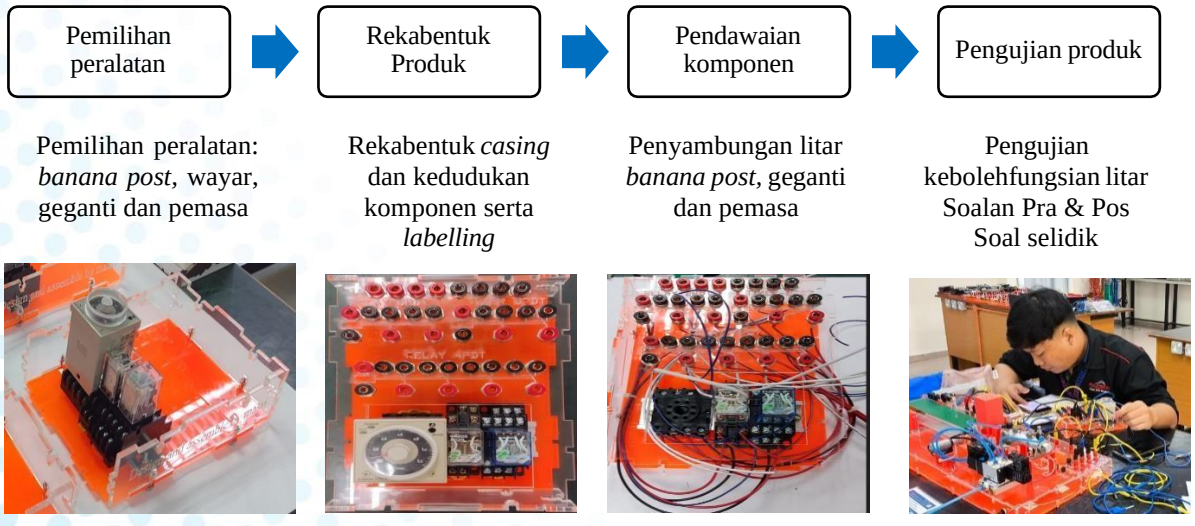
Jadual 1: Kajian literatur terdahulu

Bil	Pengkaji/ pembangun kit pembelajaran	Hasil Kajian/ dapatan
4	Mahmood, Ali, & Abd-Alhameed (2020)	Menggabungkan perkakasan dan perisian iaitu PLC dan antara muka mesin manusia (HMI) untuk memperkenalkan pelajar kejuruteraan kepada mekanisme pengendalian secara eksperimen. Ia melibatkan pelajar dalam memilih tetapan dan menaik taraf geganti perlindungan masa minimum tentu songsang (IDMT) untuk arus lebih, voltan lampau, voltan terkurang dan arus pembezaan. Hasilnya, pelajar dapat menguasai (atau hampir menguasai) bidang geganti pelindung dan pemahaman yang lebih mendalam tentang perkara yang terlibat dalam peningkatan geganti.
5	Dewi, Yanto, & Hastuti (2020)	Pembangunan kit pembelajaran *Power Electronics* bagi pelajar Kejuruteraan Elektrik. Kajian mendapati pembangunan kit pembelajaran tersebut adalah sah dalam aspek reka bentuk, media/peralatan makmal, dan bahan.
6	Artiyasa, Destria, & Desima (2020)	Membangunkan pelajaran teknologi PLC supaya lebih mudah diamalkan. Pelajar diberi ujian pra, diberi latihan mengikut modul dan dapat melakukan pendawaian.
7	Kob et al., (2019)	Mengkaji tentang keberkesanan penggunaan kit pembelajaran oleh pelajar dalam meningkatkan prestasi pelajar terhadap tajuk Reka Bentuk Mekanikal. Pembelajaran yang menggunakan kit dapat meningkatkan prestasi pelajar terutamanya dalam kursus teknikal.

Pembangunan kit pembelajaran merupakan satu aspek yang penting dalam memberikan kefahaman kepada pelajar serta meningkatkan keberkesanan dalam pembelajaran teknikal.

3. Metodologi

Kit pembelajaran ReTimer adalah berasaskan kepada komponen/ perkakasan mekanikal sahaja. Pembangunan kit terbahagi kepada empat (4) fasa iaitu pemilihan peralatan, rekabentuk produk, pendawaian komponen dan pengujian produk (Rajah 1).



Rajah 1: Langkah-langkah Pembangunan Kit Pembelajaran ReTimer

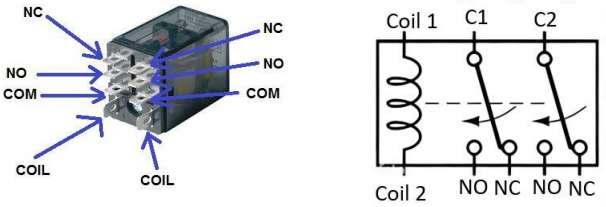
3.1 Pemilihan peralatan

Kit yang dibangunkan terdiri daripada dua (2) jenis geganti iaitu DPDT, 4PDT dan pemasa. Pemilihan peralatan berjenama Omron dipilih berdasarkan harga, ketahanan dan juga kesesuaian. Banana post digunakan untuk memudahkan pelajar membuat penyambungan litar dan menjimatkan masa. Fungsi bagi setiap komponen utama adalah:

i) Geganti DPDT

Geganti merupakan suis yang dikawal oleh litar elektrik. Ia terdiri daripada urutan input dan isyarat kawalan jika dipasang pada litar. Ianya beroperasi dengan mendapatkan isyarat masukan daripada bekalan

kuasa input yang disambungkan untuk berfungsi seperti suis biasa. Geganti DPDT adalah peranti elektromagnet yang sering digunakan dalam motor elektrik bagi menukar arah pusingan motor. Terdapat dua input dan dua output. Ia juga mengandungi dua terminal gegelung, dua *independent common* C1 dan C2, dan 2 terminal *normally open* (NO), dan 2 terminal *normally closed* (NC). Ia menyambungkan dua sambungan yang berbeza dan dapat mengawal gegelung dengan isyarat kawalan tunggal. Jika tiada *bias* pada gegelung, geganti akan berada dalam keadaan *idle*, di mana terminal *common* sentiasa disambungkan ke terminal NC. Apabila *bias* DC wujud pada gegelung, ia memberi tenaga secara magnetik dan menarik tuas terminal *common*, sekaligus menyambungkan terminal *common* ke terminal NO.

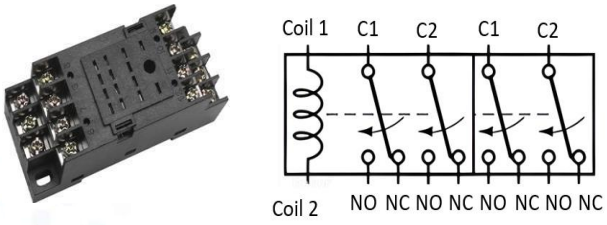


(a) (b)

Rajah 2: Geganti DPDT (a) Physical (b) Schematic

ii) Geganti 4PDT

Geganti 4PDT merupakan geganti *four-pole double-throw* yang mempunyai 12 terminal pensuisan. Terdapat 4 terminal masukan, 4 terminal keluaran, 4 terminal NC dan 4 terminal NO. Geganti ini adalah sejenis suis elektrik yang mempunyai 4 pasang kedudukan pensuisan. Setiap pasangan kedudukan pensuisan beroperasi secara bebas di mana ianya membenarkan geganti mengawal empat litar berasingan. Dalam kedudukan pertama setiap pasangan, suis menyambungkan terminal masukan ke terminal keluaran pertama. Dalam kedudukan kedua setiap pasangan, suis menghubungkan terminal masukan ke terminal output kedua. Kedudukan ketiga dan keempat setiap pasangan juga akan beroperasi sepertimana kedudkan pertama setiap pasangan. Suis dikendalikan dengan menggunakan arus ke input kawalan, yang mengaktifkan elektromagnet atau mekanisme pensuisan lain untuk menukar kedudukan suis.



(a) (b)

Rajah 3: Geganti 4PDT (a) Physical (b) Schematic

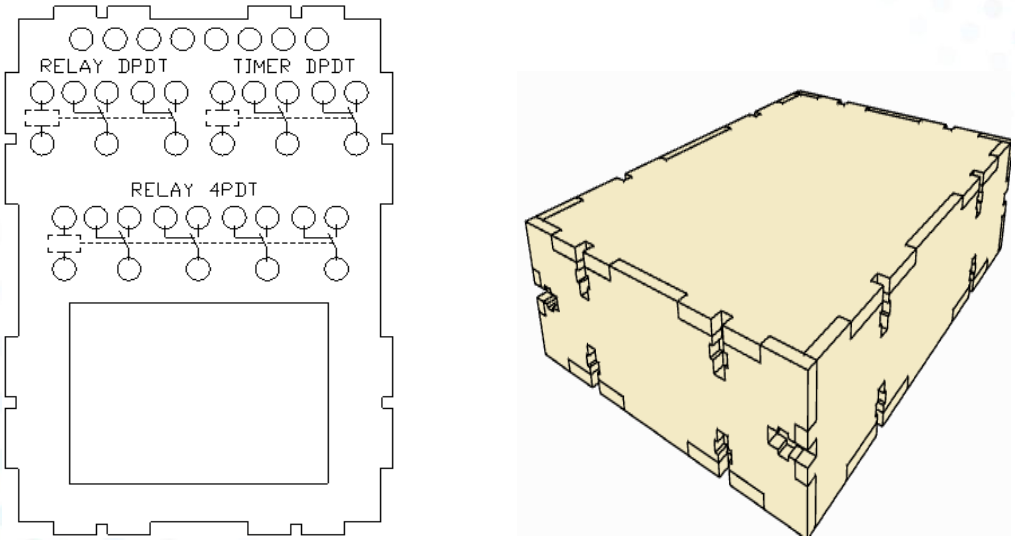
iii) Geganti pemasa

Geganti pemasa ialah satu bentuk kawalan berasaskan masa yang ringkas dan membenarkan pengguna membuka atau menutup kenalan berdasarkan fungsi pemasaan yang ditentukan. Prinsip kerja pemasa adalah menggunakan keelektromagnetan. Satu gegelung geganti sentiasa dihidupkan, manakala satu lagi boleh dimatikan dan dihidupkan dengan isyarat elektrik yang dihantar melaluinya daripada peranti kawalan. Gegelung "hidup" menerima kuasa sepanjang masa, menjadikannya bersedia untuk diaktifkan dengan segera.

Rajah 4: Geganti pemasa

3.2 Rekabentuk produk

Rekabentuk utama *casing* untuk kit ini adalah berbentuk segi empat dan menggunakan bahan plastik Acrylic. Rajah 5 menunjukkan rekabentuk *casing top panel* yang telah dilakar dengan menggunakan perisian nanoCAD. Kemudian, hasil lakaran digunakan untuk memotong *casing* dengan menggunakan mesin *CNC laser cutter*.



(a) (b)

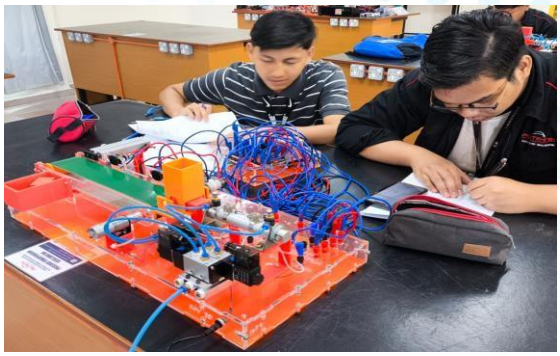
Rajah 5: Kit pembelajaran ReTimer (a) *Casing* top panel (b) *Casing* luar

3.3 Pendawaian komponen

Pendawaian daripada geganti dan pemasa telah disambung ke banana post.

3.4 Pengujian

Setelah Kit Pembelajaran ReTimer siap dibangunkan mengikut spesifikasi seperti rajah 6, ujian penggunaan dilakukan bagi memastikan kit ini berfungsi dengan sempurna dan selamat digunakan. Pelajar perlu memahami simbol relay dan timer untuk membuat pendawaian berdasarkan lembaran amali.



Rajah 6. Pengujian kit Pembelajaran ReTimer

Soalan pra & pasca telah diedarkan kepada 28 pelajar JKE bagi mengukur pencapaian hasil pembelajaran sebelum dan selepas menggunakan Kit Pembelajaran ReTimer. Soal selidik juga telah diedarkan kepada 26 pelajar bagi mengetahui tahap keberkesanan pembelajaran teknikal menggunakan Kit Pembelajaran ReTimer. Borang soal selidik menggunakan skala likert skala 1 hingga 5 yang mewakili amat tidak setuju, tidak setuju, sederhana setuju, setuju, dan amat setuju. Skor dikira adalah berdasarkan kepada interpretasi sko r min yang dinyatakan dalam jadual 1.

Jadual 1: Interpretasi skor min.

Skor min	Tahap
1.00 – 2.33	Rendah
2.34 – 3.67	Sederhana
3.68 – 5.00	Tinggi

Sumber: Pallant (2005)

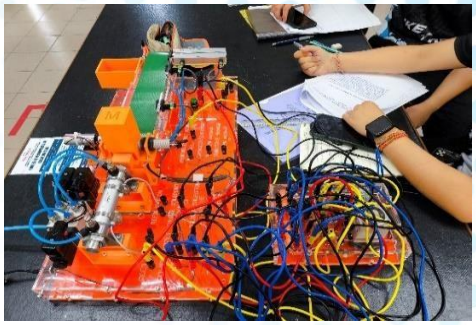
4. Dapatan dan perbincangan

Kit pembelajaran ReTimer telah Berjaya dihasilkan dengan gabungan banana post, geganti dan pemasa.

Rajah 6. Kit Pembelajaran ReTimer

Dengan adanya kit ini berserta dengan lembaran kertas amali yang dibangunkan, aktiviti PdP dilaksanakan di JKE. Soalan pra dan pasca telah diberi kepada 28 orang pelajar untuk menentukan pencapaian pelajar selepas menggunakan Kit pembelajaran ReTimer yang digabungkan dengan conveyor belt trainer seperti rajah 7. Hasil analisa keputusan markah pelajar mendapati, terdapat peningkatan peratusan min pra ke pasca iaitu sebanyak 43% kepada 88%.

(a)



(b)

Rajah 7: Pelaksanaan amali menggunakan (a) peralatan di JKM (b) Kit Pembelajaran ReTimer di JKE

Analisis min pra dan pasca telah dijalankan terhadap tiga dimensi utama iaitu minat, kesesuaian dan kefahaman pelajar mendapati bahawa setiap item pembolehubah pra memperolehi skor min di bawah 4.00, manakala skor min pasca adalah melebihi 4.00 (Jadual 2). Skor tahap tinggi pasca ini menunjukkan bahawa ketiga-tiga dimensi menyumbang kepada keberkesanan penggunaaan kit pembelajaran ReTimer dalam pembelajaran teknikal.

Jadual 2: Analisis min bagi dimensi minat, kesesuaian dan kefahaman

Dimensi	**Item pembolehubah**	**Min**	
		Pra	**Pasca**
Minat	Seronok menggunakan kit pembelajaran ReTimer.	2.92	4.85
	Memberi semangat untuk memahami *relay* dan *timer*.	2.92	4.92
	Proses PdP ini menarik minat.	3.19	4.81
	Memudahkan proses pembelajaran amali.	3.19	4.88
Kesesuaian	Tertarik dengan rekabentuk *ReTimer Trainer*.	2.77	4.85
	Berminat dengan *ReTimer Trainer* kerana ianya kreatif.	3.08	4.77
	Menyediakan kaedah pemasangan litar yang mudah dan teratur.	3.35	4.65
	Tidak terdapat bahagian/komponen yang boleh membahayakan pengguna.	3.38	4.85
Kefahaman	Melatih untuk memahami relay dan timer dengan lebih baik.	3.15	4.85
	Melatih untuk pendawaian menggunakan *relay dan timer*.	3.27	4.88
	Memberi peluang untuk melihat hasil sambungan litar yang dibina dengan aplikasi conveyor belt.	3.27	4.81
	Memahami cara relay dan timer berfungsi.	3.00	4.81
	Berkeyakinan untuk mencadangkan penggunaan kit ini kepada pelajar lain.	3.00	4.96

Berdasarkan Jadual 3, terdapat 3 item untuk pembolehubah keberkesanan penggunaaan kit pembelajaran ReTimer. Min keseluruhan yang diperolehi pra adalah tahap sederhana berbanding pasca iaitu tahap tinggi (4.83). Ini menunjukkan pelajar lebih berminat mempelajari PLC menggunakan Kit pembelajran Retimer. Selain itu, pelajar juga mendapati kit ini adalah sesuai dan dapat meningkatkan kefahaman pelajar dalam memahami fungsi relay dan timer.

Jadual 3: Analisis min keseluruhan bagi pembolehubah keberkesanan penggunaaan kit pembelajaran ReTimer

Pembolehubah Keberkesanan Penggunaaan	**Pra**		**Pasca**	
	Min	**Tahap**	**Min**	**Tahap**
Minat pelajar	2.69	Sederhana	4.86	Tinggi
Kesesuaian kit pembelajaran	2.69	Sederhana	4.78	Tinggi
Kefahaman pelajar	2.77	Sederhana	4.86	Tinggi
Jumlah min keseluruhan	2.42	Sederhana	4.83	Tinggi

5. Kesimpulan

Pembangunan kit pembelajaran ReTimer adalah praktikal dan sesuai bagi meningkatkan hasil pembelajaran teknikal bagi Kursus PLC & Automation. Pemasangan pendawaian secara *hardwire*/ konvensional oleh pelajar dengan menggunakan kit ini dapat memberi pendedahan kepada mereka tentang

Relay logic yang dikaitkan dengan asas *Relay Ladder Logic* (RLL) dalam PLC. Dengan terhasilnya kit ini juga, masalah penggiliran penggunaan peralatan bagi aktiviti pendawaian Relay logic tidak lagi menjadi isu di JKE, PTSS. Hasil pembangunan kit yang bersaiz kecil membolehkan pindahan peralatan sekaligus memudahkan pengujian masalah dalam litar *Relay Logic* dilaksanakan di mana-mana makmal/ bengkel.

Penghargaan

Penulis ingin merakamkan setinggi-tinggi penghargaan kepada Politeknik Tuanku Syed sirajuddin dalam menyokong kajian dan membiayai pembangunan Kit Pembelajaran ReTimer.

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POLITEKNIK KOTA KINABALU

The Impact of Training the Trainers (TTT) Programs on Enhancing Commitment to Teach Digital Entrepreneurship Among Educators: Analyzing Readiness and Effectiveness

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Abstract

In today's rapidly evolving digital landscape, integrating digital entrepreneurship into education is crucial for equipping students with essential skills for the modern economy. This research investigates the impact of Training the Trainers (TTT) programs on educators' readiness to teach digital entrepreneurship, conducted at Politeknik Merlimau, Malacca, by a certified trainer from the Malaysia Digital Economy Corporation (MDEC). This research focuses on 32 lecturers from Politeknik Merlimau who participated in TTT programs specifically designed to prepare them for this vital teaching role. The study employed a quantitative methodology, using correlation analysis to assess the relationship between the effectiveness of the TTT programs and educators' preparedness to deliver entrepreneurship courses. The findings reveal a strong positive correlation ($r = 0.772$, $p < 0.01$) between the perceived effectiveness of the TTT programs and educators' readiness to teach. This indicates that more effective training significantly enhances educators' readiness. The results align with the literature, which underscores the importance of practical, hands-on training in bridging the gap between theory and practice, especially in the context of digital entrepreneurship. The discussion highlights that while digital entrepreneurship education increasingly focuses on practical application and hands-on experience, the success of such programs hinges on the educators' ability to translate digital business concepts into effective teaching. The study confirms that TTT programs, by providing necessary tools and strategies, play a pivotal role in enhancing educators' skills and readiness. This research contributes valuable insights into how well-designed training programs can support educators in delivering high-quality digital entrepreneurship education. Future research should further explore the effectiveness of these programs across different educational settings and contexts.

Keywords: - Digital Entrepreneurship, Teaching Readiness, Training the Trainers.

1. Introduction

In today's fast-changing digital landscape, incorporating digital entrepreneurship into education is essential to prepare students with the skills needed for the modern economy. The success of digital entrepreneurship courses, however, depends not only on curriculum but also on the readiness and commitment of educators to teach these subjects effectively. This is where *Training the Trainers (TTT)* programs become crucial (Carayannis & Campbell, 2019). TTT programs equip educators with the necessary tools and strategies to bridge the gap between theory and practice, focusing on both entrepreneurial skills and technology. As the digital era opens more opportunities for entrepreneurship, lecturers must actively embrace these changes to better teach entrepreneurship courses (Rahmi & Cerya, 2020). The quality of education is shaped not just by what students learn, but how they are taught, a view shared by both academic and managerial staff (Longanecker & Blanco, 2003). While academics often focus on resources like reputation and publications, there is increasing recognition of the need for practical, hands-on learning, especially in digital entrepreneurship (Nguyen & Nguyen, 2020). Ensuring quality education is also vital for economic and social development. Key strategies for improving education include providing humanizing education, empowering B40 youth, supporting vocational training, and offering life skills training. Additionally, educators and university professionals need training to foster positive learning environments (Muhibbullah, Mamun, & Afroz, 2021). Entrepreneurship courses have unique demands, expecting students to not just learn theory but also develop entrepreneurial traits and take-action. To meet these demands, tailored programs that emphasize doing, rather than just knowing, are critical (Rahmi & Cerya, 2020). Innovative pedagogical approaches that incorporate Information and Communication Technology (ICT) can significantly improve the efficiency and productivity of teaching. The development and application of various digital tools enable educators to better manage their professional activities during class, making the learning experience more engaging and effective (Wardah Mustafa Din et al., 2020).

The increasing focus on digital entrepreneurship education reflects the global shift towards integrating technology into business practices. This shift is particularly evident in Industry 4.0, where digital platforms and online business models dominate the landscape. Educators must be equipped to teach entrepreneurship in this context, and one effective approach is through *Training the Trainers (TTT)* programs, which are designed to enhance educators' skills and readiness in teaching digital entrepreneurship (Carayannis & Campbell, 2019). Entrepreneurship education has evolved with the advancement of digital technologies, with courses increasingly focusing on digital platforms as a medium for business. In this regard, entrepreneurship courses aim not only to teach theory but also to develop students' entrepreneurial skills through hands-on experience (Rahmi & Cerya, 2020). However, the success of these courses is largely dependent on the educators' ability to effectively translate digital business concepts into practical lessons. Educators, therefore, require training that goes beyond theoretical knowledge, enabling them to guide students through the digital entrepreneurship process.

Therefore, this research examines the effectiveness of TTT programs in improving educators' commitment to teaching digital entrepreneurship and their readiness to deliver these courses. The TTT programs was held in Politeknik Merlimau, Malacca and conducted by certified digital entrepreneurship trainer from Malaysia Digital Economy Corporation (MDEC). By analyzing these programs, this study seeks to understand how well educators can foster entrepreneurial skills and readiness to integrate digital business concepts into their teaching.

2. Literature Review

2.1 Teacher Training and Online Business Skills

The quality of entrepreneurship education is not solely defined by the content delivered but also by the methods used to teach it (Longanecker & Blanco, 2003). Educators must be well-prepared to deliver practical, hands-on learning experiences that reflect the current digital business environment. This approach helps bridge the gap between theory and practice, ensuring that students can apply what they learn in real -world contexts (Nguyen & Nguyen, 2020). One approach to bridging this gap is through specialized workshops that focus on online business skills. Nurhayati, (2020) highlights how online business workshops have proven beneficial in improving teachers' entrepreneurial skills. These workshops equip educators with practical knowledge of online business, enabling them to create and manage online shops and teach these skills to students. Before participating in these workshops, many teachers taught online business based solely on limited knowledge or theory. However, after attending, they were able to understand the process of setting up and managing online businesses, enhancing their teaching capabilities. Nurhayati, (2020), further emphasizes that workshops like these not only help teachers develop a deeper understanding of digital entrepreneurship but also provide them with hands-on experience. This directly translates into their teaching, as teachers can now guide students through the process of creating online stores and running digital marketing campaigns. As a result, the quality of entrepreneurship education improves, aligning with the goals of Industry 4.0, where digital skills are essential for success. This aligns with the study by Anis, (2024) that discusses the need for educators to adapt to digital learning by developing technological competencies and undergoing pedagogical shifts. It highlights challenges such as mastering various digital tools, facilitating virtual collaboration, and incorporating innovative teaching methods.

2.2 Enhancing Quality of Entrepreneurial Education as a Teaching Readiness

The impact of training programs on the quality of education cannot be understated. According to Muhibbullah et al. (2021), ensuring quality education is essential for sustainable economic and social development. This includes providing educators with the necessary tools and skills to teach effectively in a digital environment. This is supported by Yu et al. (2022), in their research among Taiwan's Universities that found, in the teaching process of Digital Entrepreneurship Education (DEE), teachers and students often engage in a collaborative, hands-on learning experience, growing through mutual interaction. This dynamic not only highlights the significance of DEE for educators but also strengthens their commitment to teaching these courses. The more enthusiasm teachers bring to their instruction and the more they motivate students to participate in digital entrepreneurship activities, the more likely students are to embrace entrepreneurship.

Training programs and online business workshops address this by equipping teachers with both theoretical knowledge and practical skills. This dual approach enables educators to improve their teaching methods and helps students transition from learning entrepreneurship in theory to actively participating in it through practical application (Rahmi & Cerya, 2020). Moreover, the *Training the Trainers (TTT)* model is critical in bridging the gap between educators' existing knowledge and the rapidly evolving demands of digital entrepreneurship. Educators who undergo TTT programs become better prepared to teach digital entrepreneurship by aligning their teaching practices with current digital business trends. These programs

provide educators with the strategies and tools necessary to deliver a comprehensive entrepreneurship education, focusing on digital competencies and practical business skills. Moreover, the studies by Banha et al. (2022) suggest that to align with the EU's policy recommendations on key competencies, including entrepreneurship, educators require training that involves hands-on experiences and tools relevant to digital business practices. This aligns with the idea that teacher training in entrepreneurship education should include both knowledge of current business trends and practical application methods.

Training programs like TTT are pivotal in enhancing educators' competencies, particularly in digital entrepreneurship, which requires a blend of theoretical knowledge and practical, hands-on skills. By participating in TTT programs, educators become better equipped to navigate the complexities of digital business environments, ultimately improving their readiness and commitment to delivering entrepreneurship courses.

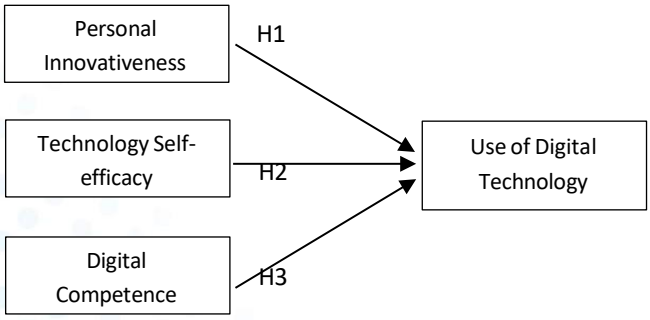
While the literature highlights the importance of Training the Trainers (TTT) programs in enhancing educators' abilities to teach digital entrepreneurship, several research gaps remain. There is limited empirical evidence on the direct impact of TTT programs on educators' readiness in varying educational settings, particularly within different cultural and institutional contexts, such as in Malaysian polytechnics.

In the context of evaluating the effectiveness of the TTT program on educators' readiness to teach entrepreneurship courses, this research framework adapts Kirkpatrick's (2016) training evaluation model and insights from Siti et al. (2022) on the use of digital technology in teaching.

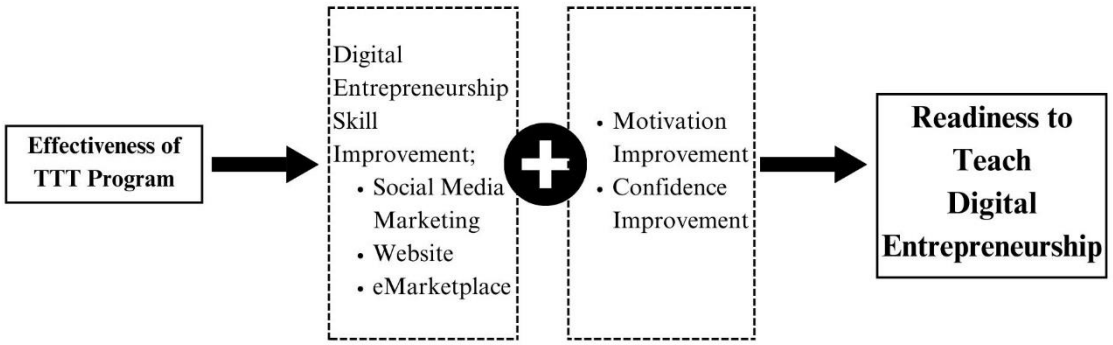
The Independent Variable in this framework is the Effectiveness of the TTT Program. This variable is evaluated based on Kirkpatrick's four levels of training outcomes:

1. Reaction: The satisfaction of participants with the TTT program.
2. Learning: Improvement in educators' knowledge and skills after attending the program.
3. Behavior: Application of newly acquired skills in teaching entrepreneurship.
4. Results: The ultimate impact of the TTT program on their readiness to teach entrepreneurship courses.

The Dependent Variable is the Educator's Readiness to Teach Digital Entrepreneurship Courses, which is influenced by the TTT program's ability to improve educators' digital literacy, pedagogical approaches, and their ability to integrate entrepreneurship content effectively into their teaching practices. Drawing from **Siti et al. (2022)**, **Technology Use in Teaching** acts as a moderating variable. The study identified several key factors influencing educators' adoption of digital technology in their teaching practices:



By adapting Kirkpatrick's model for evaluating training effectiveness and incorporating the technology adoption insights from Siti et al. (2022), this framework offers a comprehensive approach to understanding how the TTT program influences educators' readiness in the digital age.



H1: There is a positive relationship between effectiveness of TTT program and educator's readiness to teach digital entrepreneurship course.

3. Methodology

This research utilized a quantitative approach, employing descriptive research methods to explore the issues directly related to digital entrepreneurship education. Descriptive research is considered fundamental in identifying and portraying phenomena within society (Kumar, 2011). This section measures the relationships outlined in the hypotheses developed through the literature review. A non-probability sampling design, specifically judgmental sampling, was used to select participants for this study. The sample comprised 32 lecturers who successfully completed the "Training the Trainers" program in Digital Entrepreneurship, organized by the Malaysia Digital Economy Corporation (MDEC). This intensive five-day training aimed to enhance the digital entrepreneurship skills of the lecturers, equipping them with the knowledge required to teach the subject effectively.

For data collection, the researchers adapted a structured questionnaire sourced from academic literature. The questionnaire was then distributed online to the selected participants, ensuring a convenient and efficient means of gathering responses for analysis. This approach allowed for the systematic collection of data needed to explore the relationship between the effectiveness of digital entrepreneurship training and the readiness of lecturers to teach entrepreneurship. The questionnaire used in this study included a section on the respondents' profile and structured items related to each research variable. It comprised 20 items, divided into two parts: Part A focused on the respondents' profile with 5 items, while Part B contained 15 items examining the k ey factors under study. In Part B, the dependent variable, *effectiveness of digital entrepreneurship training*, was measured using 10 items. The independent variable, *readiness to teach entrepreneurship*, was assessed with 5 items. The questions related to digital entrepreneurship training were adapted from previous studies Ritz et al., (2019) and the content of the five-day training modules provided by the Malaysia Digital Economy Corporation (MDEC). These modules covered topics such as Facebook Page, Instagram for Business, TikTok Shop, WhatsApp for Business, Website Development, Shopee, Email Marketing, Content Creation, and Copywriting. Meanwhile, the elements assessing readiness to teach entrepreneurship were based on Nurhayati, (2020) research. The items in Part B were rated on a five-point Likert scale, with responses ranging from "strongly disagree" to "strongly agree," as outlined in Table 1. The mean score interpretation is adapted from Norasmah (2002) as shown in Table 2.

The data is analyzed to obtain the results regarding the relationship between effectiveness of digital entrepreneurship training with readiness to teach entrepreneurship among lecturers in Politeknik Merlimau, Malaysia. A regression analysis was performed using SPSS version 21 to examine the relationship between the dependent variable, *readiness to teach entrepreneurship* and the independent variable, *readiness to teach entrepreneurship*, offering insights into how the training impacts overall readiness.

Table 1: 5-point Likert Scale

Scale	Rating
Strongly Disagree	1
Disagree	2
Moderate	3
Agree	4
Strongly Agree	5

Table 2: Mean score interpretation

Mean Score	Interpretation
1.00 - 2.00	Low
2.01 - 3.00	Medium Low
3.01 - 4.00	Medium High
4.01 - 5.00	High

Table 3 shows the results of the reliability analysis of the items in the questionnaire. Cronbach's Alpha values are quite high, for effectiveness of digital entrepreneurship training (0.91) and readiness to teach entrepreneurship (0.93). Thus, all the items were regarded as reliable and hence, no items were deleted.

Table 3: Cronbach' Alpha

Factors	**Number of Items**	**Items Deleted**	**Total item**	**Cronbach's Alpha**
Effectiveness of digital entrepreneurship training	10	0	10	0.914
Readiness to teach entrepreneurship	5	0	5	0.934

4. Finding and Analysis

4.1 Profile of Respondents

This section presented the description of participating respondents. As discussed previously, the population of this research was lecturers involved in Training the Trainers of Digital Entrepreneurship consist of various academic departments as in the Table 4.

Table 4: Respondent's Profile

Respondent's Profile	**Frequency**	**%**
Department		
Mechanical	5	15.6
Civil	6	18.8
Electrical	4	12.5
Tourism and Hospitality	6	18.8
Commerce	6	18.8
Mathematic and Science	2	2
General Studies	3	3
Experienced in teaching entrepreneurship courses		
Yes	21	65.5
No	11	34.4
Interested in teaching entrepreneurship courses		
Yes	22	68.8
No	10	31.3
N = 32		

The respondent profile from this research consists of 32 lecturers involved in the Training the Trainers (TTT) program for Digital Entrepreneurship across various academic departments. The distribution includes departments like Mechanical (15.6%), Civil (18.8%), Electrical (12.5%), Tourism and Hospitality (18.8%), Commerce (18.8%), Mathematics and Science (2%), and General Studies (3%). Most of the lecturers have prior experience teaching entrepreneurship courses, with 65.5% indicating experience, while 34. 4% do not. Additionally, 68.8% expressed an interest in teaching entrepreneurship courses, while 31.3% are not interested. This data highlights that a majority of respondents are both experienced and interested in entrepreneurship education, suggesting a positive attitude towards digital entrepreneurship training among lecturers.

4.2 Descriptive Analysis of Construct

Table 5 shows the average mean score for all two variables; effectiveness of digital entrepreneurship training and readiness to teach entrepreneurship.

Table 5: Descriptive Statistics for effectiveness of digital entrepreneurship training and readiness to teach entrepreneurship.

Construct	Minimum	Maximum	Mean	Std.Deviation	Application Degree
Effectiveness of digital entrepreneurship training	3.78	4.00	4.01	0.406	High
Readiness to teach entrepreneurship	3.81	4.00	3.93	0.596	Medium High

The findings from Table 5 provide insightful perspectives on two key aspects related to digital entrepreneurship: the effectiveness of training and the readiness to teach entrepreneurship. The mean score of **4.01** (out of a possible 5.0, assuming Likert scale) suggests that participants generally perceive the digital entrepreneurship training as highly effective. The **minimum value** of 3.78 and the **maximum value** of 4.00 indicate a narrow range of responses, reflecting consistency in how participants rated the e ffectiveness. The **standard deviation** of **0.406** shows relatively low variability, meaning most responses are clustered closely around the mean, reinforcing the consensus that the training was indeed effective. The **application degree** is classified as **High**, affirming the positive impact of the training. This implies that the skills taught during the training were considered useful and applicable by most participants.

The mean score of **3.93** suggests that participants feel **reasonably ready** to teach entrepreneurship, though not as strongly as they perceive the effectiveness of the training. The **minimum value** of 3.81 and **maximum value** of 4.00 suggest a smaller variation in responses, indicating that participants largely agreed on their readiness. The **standard deviation** of **0.596** shows a slightly larger spread compared to the effectiveness variable, suggesting slightly more varied perceptions of readiness. However, this is st ill relatively low variability. The **application degree** is rated as **Medium High**, indicating that while participants are mostly ready to teach entrepreneurship, there might be room for improvement in their confidence or skill application.

Overall, the findings reveal that the digital entrepreneurship training is perceived as highly effective, yet there is a notable difference in how ready individuals feel to teach digital entrepreneurship. The consistent effectiveness of the training suggests it is a valuable resource, but the variability in readiness points to a need for additional support or resources to enhance teaching preparedness and ensure a more uniform level of readiness across all respondents.

4.3 Relationship between effectiveness of digital entrepreneurship training and readiness to teach entrepreneurship.

H1: There is a positive relationship between effectiveness of TTT program and educator's readiness to teach digital entrepreneurship course.

Table 6: Correlation analysis between effectiveness of digital entrepreneurship training and readiness to teach entrepreneurship.

Correlations			
		Effectiveness of digital entrepreneurship training	Readiness to teach entrepreneurship
Effectiveness of digital entrepreneurship training	Pearson Correlation	1	.772**
	Sig. (2-tailed)		.000
	N	32	32
Readiness to teach entrepreneurship	Pearson Correlation	.772**	1
	Sig. (2-tailed)	.000	
	N	32	32
**. Correlation is significant at the 0.01 level (2 tailed).			

The correlation analysis presented in Table 6 investigates the relationship between the effectiveness of digital entrepreneurship training and the readiness to teach digital entrepreneurship. The hypothesis (H1) posits a positive relationship between these two variables. The Pearson correlation coefficient is reported as 0.772, which indicates a strong positive correlation between the effectiveness of the digital entrepreneurship training and the readiness to teach entrepreneurship. This value is statistically significant, with a p -value of 0.000, confirming that the correlation is not due to random chance but is a meaningful relationship. This strong positive correlation suggests that as the perceived effectiveness of the digital entrepreneurship training increases, so does the readiness of educators to teach entrepreneurship. In other words, educators who view the training as more effective are also more likely to feel prepared to teach the entrepreneurship course. The statistical significance at the 0.01 level reinforces the reliability of this finding. It implies that the positive relationship observed is robust and unlikely to be a result of sampling variability.

Overall, these findings support the hypothesis that there is a significant positive relationship between the effectiveness of the digital entrepreneurship training and educators' readiness to teach entrepreneurship. This indicates that enhancing the effectiveness of the training program could contribute to increased readiness among educators, thereby potentially improving the quality of entrepreneurship education.

The study found a strong positive link between how effective digital entrepreneurship training is and how ready educators feel to teach entrepreneurship. This result aligns with what previous research suggests about the importance of good training programs for improving teaching readiness. According to Longanecker and Blanco (2003), it's not just the content of entrepreneurship education that matters, but also how it's taught. Effective training helps educators provide practical, hands-on learning experiences that reflect the real digital business world. Our findings show that when educators perceive their training as effective, they feel more prepared to teach these skills, supporting this idea. Research by Nurhayati (2020) and Anis (2024) shows that specialized workshops improve educators' skills and their ability to teach online business concepts. Our study supports this, indicating that effective training leads to greater teaching readiness. Similarly, Muhibbullah et al. (2021) and Yu et al. (2022) highlight that training programs that combine theory with practical skills enhance teaching quality, which aligns with our findings.

The TTT (Training the Trainers) model, as discussed by Banha et al. (2022), also plays a key role. It helps educators stay up-to-date with digital trends, which improves their readiness to teach. Our results confirm that TTT programs effectively boost educators' preparedness for teaching digital entrepreneurship. While the literature supports the benefits of TTT programs, more research is needed to understand their impact in different settings, like Malaysian polytechnics. This study adds valuable insights into this area, showing that effective training is crucial for enhancing educators' readiness. In summary, our findings confirm that effective digital entrepreneurship training improves educators' readiness to teach. This supports previous research and highlights the need for continued professional development to keep up with digital trends. Future studies should explore this further in various contexts to fully understand how best to support educators in the digital age.

5. Conclusion

This research shows a strong link between how effective digital entrepreneurship training is and how ready educators feel to teach the subject. When educators find their training valuable, they are more prepared to teach entrepreneurship effectively. The study confirms that high-quality training, which includes practical, hands-on experience, is essential for improving teaching readiness. Specialized workshops and Training the Trainers (TTT) programs are key in bridging the gap between theory and practice, helping educators stay up to-date with digital trends. In summary, effective training programs enhance educators' ability to teach digital entrepreneurship. Investing in these programs is crucial for improving the quality of entrepreneurship education.

Future research should further explore how these training programs impact different educational settings to ensure they meet the needs of a changing digital landscape.

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POLITEKNIK KOTA KINABALU

Kajian Persepsi Pelajar Terhadap Penggunaan AI Dalam Aktiviti Pembelajaran Dan Pengajaran Dalam Program Sijil Teknologi Elektrik Di Kolej Komuniti

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Abstrak

Penggunaan teknologi Kecerdasan Buatan berpotensi untuk disepadukan dalam aktiviti pembelajaran dan pengajaran di pelbagai peringkat pengajian termasuk pengajian diperingkat sijil. Ini kerana teknologi Kecerdasan Buatan dilihat berpotensi untuk meningkatkan hasil pembelajaran, memudahkan tugas pengurusan pembelajaran dan pengajaran dan memupuk metodologi pengajaran yang inovatif. Walaubagaimanapun, penerimaan dan kesediaan pelajar untuk menggunakan Kecerdasan Buatan dalam aktiviti pembelajaran dan pengajaran perlu dikenalpasti terlebih dahulu sebelum idea ini dilaksanakan. Justeru kajian ini dijalankan bertujuan untuk mengkaji persepsi pelajar Program Sijil Teknologi Elektrik di Kolej Komuniti Sandakan terhadap penggunaan Kecerdasan Buatan dalam aktiviti pembelajaran dan pengajaran. Kajian ini penting kerana persepsi pelajar mencerminkan penerimaan mereka untuk menggunakan aplikasi Kecerdasan Buatan. Kajian ini dijalankan secara kuantitatif dengan mengedarkan borang soal selidik kepada 100 orang pelajar. Item kajian yang dibangunkan dalam soal selidik terdiri daripada sepuluh pernyataan positif berkaitan penggunaan aplikasi Kecerdasan Buatan dalam aktiviti Pembelajaran dan Pengajaran. Ini termasuk penggunaan aplikasi Kecerdasan Buatan untuk menyediakan cadangan pembelajaran, diagnosis masa nyata keadaan pembelajaran, sistem penggredan, maklum balas segera tentang keadaan pembelajaran dan pemantauan kelas. Hasil kajian ini mendapati penerimaan pelajar untuk menggunakan Kecerdasan Buatan dalam aktiviti pembelajaran dan pengajaran berada pada tahap sederhana. Ini menunjukkan pelajar sedar tentang Teknologi Kepintaran Buatan dan bersedia menerima teknologi yang akan digunakan di dalam kelas. Maklumat ini dapat membantu pensyarah dan institusi mengambil langkah selanjutnya dalam membawa teknologi Kepintaran Buatan ke dalam kelas seperti merangka program khas bagi menyediakan pelajar terhadap penggunaan teknologi AI serta penstrukturan semula kurikulum sedia ada bagi memasukkan penggunaan aplikasi Kepintaran Buatan.

Kata kunci: - Kecerdasan Buatan, Pembelajaran dan Pengajaran

1. Pengenalan

Kecerdasan Buatan (AI) telah muncul dengan pantas sebagai kuasa transformatif dalam pendidikan, menjanjikan revolusi dalam aktiviti pembelajaran dan pengajaran (PdP) merentas pelbagai peringkat dan konteks. Aplikasinya dalam pendidikan mempunyai potensi besar untuk meningkatkan hasil pembelajaran, memudahkankan tugas pengurusan PdP dan memupuk metodologi PdP yang inovatif. Penggunaan AI dalam Pendidikan telah menjadi topik yang banyak dikaji dalam beberapa tahun kebelakangan ini. Penyelidikan dan pembangunan dalam AI untuk pendidikan terus berkembang, didorong oleh kerjasama antara pendidik, penyelidik dan pembangun teknologi. Laporan sektor Pendidikan Amerika Syarikat telah menganggarkan jangkaan perkembangan sebanyak 47. 77% dari 2018 hingga 2022 dalam sektor Pendidikan di negara itu (Tahiru, 2021).

Program pengajian di peringkat sijil dalam bidang Elektrik menghadapi cabaran dalam menyediakan pelajar yang bukan sahaja menguasai kemahiran dalam bidang Elektrik, selaras dengan keperluan industri tetapi juga menguasai pengetahuan dan kemahiran yang seiring dengan kemajuan teknologi AI yang pesat. Mengintegrasikan AI ke dalam aktiviti PdP di peringkat ini dapat menghasilkan graduan yang lebih celik teknologi semasa dan berdaya saing selain menguasai kemahiran asas dalam bidang elektrik bagi menghadapi pasaran kerja yang kompetitif.

Walau bagaimanapun, teknologi AI masih dianggap asing dikalangan pelajar dikebanyakan institusi pengajian terutamanya yang melibatkan program sijil yang lebih banyak menggunakan kaedah pembelajaran kemahiran praktikal. Terdapat keperluan untuk mengkaji tahap penerimaan pelajar untuk menggunakan AI dalam aktiviti PdP. Justeru kajian ini bertujuan untuk mengkaji persepsi pelajar program Sijil Teknologi

Elektrik di Kolej Komuniti Sandakan terhadap penggunaan AI dalam aktiviti PdP.

Kajian mengenai persepsi pelajar terhadap penggunaan AI dalam aktiviti PdP adalah penting. Ini kerana maklum balas daripada pelajar dapat membantu penyelidik, pensyarah dan pihak institusi untuk merangka tindakan selanjutnya dalam usaha menyepadukan teknologi AI dalam aktiviti PdP. Memahami persepsi pelajar mengenai AI dalam pendidikan membantu memberi gambaran kepada pihak institusi atau pengajar mengenai tahap penerimaan pelajar untuk menggunakan AI dalam aktiviti PdP. Penerimaan yang positif menggambarkan bahawa pelajar terbuka untuk menerima teknologi AI untuk digunapakai dalam aktiviti PdP. Ini membawa kepada penglibatan dan motivasi yang lebih tinggi terhadap penggunaan AI di dalam kelas. Ini memberi lampu hijau kepada pihak institusi untuk mula merangka penstrukturan semula kurikulum sedia ada bagi memasukkan penggunaan aplikasi AI.

Penerimaan yang tidak memberangsangkan pula menunjukkan bahawa tindakan lanjut seperti seperti merancang dan menyediakan program khas untuk pelajar bagi meningkatkan tahap kefahaman pelajar terhadap penggunaan teknologi AI. Memandangkan AI semakin berkembang dalam pelbagai industri, memahami pandangan pelajar terhadap AI dalam pendidikan dapat menyediakan mereka untuk kerjaya masa depan yang melibatkan teknologi AI. Ia melengkapkan mereka dengan kemahiran dan minda yang diperlukan untuk memanfaatkan AI dengan berkesan. Secara ringkasnya, mengkaji persepsi pelajar mengenai penggunaan AI dalam aktiviti pembelajaran dan pengajaran adalah penting untuk mengoptimumkan proses pembelajaran, meningkatkan hasil pembelajaran dan menyediakan pelajar untuk masa depan yang didorong oleh AI.

2. Sorotan Kajian

Kecerdasan Buatan (AI) adalah salah satu dari cabang ilmu dalam bidang Sains Komputer. Istilah Kecerdasan Buatan mula digunakan pada tahun 1956 pada persidangan di Dartmouth Kolej (AS) (Webb et al., 2020). AI ialah teknologi yang membolehkan instrumen seperti komputer, mesin dan perisian meniru dan mensimulasikan kepintaran manusia dalam menyelesaikan masalah (Ozkaya, 2020). AI menggunakan algoritma dalam program komputer bagi mempelajari dan mengenalpasti pola suatu data yang disediakan (Perotta & Selwyn, 2019).

Melalui AI, instrumen berkenaan dapat melaksanakan tugasan seperti mengenalpasti masalah berdasarkan data yang dipelajari dan menyediakan cadangan penyelesaian kepada masalah tersebut sama seperti keupayaan manusia berfikir. Penyelesaian masalah menggunakan AI dapat menghindari kesilapan yang berkait dengan emosi atau kelalaian memandangkan AI hanya mengambilkira fakta dari data tersedia (Zhai, 2021; Selwyn, 2022). Teknologi AI adalah pemacu kepada perkembangan Industri 4.0 seperti Internet of Things, robotik, pengkomputeran kuantum, percetakan 3D, kenderaan autonomi dan banyak lagi (Miao, Holmes, Huang & Zhang, 2021).

Banyak aplikasi AI yang digunakan pada masa kini yang digambarkan boleh mengubah lanskap Pendidikan pada masa hadapan (Vincent-Lancrin & Van Der Vlies, 2020). AI dilihat boleh menjadi alat pembelajaran yang boleh mengurangkan beban pelajar dan pendidik serta memberi pengalaman pembelajaran yang lebih efektif untuk pelajar (Fitria, 2021; Troussas, Krouska & Sgouropoulou, 2022). Justeru, pembelajaran tentang AI telah mula menjadi sebahagian daripada kurikulum sekolah di sesetengah negara (Dai et al., 2020; Knox, 2020).

Diantara aplikasi teknologi AI yang digunakan dalam bidang Pendidikan ialah Intelligent Tutoring System (ITS) yang digunakan untuk memberi pengalaman pembelajaran berbeza bagi setiap individu mengikut tahap kemampuan masing- masing (Nassr & Abu-Naser, 2019; Al Rekhawi, 2020; Alshawwa, Al-Shawwa & Abu-Naser, 2024). Selain itu, ada banyak lagi aplikasi AI dalam Pendidikan seperti Pembelajaran Peribadi, sistem Penggredan dan Penilaian Pelajar, sistem Pemantauan Bilik Darjah dan Analisis Visual dan Sistem Pengesyoran dalam Pendidikan (Zawacki-Ritcher, Marin, Bond & Gouverneur, 2019; Ahmad et al., 2023).

Perhatian yang semakin meningkat terhadap AI adalah suatu petunjuk bahawa kajian lebih terperinci perlu dilaksanakan berkenaan AI untuk menyediakan pelajar dan pendidik bagi menghadapi sebarang perubahan yang mungkin berlaku dalam dunia Pendidikan. Kajian yang lalu telah memberi inspirasi agar Kajian persepsi pelajar terhadap penggunaan AI dalam aktiviti pembelajaran dan pengajaran dalam program Sijil Teknologi Elektrik di Kolej Komuniti.dijalankan.

3. Metodologi

Kajian ini telah dijalankan secara kuantitatif dengan menggunakan borang soal selidik sebagai instrumen kajian. Borang soal selidik yang digunakan untuk mendapatkan data mengandungi item-item kajian seperti yang ditunjukkan dalam Jadual

1. Item kajian yang dibangunkan adalah terdiri daripada 10 pernyataan positif berkenaan persepsi pelajar terhadap penggunaan AI dalam aktiviti Pembelajaran dan Pengajaran. Pernyataan dalam item kajian ini mengambil inspirasi dari instrumen yang dibangunkan oleh Cheng et al., (2023). Selain itu, tinjauan dan pembacaan telah dilakukan terhadap 17 kajian terdahulu untuk membangunkan item kajian. Skala Likert lima mata telah digunakan sebagai skor untuk mengukur tahap penerimaan pelajar terhadap setiap pernyataan item kajian. Skor satu mewakili 'Sangat Tidak Setuju', skor dua mewakili 'Tidak Setuju', skor tiga mewakili 'Tidak Pasti', skor empat mewakili 'Setuju' manakala skor lima mewakili 'Sangat Setuju'.

Bagi tujuan analisis demografi, responden diminta untuk merekodkan latar belakang seperti semester pengajian, jantina, pendapatan ibu bapa dan kawasan kediaman sama ada di bandar atau luar bandar. Selain itu, responden diminta untuk merekodkan pengalaman menggunakan AI dalam aktiviti harian dan sikap pelajar terhadap penggunaan AI dalam PdP. Responden juga ditemubual secara lisan sama ada menggunakan telefon pintar dan media sosial serta sama ada responden mendapat akses internet melalui telefon pintar masing-masing.

Sampel kajian (n) adalah seramai 100 orang responden. Data dikutip menggunakan kaedah persampelan mudah iaitu dengan mengedarkan borang soal selidik kepada pelajar semua pelajar program Sijil Teknologi Elektrik dari semester satu hingga empat sesi I 2024/2025. Data kajian yang dikumpulkan dianalisis secara deskriptif untuk mendapatkan skor purata bagi setiap item kajian. Purata keseluruhan skor juga turut dikira berdasarkan skor purata setiap item kajian. Persepsi pelajar terhadap penggunaan AI dalam aktiviti PdP diukur berdasarkan nilai skor purata yang diperolehi bagi setiap item kajian. Skor purata ini diterjemahkan kepada tahap penerimaan sama ada rendah, sederhana atau tinggi mengikut Jadual 2 yang di adaptasi dari Landell (1977, dipetik daripada Ravendran, Karpudewan, Ali & Lay, 2023).

Jadual 1: Pernyataan Positif (PP): Persepsi Pelajar Terhadap Penggunaan AI Dalam Aktiviti Pembelajaran dan Pengajaran

Kod Item	Item Kajian
PP I	AI dalam pembelajaran yang melibatkan teori konsep dan pengiraan dalam litar Elektrik berguna untuk mencadangkanan soalan latihan teori berdasarkan tahap pembelajaran saya.
PP 2	AI dalam PdP yang melibatkan aktiviti pendawaian Elektrik berguna untuk mencadangkan video demonstrasi pendawaian sesuai dengan tahap pembelajaran saya.
PP 3	AI yang digunakan dalam aktiviti PdP teori dan amali berguna untuk menyediakan diagnosis mengikut masa sebenar tentang tahap pembelajaran saya.
PP 4	AI dalam aktiviti PdP berguna untuk memberikan maklum balas pada masa yang tepat tentang tahap pembelajaran saya.
PP 5	AI boleh mengoptimumkan masa yang saya gunakan untuk memberi perhatian kepada sesi pembelajaran.
PP 6	AI mampu menggunakan prestasi pembelajaran masa lalu saya untuk membantu membimbing saya dalam pembelajaran saya yang akan datang.
PP 7	AI membuat lebih sedikit kesilapan daripada pemarkahan dari pensyarah, menjadikan pemarkahan Penilaian Berterusan seperti latihan praktikal, penulisan laporan dan tugasan lebih tepat dan adil.
PP 8	Pemarkahan menggunakan AI memberikan maklum balas yang lebih tepat dan pantas daripada pemarkahan pensyarah.
PP 9	AI lebih cekap daripada pensyarah untuk mengambil kehadiran pelajar.
PP 10	Secara keseluruhannya penggunaan AI berupaya untuk meningkatkan pencapaian akademik saya.

Jadual 2: Tahap Penerimaan Berdasarkan Skor Purata

Skor Purata	Tafsiran
1.00– 2.33	Rendah
2.34– 3.67	Sederhana
3.68– 5.00	Tinggi

Sumber: Landell (1977, dipetik daripada Ravendran, Karpudewan, Ali & Lay, 2023).

4. Hasil Kajian dan Perbincangan

Demografi responden adalah seperti yang direkodkan dalam Jadual 3. Sebanyak 30% daripada responden yang telah menjawab soalan kaji selidik adalah pelajar dari semester satu, 24% dari semester dua, 31% dari semester tiga manakala baki 15% dari semester empat. Majoriti responden adalah pelajar lelaki iaitu mewakili 92% manakala 8% lagi adalah pelajar perempuan. Dari segi latar belakang kewangan, rata -rata responden iaitu 97% adalah dari keluarga berpendapatan rendah dengan jumlah pendapatan ibu bapa di bawah RM5250. Manakala 3% lagi adalah dari keluarga berpendapatan sederhana dengan jumlah pendapatan ibu bapa berada dalam julat RM5250 hingga RM11819. Tiada pelajar dari keluarga berpendapatan tinggi iaitu RM118 20 dan ke atas. Sebanyak 87% daripada responden tinggal di kawasan bandar manakala 13% lagi tinggal di kawasan luar bandar. Hanya 19% daripada keseluruhan responden berpengalaman menggunakan AI dalam aktiviti harian. Sebanyak 63% lagi memilih kurang atau sangat kurang berpengalaman menggunakan AI dalam aktiviti harian.

Melalui temubual secara lisan, semua responden didapati memiliki telefon pintar dan dapat mendapat akses internet sama ada daripada wifi yang disediakan oleh pihak Kolej Komuniti Sandakan atau langanan sendiri. Semua responden juga mempunyai sekurang-kurangnya satu akaun media sosial dan menggunakan media sosial sekurang-kurangnya sekali sehari. Ini boleh menjadi indikasi bahawa sebanyak 18% daripada responden yang memilih tiada pengalaman menggunakan AI dalam aktiviti harian, belum cukup memahami teknologi AI yang berada di sekeliling mereka. Rata- rata daripada responden ini tidak sedar bahawa mereka telah pun menggunakan AI dalam kehidupan harian melalui penggunaan aplikasi seperti Google Assistant, Google Search Recommendation, Google Maps, aplikasi untuk menyunting imej seperti FaceApp dan banyak lagi aplikasi yang digunakan bersama aplikasi media sosial. Walau bagaimanapun, majoriti daripada responden menunjukkan sikap yang positif terhadap penggunaan AI. Majoriti daripada responden iaitu sebanyak 87% memilih sama ada sangat setuju atau setuju untuk menggunakan AI dalam aktiviti PdP jika diberi pilihan sementara 13% lagi memilih tidak pasti.

Jadual 3: Latar Belakang Responden

	Item	**Bilangan (n)**	**Peratus (%)**
Semester pengajian	1	30	30
	2	24	24
	3	31	31
	4	15	15
Jantina	Lelaki	92	92
	Perempuan	8	8
Pendapatan ibu bapa	RM100 – RM5,249	97	97
	RM5,250 - RM11,819	3	3
	≥ RM11,820	0	0
Kediaman	Bandar	87	87
	Luar bandar	13	13
Pengalaman Menggunakan AI dalam aktiviti harian	Tiada pengalaman	18	18
	Sangat Kurang Berpengalaman	4	4
	Kurang Berpengalaman	59	59
	Berpengalaman	19	19
	Sangat Berpengalaman	0	0
Sikap terhadap penggunaan AI dalam PdP	Sangat Setuju	20	21
	Setuju	67	66
	Tidak Pasti	13	13
	Tidak Setuju	0	0
	Sangat Tidak Setuju	0	0

Skor purata bagi setiap item kajian ditunjukkan seperti dalam jadual 4 dan rajah 1. Purata keseluruhan skor item kajian adalah 3.62. Ini menunjukkan bahawa tahap penerimaan pelajar program Sijil Teknologi Elektrik di Kolej Komuniti Sandakan untuk menggunakan AI dalam aktiviti PdP secara keseluruhannya berada pada tahap sederhana. Berdasarkan graf pada rajah 1, item kajian PP1 mendapat skor purata tertinggi iaitu 3.73 manakala PP2 mendapat skor purata 3.70. Berdasarkan jadual 4, lebih 50% daripada responden memilih Setuju iaitu nilai skor empat bagi ke dua-dua item kajian ini. Skor purata bagi item kajian PP1 dan PP2 berada pada tahap

penerimaan yang tinggi berdasarkan tafsiran pada jadual 2. Ini menunjukkan penerimaan pelajar terhadap penggunaan AI untuk mencadangkan soalan latihan teori dan video demonstrasi pendawaian berdasarkan tahap pembelajaran adalah pada tahap tinggi. Penerimaan yang tinggi menunjukkan pelajar mempunyai keyakinan yang tinggi bahawa cadangan sumber pembelajaran yang disediakan oleh AI dapat memudahkan proses pembelajaran mereka. Item kajian PP1 dan PP2 dibangunkan berdasarkan sistem Pengesyoran AI. Sistem ini memerlukan sejumlah besar data pelajar seperti yang digunakan dalam sistem google recommendation dan lain-lain sistem pengesyoran AI. Justeru, aspek keselamatan data dan cabaran dari segi etika pengumpulan data peribadi perlu dikaji dengan lebih dalam sebelum sistem ini digunakan dalam aktiviti PdP.

Item kajian PP3 dan PP4 adalah berdasarkan Intelligent Tutoring System (ITS) yang merupakan salah satu teknologi AI yang terawal dibangunkan untuk kegunaan dalam bidang pendidikan. Sistem ITS dibangunkan bertujuan untuk memberikan pengalaman pembelajaran yang khusus dan disesuaikan mengikut kemampuan yang berbeza bagi setiap individu. Penerimaan pelajar berada pada tahap sederhana dengan skor purata bagi item kajian PP3 dan PP4 masing - masing ialah 3.61 dan 3.58. Tahap penerimaan pelajar terhadap berada pada tahap sederhana. Ini menyokong hasil kajian Cheng et al., (2023) yang menyatakan bahawa lebih daripada 65% peserta bersetuju bahawa AI boleh menyediakan diagnosis mengikut masa sebenar dan maklum balas pada masa yang tepat tentang tahap pembelajaran.

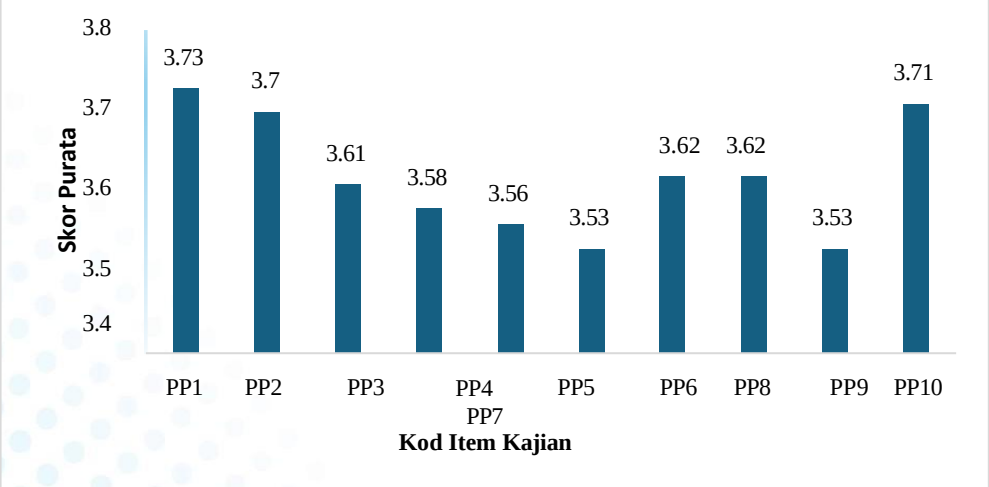
Item kajian PP5 dan PP6 pula merujuk kepada sistem Pembelajaran Peribadi yang banyak merujuk kepada penggunaan data pelajar seperti jejak log dan data prestasi pelajar. Skor purata bagi item kajian PP6 adalah yang paling rendah iaitu 3.53, selain daripada PP9 yang berkongsi skor purata yang sama. Skor purata item kajian PP5 pula adalah kedua terendah iaitu 3.56. Walau bagaimanapun, skor purata yang diperolehi menunjukkan tahap penerimaan pelajar terhadap penggunaan AI untuk mengoptimumkan masa yang digunakan untuk memberi perhatian kepada sesi pembelajaran dan kemampuan AI menggunakan prestasi pembelajaran masa lalu untuk membantu membimbing dalam pembelajaran yang akan datang masih pada tahap sederhana.

Berdasarkan kajian Nassuora, (2022), penggunaan AI untuk memberi pemarkahan dan maklum balas dari permarkahan terbukti dapat menggurangkan masa dan kos yang berkaitan. Item kajian PP7 dan PP8 yang merujuk kepada penggunaan AI untuk memberi pemarkahan dan maklum balas dari permarkahan mendapat skor purata yang sama iaitu 3.62. Ini menunjukkan bahawa penerimaan pelajar adalah pada tahap sederhana. Lebih dari 60% pelajar memillih setuju atau sangat bersetuju bahawa penggunaan AI lebih baik dalam memberi markah dan maklum balas pemarkahan berbanding pensyarah. Hasil kajian ini sedikit bercanggah dengan hasil kajian Cheng et al., (2023) yang menyatakan bahawa kira-kira 60% daripada respondennya memilih untuk tidak bersetuju bahawa AI memberikan maklum balas yang lebih berguna daripada pensyarah.

Pemantauan kehadiran pelajar menggunakan AI adalah merujuk kepada penggunaan aplikasi atau sistem pengecaman wajah. Walaupun masih dalam lingkungan skor sederhana, item kajian PP9 yang menyatakan bahawa AI lebih cekap dalam menggambil kehadiran pelajar berbanding pensyarah adalah di antara item kajian yang mendapat skor purata paling rendah selain item kajian PP6 iaitu 3.53. Berdasarkan temubual lisan dengan pelajar, perkara ini dipengaruhi oleh kebimbangkan pelajar terhadap kesilapan sistem dalam membuat pengecaman wajah yang mungkin disebabkan oleh kualiti kamera web atau kualiti sambungan internet pa da aplikasi. Selain itu, 42% daripada pelajar memilih tidak pasti, tidak setuju atau sangat tidak setuju dengan pernyataan item kajian PP9. Pelajar-pelajar ini lebih memilih pengambilan kehadiran secara manual kerana bagi kes ketidakhadiran yang melibatkan kesihatan atau hal-hal kecemasan keluarga yang tidak mempunyai surat, pelajar masih boleh memohon belas ihsan dari pensyarah untuk meluluskan kehadiran dan tidak dapat berbuat demikin dengan AI. Selain itu, penerimaan pelajar untuk menggunakan AI untuk tujuan meningkatkan pencapaian akademik juga adalah tinggi. Ini berdasarkan skor purata 3.71 yang diperolehi dalam item kajian PP10.

Jadual 4: Jadual Skor Purata Item Kajian

Kod Item	Bilangan & Peratus Pelajar Bagi Setiap Skor					Skor Purata
	1	2	3	4	5	
PP I	2	6	21	58	13	3.73
PP 2	1	7	22	59	11	3.7
PP 3	0	10	29	48	13	3.61
PP 4	1	9	31	46	13	3.58
PP 5	1	13	26	46	14	3.56
PP 6	1	10	31	48	10	3.53
PP 7	2	9	25	50	14	3.62
PP 8	0	10	29	48	13	3.62
PP 9	3	11	28	43	15	3.53
PP 10	2	5	25	55	13	3.71
				Skor Purata Keseluruhan		**3.62**



Rajah 1: Graf Skor Purata Item Kajian

5. Kesimpulan

Kajian ini dilaksanakan bertujuan untuk mengkaji persepsi pelajar program Sijil Teknologi Elektrik di Kolej Komuniti Sandakan terhadap penggunaan AI dalam aktiviti PdP. Hasil daripada kajian mendapati masih terdapat sebahagian daripada pelajar iaitu 18% yang belum memahami teknologi AI secara umum. Ini berdasarkan maklum balas pelajar yang memilih tiada pengalaman menggunakan teknologi AI dalam aktiviti harian tanpa menyedari bahawa mereka telah pun menggunakan teknologi AI melalui beberapa aplikasi dalam telefon pintar dan media sosial. Walau bagaimanapun, tiada pelajar yang memilih tidak setuju untuk menggunakan AI dalam aktiviti PdP jika diberi pilihan. Majoriti daripada pelajar iaitu sebanyak 87% memilih sama ada sangat setuju atau setuju untuk menggunakan AI dalam aktiviti PdP jika diberi pilihan sementara baki pelajar yang lain memilih tidak pasti.

Hasil daripada analisis item kajian mendapati bahawa secara keseluruhannya, tahap penerimaan pelajar terhadap penggunaan AI dalam aktiviti PdP berada pada tahap sederhana. Penerimaan pelajar terhadap penggunaan AI untuk mencadangkan soalan latihan teori dan video demonstrasi pendawaian berdasarkan tahap pembelajaran serta penggunaan AI secara keseluruhannya untuk meningkatkan pencapaian akademik adalah pada tahap tinggi. Penerimaan pelajar untuk untuk menyediakan diagnosis mengikut masa sebenar dan maklum balas pada masa yang tepat tentang tahap pembelajaran, mengoptimumkan masa pembelajaran, menggunakan prestasi pembelajaran masa lalu untuk membantu membimbing pembelajaran yang akan datang,

pemarkahan dan maklum balas pemarkahan penilaian berterusan serta mengambil kehadiran pelajarpula berada pada tahap sederhana.

Sebagai cadangan untuk kajian akan datang, kesan penggunaan kecerdasan buatan (AI) terhadap prestasi pelajar boleh dikaji dengan menjalankan ujian rintis menggunakan aplikasi AI sedia ada. Ujian ini bertujuan untuk menilai sejauh mana integrasi AI dalam proses PdP dapat mempengaruhi hasil akademik dan keberkesanan pembelajaran pelajar. Melalui ujian ini, data yang relevan dapat dikumpul. Perubahan dalam prestasi pelajar sebelum dan selepas penggunaan aplikasi AI serta maklum balas daripada pelajar dan pensyarah mengenai pengalaman mereka menggunakan teknologi AI di dalam kelas dapat dianalisis.

Selain menggunakan aplikasi AI sedia ada, kerjasama antara pihak Kolej Komuniti dengan syarikat atau komuniti pembuat aplikasi adalah perlu bagi mewujudkan aplikasi yang khusus dan sesuai untuk kegunaan dalam program sijil Teknologi Elektrik yang banyak melibatkan kerja-kerja amali. Melalui kolaborasi ini, aplikasi yang sesuai dengan pedagogi program sijil Teknologi Elektrik dapat dibangunkan selain menyokong gaya pembelajaran yang inovatif, interaktif serta dan efektif dalam meningkatkan kualiti pengajaran serta pembelajaran di dalam kelas.

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Effects of Kinesthetic Learning Approach using Moment Kit Board

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Abstract

This study examined the effects of the Kinesthetic Learning Approach (KLA) using the Moment Kit Board (MKB) on the topic of the Moment of Force, as studied by engineering students at Malaysian Polytechnic who were enrolled in an Engineering Science course. To enhance comprehension of physics topics, kinesthetic learning emphasizes hands-on, tactile and moving experiences. Before utilizing the Moment Kit Board, students who are generally weak, meek, or moderate in the classroom usually struggle to implement the lessons learned about the Force Moment Method in the topic of Moments of Force. Three respondents who took this course at Politeknik Tuanku Sultanah Bahiyah (PTSB) participated in the study. Semi-structured interviews and observation were the methods utilized to collect data. The study's findings showed that using the KLA with MKB had a beneficial cognitive impact. It increased understanding and problem-solving by using the Force Moment Method to determine the distance of force applied from the centre of gravity. The results also demonstrated the positive psychological effects of the KLA, which raised learning motivation and self-confidence. The students' academic performance through the assessment of the test showed that using kinesthetic learning had a positive impact on learning outcomes and students should be able to use physics concepts to solve engineering physics problems.

Keywords: Kinesthetic Learning Approach, Moment of Force, Physics, Hands-on

1. Introduction

Effective learning methods depend on the individual and the type of material being studied. Among the methods that have proven to be effective is kinesthetic learning. This method involves incorporating physical activities into the learning process, such as using physical models or simulations, to help students learn better through movement. Kinesthetic learning is better rather than listening to a lecture or watching demonstrations. Choosing the right method can improve learning effectiveness and keep students more engaged and motivated.

One learning style that shows a great deal of promise, but remains less understood, understudied, and underutilized at the college level is kinesthetic learning (Chisholm & Spencer, 2017). The kinesthetic learning style is focused on learning through movement. Individuals who practice this type of learning need concrete materials to help them remember information. They also love touching objects because they enjoy experiences that provide a realistic, hands-on understanding. Kinesthetic learners believe they can learn effectively through movement, touch, and hands-on work. Because of this, they will perform their best when given assignments that involve these methods. Rather than lecturing or showing videos, instructors use the Kinesthetic Learning Approach (KLA) to engender student involvement by "touching, moving, and interacting with their environment" (Wagner & Drago, 2004). Thus, a teacher must create an environment where the needs of a variety of learners can be met.

The Moment Kit Board (MKB) is an innovative project aimed at enhancing teaching and learning techniques for engineering students at Polytechnics, specifically to deepen their understanding of the topic Moment of Force in Engineering Science courses. By using this innovation, students can accurately determine the perpendicular distance (d) of force to the centre of gravity ($\bar{x}$). It also aims to improve students' proficiency in accurately answering questions related to the application of moment force.

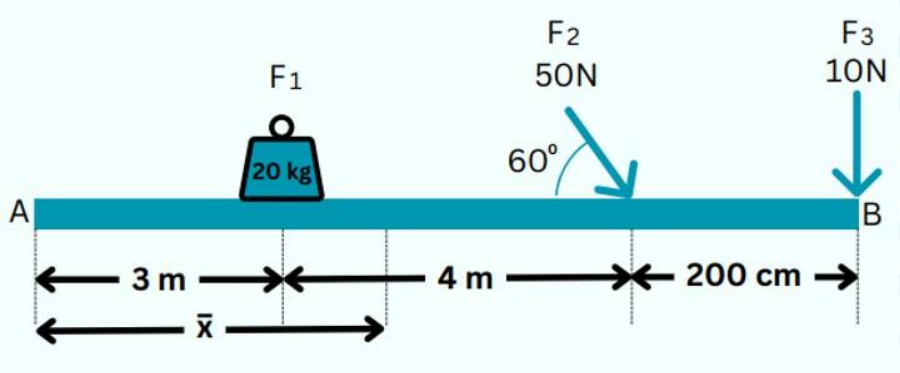

Figure 1: An example of the action of forces applied to an object

This project includes features that align with the sustainability of the education system. The MKB not only promotes kinesthetic and enjoyable learning but also incorporates a digital learning approach, as students can check their answers to practice questions using the Moment Apps. This innovation can enhance students' thinking and imagination, as well as encourage self-learning. The potential for expanding its use to all Polytechnics and Matriculation programs in Malaysia is significant.

Figure 2: Moment Kit Board and Moment Apps

Figure 3: Kinesthetics Learning Moment Kit Board

1.1 Problem Statement

According to statistics obtained from the DBS10012 Test, 39.3% and 61.1% of students failed the exam in Session I 2022/2023 and Session II 2021/2022, respectively. The test questions were analysed, and it was discovered that most students each semester struggled to answer the third question, which pertains to Moment of Force. A total of 74 samples of student answer scripts from Session I 2022/2023 and Session II 2021/2022 were analysed, and the findings showed that 47.3% of students failed to determine the 'd' value, 20.3% made mistakes in calculations, 8.1% did not answer questions, and 2.7% failed to exchange units. Learning difficulties and inactivity in the classroom also contribute to this issue. Despite teachers' best efforts, traditional learning methods like chalk and talk can cause disorientation and weak understanding. Vyas et al. (2022) investigated the perception of traditional learning as either active or not. The study revealed that students perceived traditional learning as neither active nor enthusiastic before class. As a result, Moment Kit Board has developed a kinaesthetic learning style that has the potential to improve both learning patterns and academic outcomes.

1.2 Objective

The objectives of this study are:

i. To examine the effectiveness of a kinesthetic learning approach using Moment Kit Board on students's perspectives toward cognitive and psychological.

ii. To observe students's academic performance through the assessment of tests.

2. Literature Review

2.1. Affective learning

Affective learning is indicating attitudes of awareness, interest, attention, concern, and responsibility, ability to listen and respond in interactions with others, and the ability to demonstrate those attitudinal characteristics or values which are appropriate to the test situation and the field of study. (McBeath, 1992).

2.2 Learning Styles

Keefe (1979), learning styles are defined as characteristic of cognitive, affective as well as psychological behaviours that relates on perception of learning activities, interaction and respond to learning situation. Each of learners has their own preferred learning styles and learners could adapt learning styles according to tasks given. Learning style is simply a method of learning or way of understanding new information. This is defined as the way a person takes in, understand process, remember, and express information. There are different ways in which human can learn, Lewis (2012) have identified two learning styles; Visual, and Kinesthetic learning styles. The visual learning style is referred to the process through which students gain knowledge and understanding using explicitly visual tools. While under the kinesthetic learning style, the student learns best when they can touch and feel through physical activity. Auditory learners learn best when they are able to hear the instruction (Benders & Ellington, 2012).

2.3 Kinesthetic Learner

According to Bog et al. 2021, kinesthetic activities help students who need more than visual and auditory learning activities. Also, kinesthetic refers to active learning through movement and tactile refers to learning through touch (Al Adzillina & Hasanah, 2021). Stamm et al. (2021) described kinesthetic learning as using hands-on experience and performing tasks to process information. Physical hand movements encourage student engagement by initiating learning from gestures. Kinesthetic learners prefer to experience the learning material. Kinesthetic learners best learn through physical experiences such as hand-on training, doing, touching, holding and so on (Clark, 2000). There are two categories of kinesthetic learners, known as, kinesthetic (movement) as well as tactile (touch). A kinesthetic learner work best on things done through physical experiences such as feeling, hands-on experiences, doing, touching, holding and so on.

2.4 Cognitive Effects

Cognitive effects refer to the ways in which this type of learning impacts cognitive processes, including attention, memory retention, and information processing speed. In using the Moment Kit Board in kinesthetic learning, students can experience cognitive effects such as better understanding of physical forces (conceptual understanding), improved ability to recall the laws of motion (memory retention), and enhanced ability to approach and solve physics problems (problem-solving skills). Its proved by Hamad & Alnuzaili, 2020 that the cognitive domain addresses the internal aspect of learning that includes the intellectual capacity to learn in terms of thinking and, more specifically, targets knowledge, comprehension, application, analysis, synthesis, and evaluation.

2.5 Psychological Effect

Student's perspective towards psychological effects may also take two behaviors. The first is through motivation. According to Motevalli et al. (2020) motivation is a psychological term where it stems from the desire of wanting something and give fuel as a drive to continue pursuing the desire. Reamen (2015), opined that motivation does not just occur in a vacuum, much of our motivation act is fueled by emotional states, interest, exploration, play and learning. Asif et al. (2021) discuss the research regarding the importance of engagement and its positive impact on learning outcomes. Student engagement extends beyond the completion of a required task. It includes cognitive, emotional, and behavioral effort to understand a concept evidenced by demonstrated interest, persistence, and satisfaction (Asif et al., 2021). The second behavior is self - confidence. Self-confidence is more broadly defined as one's beliefs in their abilities to learn, perform, and complete a task which is usually based on experience or evidence (Fennema & Sherman, 1976). Carr et al. (2024) also agreed that a significant increase in students' self-efficacy and self-confidence toward multiplication after the implementation of the kinesthetic learning strategies. Although not controlled for, multiple aspects of the kinesthetic program could have helped strengthen students' efficiency in multiplication, likely boosting self-confidence.

3. Methodology

3.1 Research design

This study employs a qualitative method, specifically through semi-structured interviews. The interview method was chosen because it allows the researcher to gain insights from respondents. The semi-structured interview, according to Magaldi & Berler (2020), is an exploratory interview. They explained that the semi-structured interview is generally based on a guide and is typically focused on the main topic that provides a general pattern. The study involved three engineering students from Tuanku Sultanah Bahiyah Polytechnic, where they practised the Kinesthetics Learning Approach using MKB on the topic of Moment of Force. The information collected is expected to be useful for studying the level of student achievement and student perceptions of kinesthetics learning. The process of gathering information starts with interviewing them face- to-face. Data obtained from subsequent interviews is analyzed using thematic analysis. Table 1 provides a summary of the study's methodology:

Table 1: A summary study of methodology

No.	Item	Sampling Technique
1	Research method	Qualitative
2	Sampling method	Purposive Sampling
3	Number of respondents	3 Students
4	Data sampling techniques	Face-to-face interview
5	Analysis	Thematic Analysis

3.2 Sample

This study involved 3 students from Politeknik Tuanku Sultanah Bahiyah who are taking Engineering Science in Session II 2023/2024 and implementing kinesthetic learning using the Moment Kit Board. Table 2 is a summary of the demographics of the respondents.

Table 2: Demographic respondent

Respondent	Gender	Semester	Programme
1	Female	2	Diploma in Civil Engineering
2	Male	2	Diploma in Electronic Engineering
3	Female	3	Diploma in Electrical Engineering

4. Finding and Analysis

The results of the interviews conducted found the effectiveness of Kinesthetics Learning Approach (KLA) using Moment Kit Board (MKB) on students's perspectives toward cognitive and psychological psychology. Assessment results reveal the impact of observation on academic performance. Each of the effects is summarised and discussed as follows:

4.1 Cognitive Effect: Level of understanding and Problem - solving skills with Kinesthetics Learning Approach using Moment Kit Board

Three respondents admitted that MKB allows students to physically manipulate components, leading to a deeper understanding of force moments through hands-on experience. This tactile interaction helps students grasp abstract concepts more effectively. Ojonugwa et al. 2023, described Kinesthetic Learning as requiring the manipulation of learning materials and hand-on learning through doing and the use of organised materials in line with the instructional objectives to make learning more concrete for better understanding. Respondents said that the level of understanding after using MKB for Topic Moment of Force effects where they are doing the task in grouping, e.g., using Moment Apps for practice questions, arranging indicator kits on board, and solving the question tends to better possess understanding.

"After using the Moment Kit Board, I have gained a deeper understanding of how to calculate the center of gravity in the Moment of Force." MKB is an interesting learning tool because it uses objects such as adjusters, arrows, boards, and apps for us to organise hands-on according to the questions. As a result, we are able to relate the questions to real-world situations.

-Respondent 1

"After the lecturer assigned us a task involving the Moment Kit Board, I quickly understood and enjoyed using it." "It's like a question translated into reality."

-Respondent 2

"For me, this MKB has helped me understand more than studying in books and whiteboards; it improves my weakness in understanding concepts."

-Respondent 3

During the interview process, the researcher found that KLA had developed strong problem-solving skills. Respondents respond that they can apply thinking skills, communication, and cooperation in teamwork. As students, they should utilize MKB, as the KLA method is more effective than the conventional one. Problem - solving is part of man coming across problems and challenges and thus requires skill and abilities that are needed to solve problems (Chukwuka, 2014).

"I'm excited to use my hands and involve thinking and exploring skills in MKB to determine the force distance and center of gravity. If I use the whiteboard method, it takes me a while to understand."

-Respondent 1

"Kinesthetic learning has helped me to master the solution and determination of the count in Moment of Force, which I did not understand before. I also like learning in groups and communicating well to succeed with them."

-Respondent 2

"One thing I like about arranging the objects on the board is that I quickly catch learning, and the group members also help solve the Moment of Force questions."

-Respondent 3

Using KLA, students perform two demonstrations in groups, where they use Moment Apps to obtain practice questions, answer questions, and manipulate and touch material on a board to enhance their learning. Due to their active learning style, they will concentrate solely on the learning activities.

4.2 Psychological Effect: Motivation and Self-confidence

The study interviewed the two essential keys to psychologically, that's motivation and self -confidence, following the approach of kinesthetics learning using MKB for the Topic Moment of Force. The results of this study revealed that respondents admitted that the hands-on approach of the Moment Kit Board makes learning more engaging and enjoyable, which can lead to increased motivation and a positive attitude towards problem-solving.

"In my opinion, hands-on experience can help strengthen my memory and increase my enthusiasm for studying."

-Respondent 1

"Yes of course because with kinesthetic learning, I am not bored at all in class and am very active while using MKB. After all, I can use my cellphone to scan and open moment apps to check the answer."

-Respondent 2

"Yes, I am very motivated because I am eager to get answers, and I am amazed at the innovativeness of the lecturers who succeeded in creating MKB for weak students. An inspiration for me."

-Respondent 3

From the respondent's perspective, KLA instilled self-confidence in the Moment of Force. These aspects included engaging and repetitive movement, hands-on opportunities to practice with manipulatives, and prioritisation of class and group work. It is not surprising that students' self-confidence increased regarding using MKB.

"When I study from a book, I'm not very confident, and it's hard to imagine. However, when I study in a group, we both help those who are not efficient and finally everyone has succeeded in finding the equation of force distance and point of gravity accurately."

-Respondent 2

The Moment Kit Board frequently facilitates group work, allowing students to collaborate and support each other. In an engineering project, students working together to solve a problem can share insights and strategies, which not only enhances their learning experience but also builds collective and individual confidence through peer support and shared success.

4.3 Academic Performance: Test Score and Quality of Assignment

To evaluate the effectiveness of using the Moment Kit Board, test scores are taken. The data analysis was taken from Force Moment Method question as Figure 4. Before solving the problem by calculation, student able to determined correctly the distance 'd'.

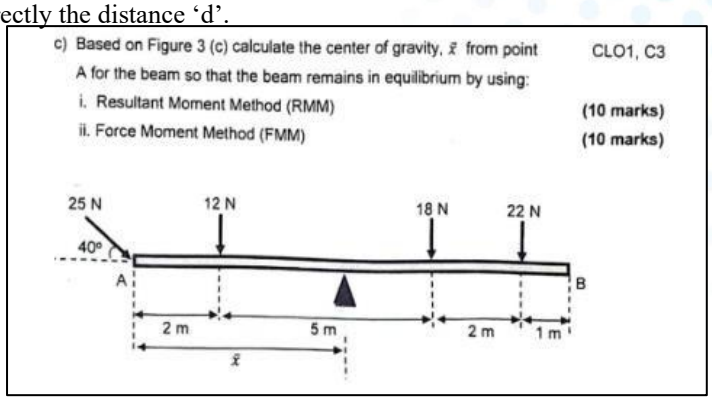

Figure 4: Test question

Figure 5 shows the analysis graph of the test results of 12 students who scored >=50% and <=50% and used the Moment Kit Board as a kinesthetics learning approach. The analysis found that 83% of students scored >=50% achievement while 17% of student made mistakes in calculations although correctly determine 'd'. The result is much better compared with previous session.

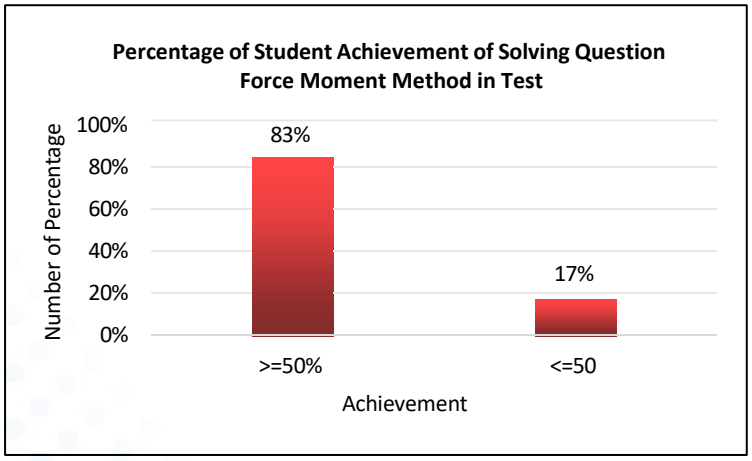

Figure 5: Percentage of Student Achievement of Solving Force Moment Method in Test

Three respondents achieved excellent results in determining the vertical distance, d, from the force's action to the centre of gravity and the question gives as Figure 6, 7 and 8. Thus, students succeed solving the questions which is demonstrate their effectiveness of using Moment Kit Board in kinesthetics learning.

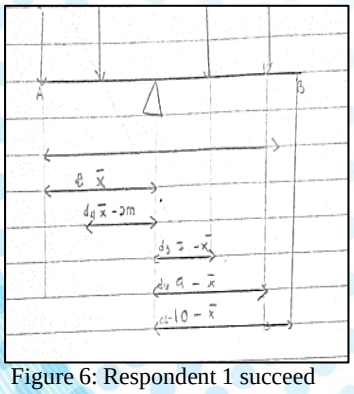

Figure 6: Respondent 1 succeed determine the distance, 'd'

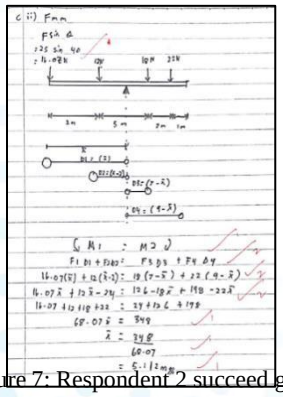

Figure 7: Respondent 2 succeed got full mark in solving the question

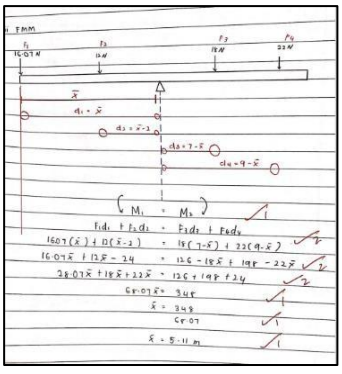

Figure 8: Respondent 3 succeed got full mark in solving the question

4.4 Discussion

Throughout the year, numerous attempts have been made to identify students' weak and difficult -to-understand understanding of the topic of Moment of Force. Therefore, effective learning methods are needed to strengthen understanding of the subject being studied. According to Chetty et al. 2019, several studies explain that students who apply learning styles according to their tendencies learn happier and can score higher on each test than those who do not practice the learning style. This explains that the right learning style can help students to learn with more fun and less stress. As a result, teachers must find an impactful way to increase students' understanding, problem-solving skills, motivation, and self-confidence through a kinaesthetic learning approach. It is easy to create a KLA that misfires because it is socially inappropriate, physically challenging, difficult to manage, or simply incomprehensible (Begel et. al. 2004). Therefore, the use of the Moment Kit Board promotes kinesthetic teaching and learning. As a result of this study through interviews, respondents agreed that the level of understanding increased better compared to traditional learning. Through this innovation, students can improve problem-solving because it involves touching objects, translating from questions to reality, and easily solving Moment of Force questions with the use of MKB and Moment Apps. Previously, they lacked concentration in class, causing their motivation to learn to decrease. After the KLA adaptation in the classroom, the enthusiasm to learn is high and more focused. Confidence in solving questions is increasing, and they can even calculate accurately. The results indicated that the student's performance on the written test was very encouraging, achieving excellent marks.

5. Conclusion

In summary, this study investigated the effects of the Kinesthetics Learning Approach (KLA) using the Moment Kit Board on the topic of the Moment of Force, as studied by engineering students at Malaysian Polytechnic who were enrolled in an Engineering Science course. This study revealed that students gained a deeper understanding and enhanced their problem-solving skills when solving the Moment of Force. In addition, the study found that KLA was more attractive and enjoyed learning in class. KLA enhance the motivation and self-confident among students more than conventional method. Based on experiences, KLA is part of the learning style for future impacts, and MKB can be modelled at other institutions of polytechnic as well effectively.

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The Implications of Multilingualism on Cognitive Ability and Personality Flexibility

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Abstract

This conceptual paper explores the implications of multilingualism on cognitive ability and personality flexibility, offering a comprehensive analysis of how proficiency in multiple languages can influence various aspects of human cognition and behaviour. Multilingualism, the ability to speak, understand, and use multiple languages proficiently, extends beyond linguistic competence to encompass a range of cognitive and psychological phenomena. Drawing on existing research and theoretical frameworks, this paper delves into how multilingualism shapes cognitive processes, focusing on executive functions, attentional control, and working memory. These cognitive functions are essential for tasks that require mental agility, such as problem-solving, managing conflicting information, and shifting between different thought processes abilities that are frequently exercised in multilingual individuals. Additionally, this paper explores the potential effects of multilingualism on personality traits linked to flexibility and adaptability. It hypothesizes that multilingual individuals may be more open to new experiences, display a greater tolerance for ambiguity, and possess an enhanced ability to navigate between diverse cultural perspectives. These traits are critical in today's interconnected world, where the ability to adapt to varying cultural contexts is increasingly valuable. The findings suggest that multilingual individuals often demonstrate superior cognitive flexibility and resilience, likely due to their ongoing engagement with multiple linguistic systems. By examining the intersections between multilingualism, cognition, and personality, this research contributes to a deeper understanding of how language diversity can foster cognitive and personal growth, offering essential insights into educational and psychological fields.

Keywords: *Personality, Cognitive, Multilingualism*

1. Introduction

Multilingualism denotes the capacity to efficiently communicate in and utilise several languages (Grech & McLeod, 2012; Okal, 2014; Cenoz, 2013). It is a common occurrence in the contemporary globalised landscape. As persons become more interconnected through travel, migration, and communication technology, the significance of multilingual proficiency has markedly increased. In addition to the pract ical benefits of interacting with varied populations, studies indicate that multilingualism may significantly impact cognitive capacity and personality adaptability. Studies in cognitive psychology indicate that multilingualism can affect cognitive capacities, including executive functioning, attentional control, and working memory （Yang H., & Yang S, 2017; Martin-Rhee & Bialystok, 2008）the continual cognitive transition between languages necessitates individuals to utilise their executive function more often. The heightened demand for executive control may augment attentional regulation and enhance problem-solving abilities in multilingual persons.

2. Literature Review

This literature review provides a comprehensive overview of the research on the relationship between multilingualism and personality flexibility. Multilingualism refers to the ability to speak and understand multiple languages. Over the years, there has been growing interest in understanding the implications of multilingualism on cognitive ability and personality flexibility. It aims to explore various studies conducted in this field and highlight the correlation between linguistic diversity and psychological qualities associated with adaptability has garnered interest in recent years. Multilingual individuals frequently exhibit enhanced open-mindedness, tolerance for ambiguity, and adaptation in varied cultural circumstances. This conceptual article examines the potential impacts of multilingualism on cognitive processes and personality qualities associated with flexibility and adaptation. By reviewing current literature from diverse fields, including cognitive psychology, psycholinguistics, and personality psychology, we may thoroughly comprehend the interplay between multilingualism and these domains.

Definition of Multilingualism

Multilingual individuals have been characterised by diverse terminology and interpretations within

educational and scientific contexts. Certain frequently utilised terms, such "bilingual" and "dual language learner," may be encompassed by or significantly overlap with the designation "multilingual" (Tucker & Richard, 1999). Multilingualism, defined as the "use of two or more languages by individuals or societies," entails the ability to communicate in diverse circumstances (Biseth, 2009). Multilingualism refers to the capacity to utilise three or more languages, either independently or with varying degrees of code-mixing. Various languages serve distinct functions, and proficiency differs based on register, profession, and education" (McArthur, 1992). This conceptual paper defines individuals who acquire two or more languages concurrently or study a second language alongside their native language(s) as multilingual.

Cognitive ability

Numerous studies have demonstrated that bilingualism or multilingualism can increase cognitive ability. Multilingualism positively impacts the cognitive capacity of speakers, however this is a contentious issue; the relationships among these processes are intricate (Antoniou, 2019). Simultaneously, various fundamental underlying multi-functional cognitive abilities, including working memory and information inhibition (Antoniou, 2019; Bialystok, 2017; Zhang, 2018). Multilingual persons frequently have enhanced executive function skills, including attention management, inhibition of extraneous information, and task -switching ability. These improved cognitive faculties arise from the continual mental exertion necessitated by the management of many languages. Mepham and Martinovic (2018) shown that multilingualism correlates with enhanced cognitive flexibility, resulting in greater acceptance of outgroups. Evidence suggests that acquiring multiple languages may confer cognitive benefits, especially for persons with high proficiency who often utilise their languages (Mosca & De Bot, 2017).

Multilingual persons generally exhibit superior language processing abilities compared to monolinguals. This advantage is evident in domains such as reading comprehension and problem-solving skills, which necessitate linguistic analysis and reasoning across various languages (Adesope, Lavin, Thompson, & Ungerleider, 2010; de Bruin, Treccani, & Della Sala, 2015; Donnelly, 2016; Grundy & Timmer, 2017; Hilchey, Saint-Aubin, & Klein, 2015; Hilchey & Klein, 2011; Lehtonen et al., 2018; Paap, Johnson, & Sawi, 2015; Zhou & Krott, 2016). Language mixing, specifically code-switching, is a prevalent characteristic of bilingual discourse, governed by rules, and demonstrates an advanced cognitive technique that allows listeners to utilise the attributes of bilingual speech throughout its production (Fricke, Kroll, & Dussias, 2016). Multilingual individuals are now seen as exemplars for comprehending how linguistic experiences influence cognition and neural processes (Kroll, Dussias, Bice, & Perrotti, 2015). Recent studies have validated the assertion that the capacity to manage multiple languages yields broader implications for bilinguals and multilinguals, augmenting their ability to disregard extraneous information, transition between tasks, and navigate conflicts among various options (Bialystok, Craik, & Luk, 2012).

Bilingual children have long been asserted to possess superior cognitive processing ability. Nonetheless, recent research indicates the opposite (Gunnerud, 2021; Poarch & van Hell, 2012). Numerous studies indicate that bilingual individuals, despite having the option to select their preferred language for vocabulary assessments, generally exhibit inferior performance compared to their monolingual counterparts (Bialystok, 2017; Bialystok, Craik, & Luk, 2012; Bialystok et al., 2009; Oller, 2005). Moreover, the cognitive assessments devised by neuroscientist Adrian Owen discern deficiencies and distinctions among diverse clinical and healthy groups. Moreover, Nichols (2020) asserted that bilingualism provides no overarching cognitive benefits in her study, which encompassed 11,000 samples. Associate Professor Hilde Lowell Gunnerud from the University of Stavanger acknowledged that multilingualism offers significant advantages; yet, in terms of cognitive processing abilities, no distinctions exist between monolingual and bilingual children (Gunnerud, 2021). Consequently, further study is warranted to ascertain the effects of multilingualism on young and adult learners across diverse demographic profiles.

Personality Flexibility

Some studies suggest that multilingualism may influence personality traits such as openness to experience and adaptability. Bilingual individuals often display increased flexibility in thinking and problem-solving due to their exposure to different cultural perspectives in various languages. The model indicated significant positive path coefficients between multilingualism, flexibility, social initiative, and open -mindedness (Dewaele & Botes, 2020). Multilingualism refers to the ability to speak and understand multiple languages, while personality flexibility pertains to one's ability to adapt their behaviour and attitudes based on the situation or context. There is evidence that suggests a relationship between multilingualism and personality flexibility. Learning and using multiple languages can expose individuals to different cultural norms, perspectives, and communication styles. This exposure may enhance their ability to understand and empathize with others and adapt their behaviour accordingly. Furthermore, bilingual or multilingual individuals often need to switch between languages depending on the situation, which requires cognitive flexibility. This

constant switching may also foster adaptability in other aspects of life. However, it is essential to note that individual differences exist in multilingualism and personality flexibility. Some people may naturally possess greater personality flexibility regardless of language abilities, while others may struggle with adapting their behaviour despite being proficient in multiple languages. While much of the current research on bilingualism has concentrated on its effects on executive functions such as attention, inhibition, and shifting (Fürst & Grin, 2023), there is an emerging recognition of the broader cognitive implications of multilingualism that extend beyond these traditional domains. Cognitive flexibility, creativity, and social cognition are increasingly being examined as areas where bilingual and multilingual individuals may exhibit distinct advantages. These additional cognitive domains provide a more nuanced understanding of how managing multiple linguistic systems influences human cognition.

Cognitive Flexibility and Creativity

Recent research highlight that the cognitive advantages of multilingualism extend beyond executive control. Research is commencing to investigate how multilingual persons execute tasks necessitating creative thinking, indicating a possible correlation between the cognitive flexibility acquired through language switching and improved creative abilities. Bilingual individuals frequently achieve superior scores on assessments of divergent thinking, which necessitates the generation of numerous solutions to ope n-ended issues (Kharkhurin, 2020). The correlation between multilingualism and creativity indicates that proficiency in various languages may enhance cognitive flexibility, providing benefits in problem-solving and inventiveness beyond linguistic activities.

Multilingualism and Social Cognition

A burgeoning topic of inquiry is the correlation between multilingualism and social cognition, encompassing the capacity to comprehend and anticipate the mental states of others. Bilinguals and multilinguals frequently modify their language and communication approaches based on the listener, cultivating a heightened understanding of others' views and intents. Research indicates that bilingual children generally excel above monolinguals in theory of mind assessments, which evaluate the capacity to ascribe mental states to oneself and others (Fan et al., 2015). This improved social cognition is thought to arise from traversing various cultural and language environments, thereby refining abilities in empathy, perspective - taking, and successful communication..

The Malaysian Context and the Lack of Assessment Tools

Despite prevalent multilingualism in nations such as Malaysia, where linguistic diversity is fundamental to the social structure, a deficiency persists in research and evaluation instruments for appraising the cognitive and language development of multilingual children. In Malaysia, multilingualism is ingrained in both urban and rural communities, with children frequently raised in settings where they encounter many languages concurrently (Razak et al., 2021). Nonetheless, there is a significant deficiency of standardised instruments intended to evaluate the linguistic capabilities of multilingual children, especially those susceptible to language damage.

Razak et al. (2021) emphasise the necessity for customised assessment tools that account for the distinct linguistic contexts of multilingual children in Malaysia. The current assessment instruments, frequently created in monolingual environments, may inadequately reflect the linguistic abilities or shortcomings of youngsters exposed to several languages. This matter is crucial as timely and precise diagnosis of language deficits is vital for administering suitable therapies. The lack of such instruments in multilingual communities may result in underdiagnosis or misdiagnosis, thereby depriving children of the necessary help to realise their full linguistic and cognitive potential.

Toward a More Comprehensive Understanding

The investigation of bilingualism and multilingualism extends beyond executive processes to examine the wider cognitive and social ramifications of navigating several languages. Fürst and Grin (2023) propose that the relationship between bilingualism and cognition encompasses more than merely attention, inhibition, and shifting. The discipline is starting to acknowledge that multilingualism enhances cognitive flexibility, creativity, and social cognition, providing a deeper insight into how linguistic diver sity influences the mind.

In the Malaysian setting, where multilingualism is inherently prevalent, the deficiency of sufficient evaluation methods highlights the necessity for additional study and innovation. Rectifying this deficiency may yield more precise assessments of multilingual children's linguistic competencies, guaranteeing that those susceptible to language deficits obtain requisite assistance. Moreover, it would offer a more thorough comprehension of the cognitive benefits that multilingual individuals may experience, thereby guiding educational and healthcare approaches in multilingual communities globally.

Multilingualism in Malaysia

Over the past five years, studies on multilingualism in Malaysia have explored the impact of language diversity on cognitive development, educational outcomes, and social identity. Razak et al. (2021) investigated the evaluation of linguistic competencies in multilingual Malaysian children susceptible to language deficits. Their research sought to create culturally relevant evaluation instruments, as prior methods did not consider the intricate linguistic contexts of these children. The findings revealed a substantial deficiency in the appropriate diagnosis of language impairments, as the majority of current instruments are designed for monolingual environments. This disparity highlighted the necessity to create localised evaluation tools that accurately represent Malaysia's multilingual context.

Mahadhir et al. (2020) investigated the cognitive benefits of bilingual and multilingual individuals, emphasising working memory and attentional control. The study revealed that multilingual Malaysians excelled in tasks necessitating memory retention and attentional shifts, suggesting that linguistic diversity enhances cognitive flexibility. This study elucidated the cognitive advantages that multilingualism may confer upon educational systems in Malaysia.

Additional research has concentrated on the societal dimensions of multilingualism. Lim et al. (2022) examined the impact of translanguaging strategies on student involvement and identity formation in Malaysian classrooms. Their research sought to determine if permitting students to utilise different languages in the classroom improved learning outcomes and engagement. The results indicated that translanguaging promoted a more inclusive and engaging educational atmosphere, enhancing students' confidence in participation. Furthermore, Ali and Hashim (2021) examined the influence of multilingualism on the formation of social identities, especially among the many ethnic communities in Malaysia. Their research indicated that linguistic diversity is essential for preserving cultural identity and promoting cross-cultural communication. Ismail et al. (2023) adopted a psychological perspective, examining the impact of multilingualism on cognitive ageing in elderly Malaysians. The study indicated that multilingual elderly individuals exhibited enhanced cognitive resilience and a postponed onset of cognitive decline, implying that the continual mental management of various languages fortifies cognitive reserves over time. This collection of research highlights the diver se impact of multilingualism on cognitive, educational, and social outcomes in Malaysia.

The correlation between multilingualism and language proficiency in educational settings has been extensively examined. Wong et al. (2021) investigated the effects of bilingual education policy on the English ability of Malaysian pupils. Their findings indicated that kids in bilingual programs generally exhibited superior performance in English, suggesting that exposure to various languages can improve competency in the target language. Kaur and Singh (2022) examined the impact of multilingualism on student s' reading comprehension across many topics, discovering that individuals exposed to numerous languages throughout their education excelled in inferential reading tasks. This enhancement was ascribed to the cognitive flexibility acquired from navigating several linguistic systems. Additionally, Che Omar and Zahari (2020) investigated the influence of multilingualism on instructors' instructional methodologies in classrooms with pupils who speak various languages. The research indicated that educators who adopted multilingualism exhibited superior classroom management and enhanced student engagement, as they were able to communicate with students in their native languages while facilitating language acquisition.

Finally, research conducted by Tan et al. (2019) and Jamaluddin et al. (2021) examined the impact of multilingualism on workplace communication in Malaysia. Tan et al. (2019) examined the ability of multilingual personnel to manage intercultural communication across international corporations, demonstrating that those proficient in many languages exhibited greater adaptability and enhanced performance in multicultural teams. Jamaluddin et al. (2021) examined the influence of multilingualism on dispute resolution in the workplace, concluding that multilingual individuals are more effective mediators due to their linguistic and cultural expertise. These studies illustrate that multilingualism in Malaysia influences cognitive and educational outcomes and is vital in professional and social contexts, hence highlighting its extensive impact.

Potential Future Research Exploration

Despite the growing body of research on multilingualism in Malaysia over the past five years, several significant benefits from further exploration.

Lack of Longitudinal Studies

Although several research investigate the cognitive, educational, and social ramifications of

multilingualism, the majority are cross-sectional, offering merely a temporal snapshot of its consequences. Longitudinal studies that monitor individuals over time are essential for a comprehensive understanding of how multilingualism influences cognitive development, academic performance, and social integration throughout various life stages.

Limited Focus on Non-Mainstream Communities

A significant portion of the research on multilingualism in Malaysia has concentrated on urban, mainstream, and educational settings, frequently neglecting rural and indigenous populations. These groups encounter diverse linguistic environments, necessitating studies to investigate the functioning of multilingualism in these under-explored circumstances. Furthermore, investigations encompassing the experiences of minor ethnic groups and the interplay of multilingualism with their cultural practices would yield a more thorough comprehension of the language environment.

Multilingualism and Language Impairment

While studies such as Razak et al. (2021) highlight the need for localized assessment tools to diagnose language impairments in multilingual children, more research is needed to develop and test these tools. Furthermore, there is a lack of in-depth investigation into how multilingualism may influence the diagnosis, treatment, and outcomes for children with language impairments or developmental disorders.

Impact of Digital Multilingualism

Despite the growing prevalence of digital platforms that utilise multiple languages in social media, gaming, and online communication, there is a paucity of research investigating the impact of digital multilingualism on cognitive development, literacy skills, or language acquisition among Malaysian children and adolescents. Investigating the influence of digital tools and platforms in a multilingual culture may provide significant insights into contemporary language patterns.

Adult and Older Populations

Despite the initiation of research by Ismail et al. (2023) on cognitive ageing in older multilingual persons, there remains a significant deficiency in studies examining the effects of multilingualism on the cognitive health of adults and the elderly in Malaysia. Further extensive research is required to examine the impact of lifelong multilingualism on memory, executive functioning, and social cognition as persons age.

Interdisciplinary and Sociocultural Dimensions

Although cognitive and educational research on multilingualism is well-established, there exists a deficiency of interdisciplinary approaches that incorporate findings from sociology, anthropology, and political science. Comprehending the impact of multilingualism on social integration, identity development, and intergroup relations across many locations and ethnicities would yield a more comprehensive perspective on its consequences. Furthermore, investigating the influence of government policies, societal attitudes, and language planning on the multilingual experiences of Malaysians could enhance the analysis.

Teacher Training and Pedagogical Approaches

While several studies have explored the impact of multilingualism on teachers' instructional practices, there remains a deficiency in comprehensive research about the preparedness of teacher training programs to educate educators for managing multilingual classrooms. Additional study is required to investigate effective educational strategies that enhance the cognitive and social advantages of multilingualism in varied classroom environments.

Economic and Workplace Impact

Despite investigations such as those by Tan et al. (2019) and Jamaluddin et al. (2021) examining the impact of multilingualism on workplace communication and conflict resolution, further research is required to understand how multilingual proficiency affects career progression, economic mobility, and cross-cultural collaboration in professional environments. The potential of multilingualism as a competitive advantage in the workforce is an inadequately examined domain.

3. Discussion

The effects of multilingualism on cognitive capacity and personality adaptability have received heightened scrutiny in both international and regional settings. Multilingual proficiency is linked to numerous cognitive and behavioural advantages, such as improved executive functioning, superior memory retention, heightened

cognitive flexibility, and enhanced adaptation in social contexts. Despite major advancements in research within this domain, especially in Malaysia, there exist gaps that hinder a thorough comprehension of the whole effects of multilingualism on cognition and behaviour.

Cognitive Ability and Multilingualism

The correlation between multilingualism and cognitive capacity, especially in executive functions such as attention, task-switching, and inhibition, has been extensively documented. Research indicates that multilingual individuals surpass monolinguals in tasks necessitating cognitive control and flexibility (Bialystok, 2017). Nonetheless, a significant portion of this research has been cross-sectional, providing merely a transient perspective on the impact of multilingualism on cognitive development. The ab sence of longitudinal studies constitutes a substantial deficiency in comprehending the influence of multilingual proficiency on cognitive abilities over time. It is uncertain how multilingualism influences cognitive ageing or if the cognitive advantages noted in childhood endure into adulthood and old age (Lin, 2018). Longitudinal research monitoring individuals over their lifespan would yield more nuanced insights into the impact of multilingualism on cognitive development, especially in diverse linguistic environments such as Malaysia.

Furthermore, although research on multilingualism in Malaysia has progressed in urban and educational contexts, the emphasis on mainstream urban populations restricts the applicability of the findings. The narrow emphasis on non-mainstream communities, including rural and indigenous populations, results in an incomplete understanding of the cognitive effects of multilingualism. These communities encounter distinct linguistic challenges and practices, potentially leading to varied cognitive outcomes. Investigating multilingualism in rural or indigenous contexts may uncover distinct cognitive adaptations or challenges absent in more urbanised, dominant-language environments. Such studies would enhance the understanding of how multilingualism influences cognitive ability across various environments.

Personality Flexibility and Social Dynamics

Multilingualism's influence on personality flexibility is another area of growing interest. Multilingual individuals often demonstrate greater adaptability and social sensitivity, as managing multiple languages requires adjusting behaviours and communication strategies based on the social and cultural context. However, much of the current research, including studies in Malaysia, focuses predominantly on cognitive aspects of multilingualism, leaving interdisciplinary and sociocultural dimensions underexplore d. Understanding how multilingualism affects identity formation, social integration, and intergroup dynamics requires sociology, anthropology, and political science insights. For instance, how does speaking multiple languages affect one's sense of identity within Malaysia's ethnically diverse population? How do multilingual individuals navigate cross-cultural boundaries, and how does this adaptability translate into broader social behaviours? These questions remain underexplored but are crucial for understanding the full impact of multilingualism on personality flexibility and social dynamics.

Gaps in Educational and Pedagogical Approaches

The significance of multilingualism in educational settings has been examined, especially about how translanguaging and other multilingual activities augment student engagement and identity formation. Although several studies, such as Lim et al. (2022), have investigated the potential of multilingualism to enhance learning outcomes, there is a deficiency of comprehensive research regarding the efficacy of teacher training programs in preparing educators to effectively manage multilingual classrooms. This disparity is especially pronounced in Malaysia, where classrooms frequently comprise kids from various language origins. Educators may be deficient in the training or resources necessary to effectively leverage the cognitive and social advantages of multilingualism, leading to lost opportunities for improving student engagement and academic performance. Investigating how educators are equipped to manage these challenges may provide pragmatic ideas for optimising the benefits of multilingualism in education.

Language Impairment and Digital Multilingualism

An associated yet less examined domain is the interaction between multilingualism and language deficits. Research, including that of Razak et al. (2021), has underscored the necessity for localised assessment instruments to identify language impairments in multilingual children; nonetheless, further investigation is required to comprehend the impact of multilingualism on the diagnosis and treatment of these impairments. This is especially significant in Malaysia, where children frequently develop in intrica te linguistic contexts that may influence the manifestation and treatment of language problems. The deficiency of research on multilingualism and language impairment creates a significant void in the literature, especially for children with developmental disabilities.

Furthermore, digital multilingualism, defined as the use of several languages on digital platforms like social media, gaming, and online education, remains inadequately examined within the Malaysian context. The impact of digital multilingualism on cognitive development, literacy, and language acquisition in children and adolescents remains inadequately comprehended amongst the growing popularity of digital communication. Investigating how Malaysian youth manage multilingualism in digital contexts may provi de significant insights into the impact of digital tools on contemporary language practices and cognitive development. The digitalisation of learning necessitates an understanding of how multilingualism is developed in online environments, which could guide future educational policies and interventions.

Cognitive and Social Health in Older Populations

Although there is increasing evidence that multilingualism may safeguard against cognitive decline in older adults (Ismail et al., 2023), further extensive investigations are required to investigate the effects of lifelong multilingualism on memory, executive function, and social cognition as individuals age. In Malaysia, where the population is ageing swiftly, comprehending the enduring cognitive and social advantages of multilingualism in older persons is becoming increasingly vital. The adult and elderly populations are under- represented in multilingualism research; future studies should evaluate how multilingualism can enhance cognitive health and social well-being in ageing populations.

Economic and Workplace Implications

While research by Tan et al. (2019) and Jamaluddin et al. (2021) has examined the influence of multilingualism on workplace communication and conflict resolution, a significant gap remains in comprehending its effects on career development and economic mobility. Multilingual proficiency is frequently regarded as an asset in globalised workplaces; yet, limited study has been conducted to investigate its potential as a competitive advantage. Further research is required to examine the impact of multilingualism on job performance, leadership prospects, and cross-cultural collaboration in professional environments.

Although considerable evidence endorses the cognitive and social advantages of multilingualism, notable deficiencies persist in comprehending its enduring effects and wider societal ramifications. Longitudinal research, inclusive studies on non-mainstream cultures, and interdisciplinary approaches are essential to provide a more thorough understanding of the impact of multilingualism on cognitive capacity and personality flexibility. Rectifying these deficiencies will enhance the scholarly literature and guide educational policies, social integration methods, and employment practices in multilingual countries such as Malaysia.

4. Implication of the study

This conceptual study examines the effects of multilingualism on cognitive ability and personality flexibility, providing notable contributions to academic knowledge and practical applications in educational, social, and professional settings. The findings highlight the substantial influence of multilingualism on human cognition and conduct, while revealing critical gaps that require additional investigation. The following are the significant consequences of this study:

Cognitive Development and Educational Practices

This study holds considerable significance for educational systems, especially in multilingual nations such as Malaysia. The study indicates that multilingualism improves cognitive functions, including memory, attention, and problem-solving, hence serving as a significant advantage in academic success. To capitalise on these cognitive benefits, educational institutions and instructors can gain by incorporating multilingual methodologies, such as translanguaging. Creating environments that enable students to utilise several languages for learning enhances cognitive flexibility and fosters deeper engagement and comprehension of content across disciplines. The findings indicates the necessity for additional longitudinal research to monitor the enduring cognitive advantages of multilingualism throughout various phases of academic development.

Addressing Gaps in Language Impairment Diagnosis

The research highlights that although multilingualism provides cognitive advantages, it also poses difficulties in the diagnosis and treatment of language problems in multilingual children. This has considerable ramifications for healthcare procedures and language development programs. Existing assessment instruments may inadequately address the intricacies of multilingual contexts, resulting in misdiagnosis or underdiagnosis of language disorders. This study advocates for the creation of diagnostic methods that are more culturally and linguistically responsive, accurately representing the linguistic realities of multilingual children, particularly in diverse language environments like Malaysia. This will facilitate more precise identification and intervention for language-related developmental disorders, resulting in improved educational results for

children with language impairments.

Policy Development in Multilingual Societies

The study indicates that government and educational policymakers should acknowledge the extensive cognitive and social advantages of multilingualism. Language policies that advocate for multilingualism in school, public institutions, and professional environments may augment cognitive and social growth. National curriculum that incorporate many languages, particularly those of minority groups, can aid in the preservation of linguistic variety while enhancing students' cognitive and social adaptability. This is especially pertinent in the Malaysian context, where it is essential to achieve a balance between promoting national unity and safeguarding the linguistic and cultural identities of many ethnic groups.

5. Conclusion

The ramifications of multilingualism on cognitive capacity and personality adaptability are significant, providing important insights into how mastery of multiple languages improves diverse facets of human cognition and behaviour. This study substantially enhances the existing knowledge by emphasising cognitive advantages, including enhanced memory, executive functioning, and cognitive flexibility, which are crucial for academic achievement and lifetime learning. Moreover, it demonstrates the beneficial eff ects of multilingualism on personality adaptability, social empathy, and cross-cultural communication, which are essential in today's progressively globalised and interconnected environment.

This study emphasises the necessity of incorporating multilingualism within educational, social, and professional frameworks. By acknowledging and utilising the cognitive and social advantages of multilingual individuals, educational institutions, policymakers, and employers may cultivate more inclusive and productive environments that foster these skills. The study underscores the necessity for additional investigation into longitudinal effects, the experiences of non-mainstream communities, and the influence of digital platforms on multilingual behaviours.

This study is significant not only for its contributions to the academic understanding of multilingualism but also for its potential to influence future educational practices, social policies, and workplace strategies, thereby serving as a foundation for promoting cognitive health, social cohesion, and cultural competence in multilingual societies.

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Design, Development and Implementation of PLC Educational Trainer Kit as Teaching and Learning Tool aid at Kolej Komuniti Beaufort

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Abstract

The demand for skilled PLC technicians continues to rise across industries. Effective PLC training is crucial for equipping students with the knowledge and practical skills required by the industries. This research focuses on the design and development of a PLC Educational Trainer Kit aimed at enhancing PLC teaching and learning in community college students. The primary objective is to provide teachers and students with appropriate teaching aid tools and learning material for PLC courses to make teaching sessions easier, interesting, and more effective. The project addresses the challenges associated with PLC courses, including unsuitable teaching aid tools and limited learning resources. Preliminary studies have found that there is no readymade trainer kit module developed for PLC courses specifically at Kolej Komuniti Beaufort. Therefore, this project developed a PLC Educational Trainer Kit integrating hardware and a mobile app to enhance PLC teaching and learning session among community college students. The hardware includes 4 trainer kit modules, which include an input/output module, a Bluetooth module, and radio frequency modules that can be connected to a main PLC device, while the mobile app module provides interactive notes, videos, and other teaching material such as worksheets and assessment tasks. Employing the ADDIE model to develop the trainer kit, the kit was evaluated through student perception using google form questionnaire. Preliminary findings indicate that the PLC trainer module successfully captivates students' interest, improves understanding of PLC concepts and improves the effectiveness of practical learning experiences.

Keywords: - Programmable Logic Controller, Teaching and learning-aid, Mobile Apps

1. Introduction

One type of controller that is frequently utilized in the manufacturing and transportation sectors is the Programmable Logic Controller (Tafakur et al., 2020). A PLC consists of hardware and software designed to control machines or processes, with the capability to manage multiple input/output configurations. (Akparibo et al., 2016). There are several benefits of PLC that make it a reliable choice for industries due to its cost - effectiveness, flexibility, reliability, and toughness. Programmable Logic Controllers (PLCs) have become indispensable in modern automation systems, spanning industries from manufacturing to building automation. However, traditional PLC education often relies on theoretical knowledge and limited hands-on experience, hindering students' ability to apply concepts to real-world applications. To address this gap, this research proposes the design and development of a PLC Educational Trainer Kit as a versatile learning tool aid for community colleges.

The PLC Educational Trainer Kit aims to provide students with a comprehensive and interactive platform to explore PLC programming, troubleshooting, and operation. By simulating industrial environments and offering a variety of practical exercises, the kit will enable students to develop essential skills and knowledge required for successful careers in automation and control engineering. By bridging the gap between theoretical knowledge and practical application, the PLC Educational Trainer Kit has the potential to revolutionize PLC education in community colleges. This research aims to contribute to the development of skilled automation professionals who are equipped to meet the growing demands of the industry.

1.1 Problem Statement

PLC is a compulsory subject that must be taken by students of the Electrical Technology Unit at Kolej Komuniti Beaufort when they are in the 2nd semester of studies. Although basic equipment and accessories for learning PLC are already available, but they come separately. Similarly, there is no centralize d learning material that can be utilized immediately for teaching and learning sessions. Therefore, there is a need to develop a teaching aid that can facilitate the teaching and learning process either to access learning notes or as teaching material to carry out practical work.

2. Literature Review

Some research highlights have been done in developing this educational trainer kit. Akparibo et al., (2016)

have developed platform for PLC training which focus in industrial controls. Wiring and programming any kind of inputs and outputs is made flexible with this training technique. Arowolo, et al., (2020) proposed the design step for PLC Trainer Workstation. The proposed PLC Trainer discuss about the hardware connection of the input/output component with its descriptions. It aims to train the participants on PLC Programming language. The findings showed that comprehension of the design phase module and ladder logic as a programming module had significantly improved.

Meanwhile Sudarto, et al., (2021) discuss the development of the Omron CP1E as a teaching tool in their practicum activities in the Control System Engineering Laboratory. Basically, the researchers use the OMRON CP1E PLC trainer as the basis of teaching aids to support the existing OMRON C28H equipment. The results of the study show that the CP1E PLC is more efficient compared to the C28H PLC model. Another researcher, Pratama, H. et al., (2021) has also develop an PLC teaching aid, but it is designed to be used for electrical motor installation course. The results revealed that, on average, the respondents agreed that using training kits is very suitable for learning session that involves theory and practice.

According to Khairudin et al. (2019), in their investigation, discovered variations in the proficiency level of pupils utilizing PLC teaching tools. When using PLC teaching aids for simulations, students' interest and performance in learning competencies are higher than when they do not use the aids in their learning activities. Likewise, the results of the study conducted by Sukir et al. (2019) found that the use of Conveyor trainer kits along with PLC practical learning modules can enhance student learning outcomes in cognitive, psychomotor, and affective domains respectively.

Thus, from the previous study the researchers think there is a need to develop an educational trainer kit for PLC course that meets the content of the syllabus and adapts to the existing equipment at Kolej Komuniti Beaufort itself. The educational trainer kit that was developed was improved in terms of the addition of interactive mobile applications and diversifying the input device to make students more interested and focused during the learning session.

3. Methodology

This PLC Trainer Education Kit package was designed and developed using the ADDIE model as a guide. The five stages of development are referred to as analysis, design, development, implementation, and evaluation, or ADDIE for short. ADDIE paradigm lowers the possibility of subpar execution. By applying this methodology guarantees that all development phases are finished prior to implementation, which is suitable for this innovative product. The process of ADDIE model is depicted in Figure 1.

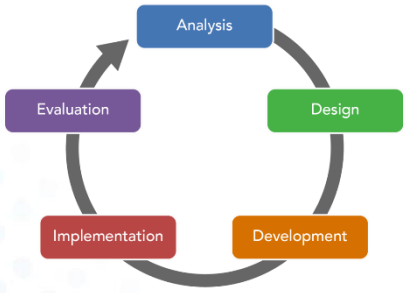

Figure 1 : ADDIE Model

3.1 Design & Development

The primary goal of this project is to provide a teaching and learning tool for PLC courses that will benefit both instructors and students. The following requirements must be fulfilled by the educational trainer tools that are developed:

The content satisfies the syllabus's theoretical and practical requirements.

Notes, assignments, and other learning materials are gathered in a centralized and easily accessible manner.

It is user-friendly and engaging for students.

It applies elements—such as multimedia, IoT, and basic AI—in accordance with the present educational policy.

In order to accomplish this, the educational trainer kit created will be divided into multiple modules as

shown in Figure 2. Overall, there are 4 main module that are developed for this PLC Educational Trainer Kit such as:

i. Mobile Apps module (iN-PLC)
ii. Bluetooth module
iii. Radio-Frequency Module
iv. Input/Output module

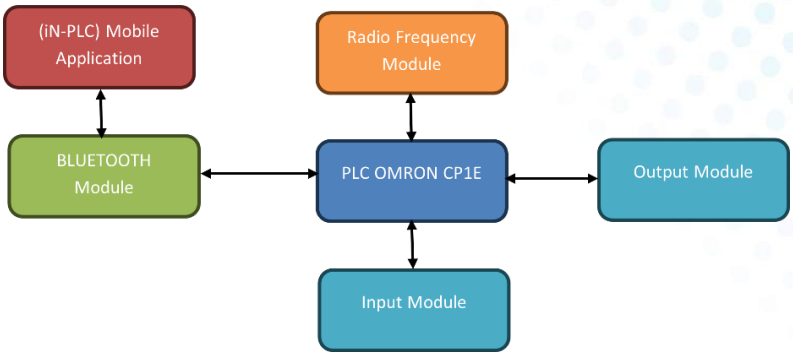

Figure 2 : Design Model for PLC Educational Trainer Kit

The primary source of information for this PLC Educational Trainer Kit is the developed smartphone application (iN-PLC) as in Figure 3. It serves as a hub for educational resources, containing all the interactive notes, videos, assignments, assessments, and general course information in one convenient application that can be accessed by both instructors and students.

Figure 3 : Design Model for Mobile Apps (iN-PLC)

Additionally, this application also applies the IoT function, where it can act as an input signal to the PLC to control the output devices. It can be connected to the PLC through a Bluetooth module. Bluetooth module is one of the trainer modules developed. It is used together with the (iN-PLC) application to connect the smartphone application to the PLC input terminal. This mobile apps can remote the input signal to the PLC and can be programmed using Ladder Diagram to control various types of output devices and control operation such as forward-reverse, Star-Delta motor control, conveyor system application and so on. With it, students can carry out practical's by using smartphone, in addition to controlling the PLC output manually through the push button devices. This App also have a basic function for AI using the "Object Identifiers" concept.

All things considered; this mobile application gives students all the information and learning resources they require to study the PLC course. This mobile application is built using MIT APPS software and is available through the Google Play Store service. While the Bluetooth module is built using Arduino Uno, Bluetooth module HC-05, and connectors. Figure 4 show the Bluetooth module along side the mobile apps smartphone.

Figure 4 : Design Model for Mobile Apps (iN-PLC) and Bluetooth Module

The third trainer kit module uses radio frequency technology to establish a wireless connection with the OMRON CP1E PLC. It can also be programmed using a ladder diagram, and by feeding input signals to the PLC directly, it can control several kinds of PLC devices outputs. It will provide students with a variety of options to carry out practical work while also attracting students' interest. Figure 5 show the design model for Radio-Frequency Module.

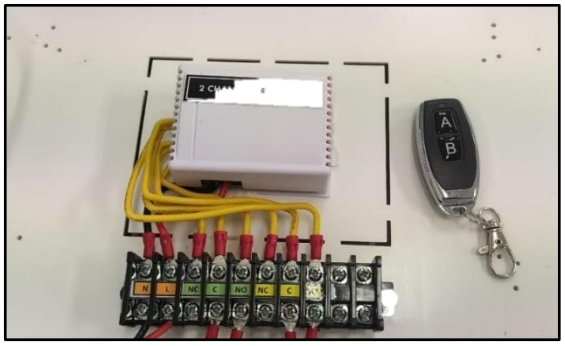

Figure 5 : Design Model for Radio-Frequency Module

For the 4th trainer kit module, which is the Input/Output module, it is further divided into two separate modules. The first module is a push button and pilot lamp module as in Figure 6. The push button functions as an input to send a signal to the PLC, while the pilot lamp functions as an output device. The construction of this module consists of:

a) 3 x push button (normally open), 1 x push button (normally close)

b) 4 x pilot lamps

c) 2 x terminal blocks

The second module is a 4-Channel Contactors as in Figure 7 which is an output device for the PLC. The construction of this module consists of:

a) 4 x 220 V - 240 V 50Hz contactors

b) 1 x terminal block

Figure 6 : Design Model for Input/Output Module – Push button and Pilot Lamp module

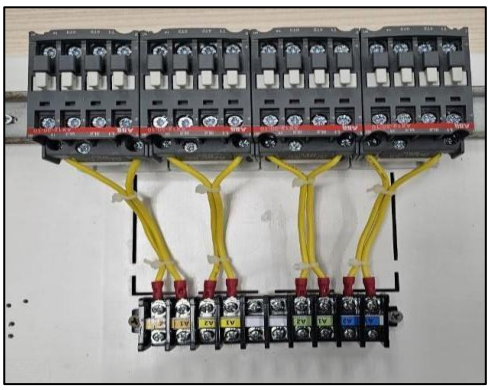

Figure 7 : Design Model for Input/Output Module – 4 Channel Contactor

All these trainer kits are self-built and adapted to the current syllabus and equipment for the PLC course implemented at Kolej Komuniti Beaufort.

4. Finding and Analysis

To evaluate the effectiveness and satisfaction of PLC Educational Trainer Kit, 46 respondents were selected from students of Electrical Technology Unit, Kolej Komuniti Beaufort to answer the questionnaire. All the students are in semester 2 and just completed the PLC Course which uses the PLC Educational Trainer Kit that was developed. Table 1 shows the data of respondents that participate in this survey.

Table 1: Sample Data

Session	**Subject**	**No. Of Participant**
Session II 2022/2023 (SKE 2A)	SEW 40034 *Pengawal Logik Boleh Aturcara*	23
Session II 2022/2023 (SKE 2B)		23
Total		46

The survey questionnaire is divided into two sections. Section A is a survey of the Design, Interface and Safety of the PLC Educational Trainer Kit, while Section B is the perception of the respondent in terms of suitability of the PLC Educational Trainer Kit as a learning tool in SEW40043 PLC Course. The research data will be analyzed using SPSS v.24 software to find the mean score. The mean score value will be translated to the level value as suggested by Landell. (1997) as in Table 2.

Table 2: Design PLC Educational Trainer Kit

Range of Mean Score	Frequency, f
1.00 – 2.33	Low
2.34 – 3.67	Average
3.68 – 5.00	High

Table 3: Design PLC Educational Trainer Kit.

QUESTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Score	Standard Deviation
PLC Educational Trainer Kit has an interesting, creative and interactive design	0 *0%*	0 *0%*	11 *23.91%*	22 *47.83%*	13 *28.26%*	4.04	0.72
PLC Educational Trainer Kit is easy to operate	0 *0%*	0 *0%*	10 *21.74%*	20 *43.48%*	16 *34.78%*	4.13	0.74
PLC Educational Trainer Kit are easy to assemble	0 *0%*	0 *0%*	12 *26.09%*	20 *43.48%*	14 *30.43%*	4.04	0.75
PLC Educational Trainer Kit is safe to use	0 *0%*	0 *0%*	11 *23.91%*	19 *41.30%*	16 *34.78%*	4.11	0.76

Table 4: Suitability and effectiveness of using Plc Educational Trainer Kit

QUESTION	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean Score	Standard Deviation
1. PLC Educational Trainer Kit content is compatible with the course syllabus	0 *0%*	2 *4.35%*	13 *28.26%*	23 *50%*	8 *17.39%*	3.80	0.77
2. The use of PLC Educational Trainer Kit in teaching and learning interests me	0 *0%*	2 *4.35%*	8 *17.39%*	23 *50%*	13 *28.26%*	4.02	0.79
3. The use of PLC Educational Trainer Kit as a teaching aid improved my understanding in the SEW40043 course more clearly	0 *0%*	2 *4.35%*	10 *21.74%*	22 *47.83%*	12 *26.09%*	3.96	0.81
4. The use of PLC Educational Trainer Kit as a teaching aid improved my skill during practical activities in the SEW40043	0 *0%*	2 *4.35%*	10 *21.74%*	117 *36.96%*	17 *36.96%*	4.07	0.87
5. PLC Educational Trainer Kit is an effective learning aid tool in classroom	0 *0%*	2 *4.35%*	8 *17.39%*	24 *52.17%*	12 *26.09%*	4.00	0.78
6. Using PLC Educational Trainer Kit makes it easier for me to make references and get learning materials	0 *0%*	2 *4.35%*	10 *21.74%*	22 *47.83%*	12 *26.09%*	3.96	0.81
7. The use of PLC Educational Trainer Kit saves time in practical implementation	0 *0%*	2 *4.35%*	8 *17.39%*	23 *50%*	13 *28.26%*	4.02	0.79
8. I was able to prepare earlier before attending class with the use of PLC Educational Trainer Kit	0 *0%*	3 *6.52%*	9 *19.57%*	23 50.00%	11 *23.91%*	3.91	0.83

9. I agree that PLC Educational Trainer Kit is suitable for use in the SEW40043 course	0 *0%*	2 *4.35%*	8 *17.39%*	21 *45.65%*	15 *32.61%*	4.07	0.82

Table 3 show the results of students' perception in terms of the Display Design, Usability and Safety of the developed PLC Educational Trainer Kit. Based on the results, 100% respondent agree that this trainer kit is interesting, easy to operate and assemble, and also is safe to use. All of their satisfaction level is at a high level (mean score above 3.68), indicate there are fully satisfy by this product design, usefulness and safety.

Table 4 show the perception of the respondent regarding the suitability and effectiveness of this PLC Education Trainer Kit. Q6 specifically show that respondents are more engaging to teaching and learning when using this trainer kit, with the mean score equal to 4.02 is at a high-level reading. Respondent also agree that this trainer kits can improve their knowledge and skill by looking at the result of Q7 and Q8 respectively where both of the mean score (Q7 = 3.96, Q8 = 4.07) also at the high-level reading. Q10 and Q11 with the mean score reading above 3.68 (High level) show that by using this Trainer Kit, respondent can easily access all the learning material and also can save time doing practical works. From result of Q5, Q9, Q13 indicated that this PLC Trainer kit is suitable to be use as teaching and learning tools with mean score also above high - level reading. Respondent are agreeing that the content of the trainer is in line with the syllabus, easy to make a reference on the learning material and therefore suitable for use as a teaching and learning tools.

Overall, we can conclude this project is successfully developed and implemented as a teaching and learning tools aid in Kolej Komuniti Beaufort. Even so there are a handful of students who do not agree with this trainer, but their number is very small.

5. Conclusion

The objective of this project was to develop PLC instructional learning materials for courses on SEW40043 Programmable Logic Controller (PLC). PLC teaching and learning aids can expedite the delivery of lessons and facilitate teacher control over their students. Effective and suitable teaching tools typically draw students in and keep them focused on the process of learning. With the help of these instructional materials, instructors may more effectively explain automation and PLC programming, both conceptually and practically. Furthermore, this trainer kit's dimensions are relatively small and light, make it portable and versatile for use in a variety of settings. Based on the findings, the respondents firmly agreed, that "PLC Educational Learning Kit" teaching aids are suitable and secure for usage by students during the teaching and learning process. In addition, it is easy to assemble and operate. Nonetheless, more research is required to determine the efficacy and influence of this trainer module consumption on the accomplishment of cognitive and psychomotor learning outcomes.

Acknowledgment

Author would like to thank the staff of the Electrical Technology Unit, Kolej Komuniti Beaufort who provided a lot of assistance and cooperation in developing this "PLC Educational Trainer Kit" teaching and learning material.

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POLITEKNIK KOTA KINABALU

Akta 174 Antara Kefahaman Dan Implikasinya Terhadap Pelajar Politeknik Dan Kolej Komuniti

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Abstrak

Isu berkaitan pemahaman pelajar terhadap Akta Institusi-Institusi Pelajaran (Tatatertib) 1976, atau lebih dikenali sebagai Akta 174, semakin mendapat perhatian, khususnya di Institusi Pengajian Tinggi (IPT) Politeknik dan Kolej Komuniti (POLYCC). Akta ini memainkan peranan penting dalam mengawal disiplin dan tingkah laku pelajar, namun terdapat kekurangan dalam kefahaman terhadap sejarah, tujuan, dan implikasinya terhadap kehidupan pelajar. Objektif kajian ini adalah untuk menilai tahap pemahaman pelajar terhadap Akta 174 serta mengenal pasti kesan yang mungkin timbul daripada pelaksanaannya di kampus. Sampel kajian melibatkan 173 pelajar POLYCC yang dipilih melalui teknik pensampelan rawak, dengan institusi yang terlibat terdiri daripada beberapa Politeknik dan Kolej Komuniti di Sabah dan Semenanjung Malaysia. Instrumen kajian yang digunakan ialah borang soal selidik, yang diedarkan melalui Google Form untuk mengumpulkan data. Data yang diperoleh dianalisis menggunakan analisis deskriptif dengan bantuan *Statistical Package for Social Sciences* (SPSS). Hasil kajian mendapati bahawa tahap kefahaman pelajar terhadap Akta 174 adalah sederhana secara keseluruhan, dengan pemahaman pelajar terhadap sejarah dan perubahan Akta 174 mencatatkan skor min yang agak rendah iaitu 2.94, manakala keperluan untuk penjelasan tambahan mengenai Akta 174 mencatat skor min setinggi 4.01. Dari segi kesan terhadap kebebasan bersuara, aktivisme politik, dan keselamatan kampus, pelajar menunjukkan pengaruh yang sederhana dengan skor min antara 3.63 hingga 3.89. Kepentingan kajian ini terletak pada cadangannya untuk meningkatkan program pendidikan dan penerangan di IPT bagi memperkukuh pemahaman pelajar terhadap Akta 174, sekali gus membantu mengurangkan sebarang implikasi negatif yang mungkin timbul daripada pelaksanaannya.

Kata kunci: Akta 174, Kefahaman, Implikasi

1. Pengenalan

Dalam era globalisasi yang semakin pesat dan perubahan dinamik politik serantau, Akta Institusi -Institusi Pelajaran (Tatatertib) 1976, yang lebih dikenali sebagai Akta 174, di Malaysia telah muncul sebagai instrumen perundangan yang penting dalam mengawal tatatertib pelajar di institusi pengajian tinggi awam. Akta 174 digubal oleh kerajaan Malaysia dengan tujuan utama untuk mengatur tingkah laku dan disiplin pelajar, serta memastikan keselamatan dan kestabilan dalam persekitaran institusi pendidikan. Akta ini diwujudkan bagi melindungi kepentingan institusi pengajian tinggi dan masyarakat kampus daripada ancaman yang mungkin timbul akibat kelakuan pelajar yang melanggar peraturan dan undang-undang. Keperluan untuk menguatkuasakan Akta 174 di POLYCC adalah penting kerana institusi-institusi ini melibatkan pelajar daripada pelbagai latar belakang dan peringkat akademik. Dengan populasi pelajar yang besar dan kepelbagaian sosial, Akta ini berperanan penting dalam memastikan wujudnya persekitaran pembelajaran yang selamat dan terkawal, di samping mengukuhkan disiplin pelajar. Pelaksanaan Akta ini di POLYCC membantu memastikan bahawa peraturan dan undang-undang dipatuhi, seterusnya mengekalkan kestabilan dan keharmonian dalam kalangan warga kampus.

Akta 174 juga adalah sebahagian daripada perundangan yang diwujudkan untuk menguruskan isu-isu tatatertib yang melibatkan pelajar di peringkat institut pengajian tinggi awam. Akta ini menetapkan prosedur bagi mengendalikan kes-kes disiplin pelajar, termasuk tindakan yang boleh diambil sekiranya peraturan dilanggar. Dalam konteks POLYCC, pelaksanaan Akta ini bukan sahaja penting untuk mengawal kelakuan pelajar, malah turut menyumbang kepada pembentukan persekitaran akademik yang lebih selamat dan kondusif.

Kajian ini menelusuri pemahaman pelajar POLYCC terhadap Akta 174, di samping mengkaji implikasi yang mungkin timbul daripada pelaksanaannya. Dalam konteks institusi seperti POLYCC, di mana pelajar terdiri daripada pelbagai lapisan masyarakat, kajian ini akan memberi gambaran mengenai sejauh mana mereka memahami tujuan, prosedur, dan sejarah Akta 174, serta bagaimana ia memberi kesan kepada kehidupan mereka di kampus. Selain itu, kajian ini juga bertujuan mengenal pasti implikasi Akta 174 terhadap kebebasan bersuara, aktivisme politik, kebebasan akademik, serta rasa selamat dan ketenteraman di kampus. Dengan merangkumi dimensi-dimensi ini, kajian ini diharapkan dapat memberikan sumbangan yang bermakna kepada pemahaman mengenai peranan Akta 174 dalam memastikan disiplin dan keselamatan di

institusi pengajian tinggi, terutamanya dalam konteks POLYCC.

2. Sorotan Kajian

Undang-undang keselamatan, terutamanya yang dinyatakan dalam Akta 174, telah menjadi perhatian utama dalam konteks kehidupan kampus, khususnya di Institut Pengajian Tinggi (IPT) POLYCC. Selaras dengan perkembangan undang-undang keselamatan di peringkat global dan tempatan, pengaruh Akta 174 terhadap kehidupan kampus telah menjadi penting dan kompleks. Ahmad et al. (2017) menyatakan bahawa undang-undang keselamatan seperti Akta 174 diperlukan untuk mengekalkan disiplin dan keharmonian dalam kalangan pelajar, terutamanya di institusi pengajian tinggi Malaysia. Zain (2018) menambah bahawa kebanyakan institusi pendidikan di Malaysia menguatkuasakan Akta ini sebagai langkah proaktif untuk mengekang aktiviti-aktiviti yang boleh menggugat kestabilan kampus.

Selain itu, kajian oleh Yusof dan Rahman (2019) menegaskan bahawa pemahaman mendalam terhadap undang-undang keselamatan, termasuk Akta 174, adalah penting bagi pelajar institusi pengajian tinggi. Mereka mendapati bahawa ketidakfahaman terhadap undang-undang ini boleh membawa kepada pelanggaran disiplin yang tidak disengajakan. Kajian Ismail (2020) pula menekankan bahawa pemahaman pelajar terhadap undang-undang keselamatan seperti Akta 174 dapat mengurangkan kejadian pelanggaran disiplin dan meningkatkan kesedaran mengenai hak dan tanggungjawab mereka sebagai warga kampus.

Menurut Smith et al. (2019), undang-undang keselamatan menyediakan landasan undang-undang yang kritis untuk memastikan keamanan dan keselamatan di dalam kampus. Mereka menegaskan bahawa pemahaman yang baik terhadap undang-undang ini penting bagi pelajar untuk mengelakkan pelanggaran yang mungkin membawa akibat serius kepada mereka dan masyarakat kampus. Selain itu kajian oleh Tan dan Jamaludin (2018) turut mengesahkan bahawa pelajar yang memiliki kesedaran yang tinggi terhadap Akta 174 menunjukkan perilaku yang lebih bertanggungjawab dalam mengurus kebebasan bersuara mereka di kampus.

Dalam konteks POLYCC, kajian oleh Tan (2021) mengeksplorasi bagaimana pelajar di institusi ini merespon dan menyesuaikan diri dengan perubahan dalam undang-undang keselamatan, terutamanya Akta 174. Beliau menggariskan pandangan pelajar terhadap perubahan undang-undang dan sejauh mana pemahaman mereka terhadap implikasi undang-undang tersebut dalam kehidupan kampus. Selain itu, kajian oleh Ramli et al. (2020) mendapati bahawa pelajar POLYCC yang lebih terdedah kepada pendidikan undang - undang menunjukkan pemahaman yang lebih baik terhadap implikasi undang-undang keselamatan dan hak asasi mereka.

Pandangan berkaitan evolusi undang-undang keselamatan global dan tempatan, seperti yang dinyatakan oleh Smith (2018) dan Wong (2019), membentuk kerangka konseptual yang memahami perkembangan semasa dan cabaran yang dihadapi dalam mencapai kestabilan negara. Analisis ini membuka ruang untuk penerokaan kritis, menggariskan titik tumpuan terhadap aspek-aspek yang melibatkan hak asasi manusia dan kebebasan individu. Kajian oleh Latif et al. (2019) turut menekankan bahawa pelajar yang terlibat dalam aktivisme politik di Malaysia sering kali berhadapan dengan cabaran dalam mengimbangi hak kebebasan bersuara mereka dengan kekangan undang-undang keselamatan kampus.

Melalui perspektif perbandingan yang diberikan oleh Lee et al. (2020) dan Rahman et al. (2021), konsep keselamatan nasional dan hak asasi manusia diperluaskan melibatkan pemahaman yang mendalam dari sudut global. Ini menyediakan konteks perbandingan yang kritikal, yang membentuk cara Akta 174 difahami dan diaplikasikan di Malaysia berbanding dengan negara-negara lain. Salleh (2017) pula menekankan pentingnya kebebasan akademik dalam kerangka undang-undang keselamatan yang lebih inklusif, terutamanya dalam menjaga kebebasan bersuara pelajar di institusi pendidikan tinggi.

Selain itu, analisis dalam kajian Abdullah (2022) dan Lim (2017) memberi fokus kepada aspek psikologi dan kebebasan individu dalam membentuk konsep holistik dan menyeluruh. Kajian ini memberikan asas kepada pemahaman implikasi undang-undang keselamatan, terutamanya Akta 174, terhadap mental dan kebebasan pelajar POLYCC. Syed et al. (2018) turut menegaskan bahawa pendidikan undang-undang yang komprehensif dapat membantu pelajar memahami peranan mereka dalam mengekalkan keselamatan kampus tanpa menjejaskan kebebasan individu. Pentingnya pendidikan undang-undang dan kesedaran, seperti yang dirungkai dalam kajian Brown (2020) dan Ibrahim (2018), menjadi unsur kritikal yang memperkaya konsep pemahaman pelajar terhadap undang-undang keselamatan, serta membentuk pandangan mereka terhadap Akta 174.

Kajian oleh Wong (2019) dan Lee et al. (2020) menjelaskan konsep tren dan cabaran dalam undang-undang keselamatan, mencetuskan pemikiran mendalam tentang keperluan untuk pemahaman yang dinamik dan berterusan mengenai Akta 174. Manakala kajian oleh Ali et al. (2020) pula menekankan kepentingan kerjasama antara pihak berkuasa kampus dan pelajar dalam memastikan penguatkuasaan undang-undang

keselamatan yang adil dan seimbang. Secara keseluruhan, interaksi antara konsep keselamatan nasional, hak asasi manusia, pendidikan undang-undang, dan implikasi psikologi serta kebebasan individu, bersamaan dengan kepentingan untuk memahami tren dan cabaran semasa, membentuk kerangka rujukan yang kukuh dan menyeluruh dalam meneroka Akta 174 terhadap pelajar POLYCC.

3. Metodologi Kajian

Kajian ini menggunakan borang soal selidik sebagai instrumen utama bagi mengumpul data daripada 173 pelajar (POLYCC). Institusi yang terlibat merangkumi Kolej Komuniti Sandakan, Kolej Komuniti Tambunan, Kolej Komuniti Tawau, Politeknik Sandakan, serta Politeknik Sultan Haji Ahmad Shah (POLISAS). Pemilihan POLYCC sebagai lokasi kajian dibuat berdasarkan kepelbagaian latar belakang pelajar serta kepentingan institusi ini dalam konteks pendidikan tinggi di Malaysia. Meskipun POLISAS terletak di Semenanjung Malaysia, ia dipilih untuk mewakili institusi di kawasan barat Malaysia, namun disebabkan kekangan tertentu, institusi di Sarawak tidak dapat disertakan dalam kajian ini. Oleh itu, dapatan kajian ini lebih menjurus kepada perspektif pelajar di Sabah dan Semenanjung Malaysia.

Pelajar yang terlibat dalam kajian ini terdiri daripada mereka yang berdaftar secara aktif di POLYCC, dan teknik pensampelan rawak mudah digunakan untuk memastikan setiap individu dalam populasi mempunyai peluang yang sama untuk dipilih. Jumlah 173 responden dipilih sebagai sampel kajian, yang mencukupi berdasarkan metodologi yang disarankan oleh Hair et al. (2018) untuk memperoleh analisis yang tepat. Borang soal selidik yang dibangunkan sendiri oleh penyelidik ini disusun berdasarkan aspek yang berkaitan dengan pemahaman pelajar terhadap Akta 174 dan kesannya dalam kehidupan kampus. Kajian ini dilaksanakan secara dalam talian bagi menilai tahap pengetahuan pelajar mengenai Akta 174 serta persepsi mereka terhadap implikasi undang-undang tersebut. Borang soal selidik ini disediakan dalam bahasa Melayu, iaitu bahasa utama di POLYCC, bagi memastikan setiap responden dapat memahami soalan dengan jelas dan tepat.

4. Hasil Kajian

4.1 Latar Belakang Responden

Latar belakang responden ditunjukkan dalam **Jadual 1**, yang memperincikan data berkaitan jantina, umur, institusi, dan program pengajian pelajar. Jadual ini menunjukkan keseimbangan dalam profil responden, dengan 46.8% responden terdiri daripada lelaki dan 53.2% perempuan.

Majoriti pelajar berada dalam lingkungan umur 18 hingga 20 tahun (62.4%), manakala selebihnya berusia antara 21 hingga 24 tahun (36.4%), dan hanya sebilangan kecil berumur lebih daripada 30 tahun (1.2%). Latar belakang responden adalah seperti yang ditunjukkan dalam Jadual 1

Jadual 1: Profile Responden

Item		Kekerapan	Peratus
Jantina	Lelaki	81	46.8
	Perempuan	92	53.2
Umur	18-20 tahun	108	62.4
	21-24 tahun	63	36.4
	Lebih dari 30 tahun	2	1.2
Institusi	Kolej Komuniti Sandakan	56	32.4
	Kolej Komuniti Tambunan	22	12.7
	Kolej Komuniti Tawau	23	13.3
	Politeknik Sandakan	38	22.0
	Politeknik Sultan Haji Ahmad Shah	34	19.7
Program	Diploma Agroteknologi	19	11.0
	Diploma Akuakultur	17	9.8
	Diploma SeniBina	34	19.7
	Sijil Agroteknologi	16	9.2
	Sijil Kulinari	2	1.2
	Sijil Pengembaraan Pelancongan	25	14.5
	Sijil Penyelenggaraan Kenderaan dan Pacuan Empat Roda	6	3.5
	Sijil Sistem Komputer dan Rangkaian	15	8.7
	Sijil Teknologi Automotif	2	1.2
	Sijil Teknologi Elektrik	37	21.4

4.2 Analisis Dapatan Kajian

Analisis dapatan kajian adalah seperti yang ditunjukkan dalam Jadual 2 dan 3. Analisis kajian ini menggunakan skala Likert lima mata untuk menilai tahap pemahaman dan persepsi pelajar terhadap Akta 174, bermula dari "sangat tidak setuju" (1) hingga "sangat setuju" (5). Pemilihan skala ini didasarkan pada kajian Ismail (2021), yang mendapati bahawa skala tersebut menawarkan variasi yang mencukupi untuk menggambarkan persepsi pelajar di institusi pengajian tinggi. Penggunaan skala ini turut disokong oleh Ahmad et al. (2020) yang menekankan kepentingannya dalam kajian pendidikan di Malaysia. Data yang dikumpulkan dianalisis menggunakan perisian SPSS, dengan analisis deskriptif digunakan untuk menentukan nilai skor min.

Jadual 2: Pemahaman Akta 174

Pemboleh Ubah	Kod Item	Item Kajian	Sisihan Piawai	Skor Min	Petunjuk
Pemahaman Akta 174	FAHAM01	Kefahaman tentang Akta 174	0.86	3.17	Sederhana
	FAHAM02	Kefahaman tentang tujuan dan kandungan utama Akta 174	0.91	3.18	Sederhana
	FAHAM03	Kefahaman tentang prosedur dan mekanisme pelaksanaan Akta 174	0.92	3.17	Sederhana
	FAHAM04	Kefahaman mengenai sejarah atau perubahan yang telah dibuat dalam Akta 174 dari semasa ke semasa	0.98	2.94	Agak Rendah
	FAHAM05	Kefahaman mengenai proses undang-undang yang digunakan dalam perlaksanaan Akta 174	0.97	3.04	Sederhana
	FAHAM06	Kefahaman mengenai perbezaan antara Akta 174 dan undang-undang lain yang berkaitan dengan keselamatan dalam negeri di Malaysia	1.00	2.99	Agak Rendah
	FAHAM07	Kefahaman peranan agensi penguatkuasaan dan pihak berkuasa yang terlibat dalam pelaksanaan Akta 174	0.94	3.22	Sederhana
	FAHAM08	Akta 174 adalah relevan dengan isu-isu keselamatan dalam negeri di Malaysia	0.94	3.29	Sederhana
	FAHAM09	Pernah menghadiri sesi penerangan atau perbincangan tentang Akta 174 di IPT Sabah	1.15	3.15	Sederhana
	FAHAM10	Keperluan lebih banyak penjelasan dan penerangan berkenaan Akta 174 kepada pelajar di IPT POLYCC	1.06	4.01	Tinggi

Selain itu, responden turut menilai implikasi Akta 174 terhadap kebebasan mereka di kampus, seperti yang ditunjukkan dalam Jadual 3. Dapatan kajian menunjukkan bahawa Akta ini mempunyai pengaruh sederhana terhadap kebebasan bersuara, aktivisme politik, dan kebebasan akademik, dengan skor min yang mencerminkan tahap kesederhanaan dalam persepsi pelajar. Kajian Ismail (2021) juga menyokong penemuan ini, menyatakan bahawa undang-undang keselamatan seperti Akta 174 biasanya memberikan kesan sederhana terhadap kebebasan bersuara dalam kalangan pelajar institusi pengajian tinggi di Malaysia.

Jadual 3: Implikasi Akta 174

Pemboleh Ubah	Kod Item	Item Kajian	Sisihan Piawai	Skor Min	Petunjuk
Implikasi Akta 174	IMP01	Akta 174 mempengaruhi kebebasan bersuara di kalangan pelajar di IPT	0.81	3.71	Sederhana
	IMP02	Akta 174 mempengaruhi aktivisme politik di kalangan pelajar di IPT Sabah	0.80	3.80	Sederhana
	IMP03	Akta 174 mempengaruhi kebebasan akademik di IPT Sabah	0.82	3.78	Sederhana
	IMP04	Akta 174 mempengaruhi rasa selamat dan ketenteraman di kampus	0.82	3.89	Sederhana
	IMP05	Perlindungan terhadap hak kebebasan bersuara dan aktivisme di IPT Sabah dalam konteks Akta 174	0.82	3.82	Sederhana
	IMP06	Akta 174 yang membatasi kebebasan akademik dalam pengajian anda di IPT Sabah	0.80	3.80	Sederhana
	IMP07	Akta 174 telah memberi sumbangan kepada keselamatan negara dan masyarakat secara keseluruhannya	0.84	3.86	Sederhana
	IMP08	Akta 174 mencerminkan sejauh mana negara Malaysia mementingkan kebebasan bersuara dan hak asasi individu	0.77	3.87	Sederhana
	IMP09	Akta 174 memberikan peluang untuk penyalahgunaan kuasa oleh pihak berkuasa	1.00	3.63	Sederhana

Pengelasan skor min bagi tahap pemahaman pelajar terhadap Akta 174 dibuat berdasarkan kaedah Kamaruddin & Ramli (2020), di mana skor di bawah 3.00 dikategorikan sebagai agak rendah, antara 3.00 hingga 4.00 sebagai sederhana, dan melebihi 4.01 sebagai tinggi. Berdasarkan kaedah ini, dapatan kajian menunjukkan bahawa pemahaman pelajar mengenai sejarah dan perubahan dalam Akta 174 adalah agak rendah, dengan skor min serendah 2.94. Namun, bagi aspek pemahaman tentang peranan agensi penguatkuasaan serta relevansi Akta 174 dalam konteks isu keselamatan dalam negara, skor min menunjukkan tahap pemahaman sederhana hingga tinggi, dengan skor tertinggi pada 4.01 bagi aspek keperluan penjelasan lebih lanjut mengenai Akta ini di IPT POLYCC.

5. Perbincangan Dan Implikasi

Dapatan kajian ini menunjukkan bahawa kefahaman pelajar terhadap Akta 174 secara keseluruhannya berada pada tahap sederhana. Walau bagaimanapun, terdapat kelemahan yang jelas dalam pemahaman pelajar terhadap sejarah dan perubahan dalam Akta ini, dengan skor min yang agak rendah, iaitu 2.94. Keputusan ini konsisten dengan kajian yang dijalankan oleh Ismail (2021), yang juga mendapati bahawa kebanyakan pelajar institusi pengajian tinggi mempunyai pemahaman yang terhad tentang sejarah undang-undang keselamatan di Malaysia. Hal ini menunjukkan perlunya usaha berterusan untuk meningkatkan kesedaran pelajar terhadap perkembangan dan perubahan undang-undang keselamatan seperti Akta 174. Penelitian dan penjelasan yang lebih mendalam perlu diberi perhatian bagi menangani kekurangan pemahaman ini, seperti yang disarankan oleh Rahman dan Yusof (2020), yang menegaskan bahawa pendekatan pendidikan yang lebih menyeluruh diperlukan untuk memperkukuh pemahaman pelajar terhadap peranan undang-undang keselamatan.

Responden juga melihat Akta 174 sebagai relevan dengan isu keselamatan dalam negeri, yang menunjukkan kesedaran pelajar terhadap kepentingan undang-undang keselamatan dalam konteks Malaysia. Kajian oleh Ahmad et al. (2020) turut mendapati bahawa pelajar IPT di Malaysia menyedari kepentingan undang-undang keselamatan dalam mengekalkan ketenteraman awam dan keselamatan kampus. Namun, dapatan ini juga menunjukkan bahawa perbincangan lebih lanjut dan penyelidikan perlu dilakukan untuk memahami secara kritikal pandangan pelajar terhadap keselamatan dalam negeri dan bagaimana Akta 174 dapat menyumbang ke arah mencapai objektif tersebut. Oleh itu, kajian-kajian seperti ini dapat memberikan gambaran lebih jelas tentang persepsi dan pengalaman pelajar, yang boleh membantu pihak pengurusan institusi dalam merangka dasar keselamatan yang lebih efektif dan mesra pelajar.

Hasil kajian juga menunjukkan bahawa terdapat keperluan yang tinggi untuk penjelasan tambahan mengenai Akta 174, khususnya di IPT POLYCC, dengan skor min mencapai 4.01. Keputusan ini sejajar dengan kajian oleh Ismail (2021) yang mendapati bahawa majoriti pelajar di Malaysia mahukan lebih banyak penerangan dan pendidikan mengenai undang-undang keselamatan yang mempengaruhi kehidupan kampus mereka. Keperluan ini mencerminkan keinginan pelajar untuk memahami implikasi undang-undang keselamatan secara lebih mendalam dan terperinci. Oleh itu, inisiatif pendidikan dan penerangan perlu dipertingkatkan bagi memastikan pelajar mempunyai pemahaman yang menyeluruh mengenai Akta 174 serta peranan undang-undang tersebut dalam menjaga keselamatan kampus tanpa menjejaskan hak kebebasan individu.

Implikasi Akta 174 terhadap kebebasan bersuara, aktivisme politik, kebebasan akademik, dan rasa selamat di kampus juga mencerminkan bahawa responden melihat undang-undang tersebut memberi kesan yang sederhana dalam kehidupan kampus mereka. Kajian oleh Zain et al. (2020) turut menyokong dapatan ini, di mana beliau mendapati bahawa undang-undang keselamatan di institusi pengajian tinggi di Malaysia sedikit sebanyak mempengaruhi kebebasan bersuara dan aktiviti politik pelajar. Walaupun begitu, kajian lanjut diperlukan untuk memahami secara lebih mendalam bagaimana Akta 174 sebenarnya mempengaruhi kehidupan dan kebebasan pelajar di IPT. Kajian mendalam seperti ini boleh membantu dalam merangka dasar dan pendekatan yang lebih baik untuk menangani isu-isu ini di kalangan pelajar, sepertimana yang disarankan oleh Rahman dan Ali (2021) dalam kajian mereka mengenai undang-undang keselamatan di IPT.

Terdapat juga kebimbangan pelajar tentang potensi penyalahgunaan kuasa oleh pihak berkuasa, dengan skor min 3.63. Ini menunjukkan pentingnya mempertimbangkan aspek hak asasi manusia dan kebebasan individu dalam merangka undang-undang keselamatan. Kajian oleh Ibrahim (2021) menegaskan bahawa undang-undang keselamatan perlu dirumuskan dengan teliti bagi mengimbangi antara keselamatan negara dan hak asasi manusia. Oleh itu, dapatan ini mencadangkan perlunya kajian dan pembaharuan yang lebih menyeluruh terhadap aspek-aspek tertentu dalam Akta 174, bagi memastikan ia melindungi hak-hak individu tanpa mengorbankan keselamatan negara.

Dengan memahami pandangan dan pemahaman pelajar terhadap Akta 174, kajian ini memberikan landasan untuk pembahasan lanjut dan perbincangan dalam merangka dasar dan pendekatan yang lebih bersepadu. Kajian lanjutan boleh memfokuskan kepada aspek-aspek seperti impak sosio-ekonomi undang-undang

keselamatan, perbandingan dengan undang-undang serupa di negara lain, dan analisis perbandingan antara institusi pengajian tinggi di Malaysia. Dengan menyelidiki dan merungkai aspek-aspek ini, pemahaman yang lebih holistik dan mendalam mengenai hubungan antara undang-undang keselamatan dan kehidupan pelajar dapat diperoleh. Hal ini seterusnya dapat menyumbang kepada pembentukan masyarakat akademik yang lebih prihatin terhadap hak asasi manusia, kebebasan individu, serta kepentingan keselamatan negara secara seimbang, sebagaimana yang dicadangkan oleh Syed et al. (2020) dalam kajian mereka tentang pendidikan undang-undang di institusi pengajian tinggi.

6. Kesimpulan

Dalam landskap globalisasi yang semakin meluas dan perubahan dinamika politik serantau, Akta 174 di Malaysia muncul sebagai fokus perbincangan yang semakin mendalam. Kajian-kajian terdahulu menunjukkan bahawa undang-undang keselamatan, seperti Akta 174, memainkan peranan penting dalam membentuk landskap kehidupan kampus dan memberi impak terhadap hak-hak dan kebebasan pelajar (Din et al., 2018; Rahim & Tan, 2019). Kajian ini bertujuan untuk menilai pemahaman pelajar terhadap Akta 174 dan mengenal pasti implikasi undang-undang tersebut terhadap kehidupan mereka. Objektif utama adalah menganalisis sejauh mana pelajar memahami butir-butir utama, tujuan, prosedur, dan sejarah Akta 174, serta mengenalpasti kesannya terhadap kebebasan bersuara, aktivisme politik, kebebasan akademik, dan rasa selamat di kampus. Dapatan kajian menunjukkan bahawa pemahaman pelajar terhadap Akta 174 adalah pada tahap sederhana. Terdapat kelemahan dalam pemahaman terhadap sejarah atau perubahan dalam Akta 174. Responden melihat Akta 174 sebagai relevan dengan isu-isu keselamatan dalam negeri. Terdapat keperluan yang tinggi untuk penjelasan tambahan mengenai Akta 174, terutama di IPT POLYCC.

Terdapat penemuan penting hasil dari kajian ini dimana terdapat keperluan untuk meningkatkan pemahaman pelajar terhadap sejarah Akta 174 dan perlunya penjelasan tambahan di peringkat institusi pendidikan tinggi. Implikasi Akta 174 terhadap kebebasan bersuara, aktivisme politik, kebebasan akademik, dan rasa selamat di kampus menjadi aspek yang perlu diperhatikan. Kajian ini memberikan sumbangan kepada pemahaman holistik mengenai pandangan dan pengalaman pelajar POLYCC terhadap Akta 174. Implikasinya merangkumi keperluan untuk meningkatkan pendidikan undang-undang dan kesedaran di kalangan pelajar, serta menyoroti kepentingan merangka dasar yang seimbang antara keselamatan negara dan hak asasi individu. Cadangan penambahbaikan perlu secara berterusan termasuk memberi inisiatif pendidikan dan penerangan mengenai Akta 174, khususnya mengenai sejarah dan perubahan undang-undang tersebut. Selain itu, perlu dilakukan kajian lanjut untuk memahami secara lebih mendalam implikasi undang-undang keselamatan terhadap kehidupan pelajar, dengan penekanan kepada hak asasi manusia dan kebebasan individu.

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Flipped Classroom as a Tool for Improving Engineering Mathematics Understanding in Repeater Students: A Qualitative Study

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Abstract

This research explores the impact of flipped classroom pedagogy on the understanding of Engineering Mathematics among repeater students and examines the experiences and perceptions of lecturers implementing this approach. Utilizing qualitative data from interviews with two lecturers and two students from Politeknik Tuanku Sultanah Bahiyah, the study reveals that the flipped classroom model positively influences students' comprehension by providing pre-class materials such as videos, slides, and practice questions, enabling self-paced learning. Students reported enhanced confidence and improved performance, with one student noting a significant increase in test scores after adopting the flipped classroom method. Lecturers expressed optimism about the pedagogical model, highlighting its potential to foster student independence and promote creative teaching practices. However, they also identified challenges, particularly related to technology access, such as unreliable internet connectivity, which hindered student engagement. Time management emerged as another challenge for repeater students balancing multiple courses. The study concludes that the flipped classroom model can effectively enhance the learning experience for repeater students in Engineering Mathematics, though its success depends on institutional support and improved technological infrastructure. Recommendations for future research include exploring strategies to boost student motivation, conducting longitudinal studies to assess the long-term impact of flipped learning, and investigating its applicability across various subjects. This study contributes to the growing body of literature on flipped classrooms, emphasizing its potential to reshape teaching and learning in higher education.

Keywords: Flipped classroom, Engineering Mathematics, repeater students, pedagogy, self-paced learning, qualitative research

1. Introduction

Engineering Mathematics is a crucial component of the engineering curriculum of Malaysia Polytechnics, providing the fundamental basis for the entire profession. There are three compulsory Engineering Mathematics courses which are Engineering Mathematics 1, Engineering Mathematics 2, and Engineering Mathematics 3. These subjects have practical applications in various engineering disciplines, in addition to their theoretical foundation. Mastery of mathematics is crucial for attaining success in engineering f ields since it equips individuals with the necessary analytical tools and problem-solving skills for solving difficult engineering challenges. In the field of engineering, mathematics plays an important part as a common language that facilitates effective collaboration and communication among many disciplines. However, students may face challenges in understanding mathematical concepts, even though these concepts are highly important. This is particularly true when dealing with complex ideas that need advan ced analytical skills. These challenges may appear in several ways, including a struggle to generate creative thinking, limited problem-solving skills, or difficulty in applying mathematical concepts to real-world engineering situations. As a result, these challenges can limit students' academic achievement and overall growth in engineering education. The increasing number of students repeating Engineering Mathematics courses, especially Engineering Mathematics 2, at almost all Malaysia Polytechnics serves as evidence for these claims.

These students may have difficulty grasping key mathematical concepts that are needed to do well in advanced engineering courses, potentially as a result of prior academic challenges, inadequate preparatory knowledge, or other contributing factors. Consequently, individuals may encounter difficulties in keeping pace with the curriculum, resulting in dissatisfaction and reduced motivation due to prior academic challenges or difficulties. Zan and Martino (2008) discovered that students are inclined to mathematics when they can understand and effectively overcome its challenges. Nevertheless, individuals frequently experience a sense of discomfort towards the subject matter when they encounter difficulties that surpass their abilities. The students' passion for mathematics is intrinsically linked to their comfort and pleasure in interacting with the subject matter.

Furthermore, students who repeat a grade occasionally struggle to stay motivated because of their prior academic setbacks. Students who have previously struggled in the course could experience anxiety or doubt,

resulting in a decline in their self-confidence over their ability to attain success. The absence of motivation might worsen their learning challenges, leading to a cycle of disinterest that impacts their academic advancement. According to Howard and Whitaker (2011), students with low motivation demonstrate reduced engagement in classroom activities, limited participation in discussions, and a hesitancy to provide answers to questions. As a result, their performance on exams is below the highest possible standard. Inadequate support and motivation can cause disengagement, resulting in lower academic achievement and the necessity to retake the course.

Therefore, to ensure that students acquire the essential mathematical skills necessary for success in their chosen engineering fields, effective teaching methods that accommodate the diverse learning styles of their students must recognized. The flipped classroom is a modern and important teaching method that has been lately employed (Fernández Martín et al., 2020). Flipped classrooms are a substantial departure from traditional teaching approaches in education, as they redefine the roles of students and ed ucators. Flipped classrooms, essentially, are a reversal of conventional teaching approaches, where students get lectures during class time and then engage in independent study outside of class (Fung, 2020). Instead, students connect with educational resources beyond the confines of the classroom, such as pre-recorded video lectures, written texts, or interactive modules, allowing them to absorb information at their desired pace and convenience. This methodology creates an engaging and dynamic learning atmosphere, motivating students to assume accountability for their educational progression. It enables individuals to actively engage in their education and cultivate crucial analytical skills that are required for success in contemporary society.

Recent research has conducted multiple studies, specifically in the field of mathematics, to examine and gain an understanding of students' perspectives on learning through flipped classroom methods. The educator applies these teaching methods in mathematical subjects, as evidenced by their emphasis on student-centred instruction and active learning (Fernández-Martín et al., 2020). Furthermore, the study's results demonstrate that the use of the flipped classroom technique led to improved understanding and attitude among students towards the subjects and mathematical discipline. In a study conducted by Ruiz-Jiménez et al. (2022), the researchers investigated the experiences of statistics and business students in Spanish higher education institutions who were instructed to utilize the flipped classroom methodology. The study revealed that these students expressed a sense of being actively involved, motivated, and intellectually enhanced by the process of learning.

Current research on flipped classrooms frequently utilizes a quantitative methodology and neglects to specifically examine the experiences of students who have repeated the course. Therefore, this study seeks to employ qualitative research to explore the impact of flipped classroom pedagogy on the understanding of Engineering Mathematics among repeater students and examine the experiences and perceptions of lecturers in implementing the flipped classroom for repeater students in Engineering Mathematics. Thi s is essential for developing instructional methods that effectively address their specific needs.

1.1 Problem statement

The ongoing trend of high failure rates in Engineering Mathematics, particularly Engineering Mathematics 2, across Malaysian polytechnics has been a major source of concern for educators. Students with poor mathematical fundamentals encounter significant challenges comprehending the course material over a 14- week semester, frequently leading to the necessity of retaking the course. This ongoing academic setback not only hinders the progress of learners but also places a burden on the educational resources of these institutions. Although several supportive measures have been put in place, such as the use of flipped classroom methodologies as a modern alternative to traditional teaching methods, the impact of these strategies on improving the academic performance and engagement of students who are repeating a grade is still unclear.

The current body of research, consisting of studies by Bernard (2015), Bishop and Verleger (2013), Chua and Lateef (2014), Giannakos et al. (2014), Lelean and Edwards (2020), O'Flaherty and Phillips (2015), Ward, Knowlton, and Laney (2018), Zainuddin and Halili (2016), and Zuber (2016), presents inconclusive results regarding the impact of flipped classrooms on the academic performance and perspectives of engineering students. The contradictory results indicate an important gap in our understanding of the influence of flipped classroom models on students who are repeating a course, as they may face distinct challenges and require targeted support techniques to attain success. To further study the experiences, viewpoints, and academic involvement of students who repeat courses in the flipped classroom environment of Engineering Mathematics, a qualitative study is needed due to this lack of clarity. Additionally, the purpose of this study is to actively participate in the broader discourse on educational advancements in Malaysian polytechnics, with the ultimate goal of enhancing student achievement rates in challenging disciplines such as Engineering Mathematics.

1.2 Research Objectives

In this study, two (2) research objectives are intended to be achieved:

i. to explore the impact of flipped classroom pedagogy on the understanding of Engineering Mathematics among repeater students
ii. to examine the experiences and perceptions of lecturers in implementing the flipped classroom for repeater students in Engineering Mathematics

2. Literature Review

2.1 Review of empirical studies

Flipped classrooms have gained considerable attention due to their ability to improve academic performance by restructuring conventional teaching approaches. Several empirical studies have investigated the influence of flipped classrooms on student achievement, encompassing factors such as exam scores, grades, and overall academic success. In their study, Uy (2022) evaluated the effectiveness of implementing the flipped classroom learning method in improving the academic performance of undergraduate student s in mathematics in the Philippines. Uy's research revealed that students in the experimental group who utilized the flipped classroom method performed significantly better than the students in the control group. Similarly, Harmini et al. (2022) examined the influence of flipped classroom-based learning on the calculus performance of learners in West Kalimantan, Indonesia, and reported that students in the experimental group, who were taught calculus utilizing a flipped classroom technique, outperformed their counterparts in the control group. Furthermore, research conducted by Fernández-Martín et al. (2020) and Cho et al. (2021) has demonstrated that adopting the flipped classroom approach can improve students' comprehension and attitudes toward mathematical concepts, resulting in improved academic achievement. In addition, Schallert et al. (2021) emphasized that flipped classroom approaches have proven effective in enhancing student achievement, not only in the field of scientific education but also in mathematics education.

While some studies have demonstrated positive outcomes in terms of academic achievement in the flipped classroom, others have reported mixed results. Umam et al. (2019) demonstrated that the implementation of the flipped classroom approach resulted in enhanced communication skills and increased mathematical performance among students. In contrast, Zhang et al. (2021) stated that experimental studies investigating the influence of the flipped classroom on academic achievement have produced inconsistent outco mes. Nevertheless, there is a lack of research conducting longitudinal studies focusing on the impact of the flipped classroom model on academic performance in mathematics. Longitudinal studies are required to provide more conclusive information regarding the enduring efficacy of this method over an extended period.

2.2 Factors influencing academic performance

2.2.1 Instructional design

The effectiveness of flipped classrooms in enhancing academic achievement is influenced by several factors, including instructional design characteristics such as the quality of pre-class resources, the coherence between pre-class and in-class tasks, and the integration of formative assessments to track student progress. In traditional education, students gain new knowledge in the classroom. Subsequently, the student goes back to their home and attentively finishes their schoolwork. However, by adopting the flipped classroom approach, students can learn new material in advance from home using a variety of digital resources and educational websites provided by their teachers. Educators produce and share a video that lasts between 5 to 10 minutes. In addition, educators can utilize multimedia, social media platforms, educational games, YouTube for instructional purposes, TED Talk, Khan Academy, iTunes University, or other educational websites to promote the implementation of a flipped classroom approach (Elian & Hamaidi, 2021).

As to the findings of Asiksoy and Ozdamli (2016), the flipped classroom method is oriented towards the students. Students can acquire new knowledge by utilizing smartphones or computer devices in the comfort of their own homes. These technology tools enable students to repeatedly view educational videos to completely comprehend new content. In addition, the students can go ahead with the instructional videos and review areas they have already studied, allowing them to make notes. The flipped classroom appro ach considers the individual differences among students, enhances efficiency, removes monotony, and enhances enthusiasm and happiness in learning (Asiksoy & Ozdamli, 2016).

2.2.2 Student engagement

Studies on flipped classrooms regularly show a strong correlation between student engagement, interactive exercises, and peer collaboration, leading to improved academic performance. This finding is reinforced by

research conducted by Hodgson et al. (2017), which demonstrated a positive correlation between flipped classrooms and heightened levels of student engagement in comparison to conventional educational environments. In addition, Xiao et al. (2018) discovered that implementing the flipped classroom method not only reduced the gap in academic performance between students with low and high achievement levels, but also encouraged collaborative work among peers. Research has demonstrated that peer collaboration in flipped classrooms is especially beneficial. Graziano (2016) found that implementing flipped instruction in teacher education resulted in increased student engagement, enhanced learning outcomes, and reduced classroom issues. In addition, Ghufron & Nurdianingsih (2021) highlighted that the flipped classroom model encourages peer instruction through collaborative activities, which facilitates continuous growth among students.

Moreover, the integration of interactive exercises and collaborative work among peers in flipped classrooms has been emphasized as highly effective. Rau et al. (2017) established that the utilization of collaboration assistance and flipped classroom techniques led to markedly superior learning outcomes in comparison to conventional education. These findings are consistent with the research conducted by Fung et al. (2021), which highlights the need to include discussions, teacher feedback, and peer collaborative work in flipped classrooms to improve academic outcomes. The combination of these studies emphasizes the significance of student engagement, interactive activities, and peer collaboration in flipped classrooms for enhancing academic achievement. By utilizing these components, educators can establish dynamic educational settings that promote active engagement, cooperation, and eventually, improved learning outcomes.

2.3 Challenges and difficulties

Flipped classrooms have become popular in education due to their ability to improve student engagement and learning outcomes. However, critics have raised many concerns regarding the high resource requirements of this pedagogical strategy. One major challenge is the amount of time needed for the creation of content. According to Jensen (2011), students may find recorded lectures to be less interesting and encounter more disruptions compared to traditional classroom lectures. Students may not view the entire instructional video or face difficulties in understanding the material, resulting in their lack of preparation for classroom activities or their inability to keep pace with their peers (Milman, 2012). Educators in a flipped classroom model must create high-quality video lectures, interactive activities, and additional materials to support self-directed learning outside of class hours. This process can be time-consuming and challenging, particularly for educators who are inexperienced with this instructional method.

Another resource-intensive feature of flipped classrooms is the technological infrastructure required to support this instructional approach. To effectively apply the flipped classroom model, institutions need to allocate resources towards dependable internet connectivity, provide gadgets for students who lack access to them at home, adopt learning management systems, and acquire other digital tools. Students with limited access to resources, such as financial or technology, might experience challenges in downloading or watching vodcasts (O'Bannon et al., 2011). The technology needs might place a burden on the financial resources of educational institutions, especially those that cater to disadvantaged groups.

Moreover, the provision of faculty training is crucial for the effective execution of flipped classrooms. Educators need to have a high level of skill in generating digital content, efficiently using online platforms, and promoting active learning during face-to-face class sessions. It will need more time and money from institutions to provide professional development opportunities for teachers to gain these abilities. The high resource requirements of flipped classes can indeed affect the ability to scale up and sustain these initiatives over time. Institutions that have low resources may face difficulties in implementing and sustaining flipped classroom practices due to the financial and time commitments involved in them. Furthermore, the gap in the availability of technology and internet access among students gives rise to concerns regarding fairness and equality. Students from low-income households or rural areas may have difficulties when it comes to obtaining digital resources and fully engaging in a flipped classroom setting.

To address these equity considerations, schools must prioritize the task of ensuring that all students have equal access to the materials and resources required for the flipped classroom. This could involve providing devices and internet hotspots to students who lack them, giving alternative offline learning options, and developing comprehensive instructional approaches that cater to various learning needs. By addressing these issues and fostering equitable access, schools can reduce academic performance gaps and create a more inclusive learning environment for all students.

2.4 Theoretical framework

2.4.1 Social constructivist theory

The study's theoretical framework is grounded in Lev Vygotsky's social constructivist theory, initially introduced in 1968. Social constructivism believes that students engage in active knowledge construction and create meaning based on their experiences. Constructivism is based on the idea that through critical reflection on our experiences, we may enhance our comprehension of the universe. Every individual develops their own set of norms and mental models to interpret and understand their experiences. Therefore, the core of learning lies in modifying our mental models to include new information. Students derive meaning by building upon preexisting knowledge, therefore establishing a correlation with the flipped classroom approach. Students actively engage in the learning process. Throughout the process, they create a suitable educational environment in which learners can enhance their understanding instead of simply providing them with direct information. Active learning approaches are employed in the classroom to facilitate complex cognitive tasks that need student engagement (Saglam & Arslan, 2018). Hence, Vygotsky's theory was crucial in this study as it improved learning and facilitated social interaction among learners, thereby reducing the need for mathematics professors to always provide direct teaching in front of the class. The children adeptly acquired socialization skills through the flipped classroom learning experience, and they grasped the mathematics idea through engaging activities and games that encouraged their zone of proximal development (ZDP), hence boosting their achievement and interest in mathematics.

2.4.2 Self-determination theory and the Attention-Relevance-Confidence-Satisfaction (ARCS) model

In a flipped classroom, self-determination learning is the only factor that influences learning outside the classroom in a flipped classroom setting. This study examines the theoretical frameworks of the self-determination theory and the Attention-Relevance-Confidence-Satisfaction (ARCS) model. The self-determination hypothesis, as clarified by Ryan and Deci (2000), centers on the investigation and evaluation of the motivational variables that impact an individual. The theory emphasizes that individuals ach ieve self-awareness by combining new experiences and interpersonal relationships, a process that is aided by the satisfaction of their wants, desires, and interests. The self-determination theory distinguishes between intrinsic and extrinsic incentives, as explained by Nguyen and Goodin (2016). Intrinsic motivation arises from the personal satisfaction obtained through involvement with a particular subject, such as a student experiencing satisfaction when solving mathematics problems. In contrast, extrinsic motivation is influenced by external or societal factors, such as receiving praise from parents or being rewarded with money for attaining great grades. In addition, the ARCS model, proposed by Keller (2009), strengthens the basis of this work. Keller argues that the ARCS model emphasizes students' focus, the importance of instructional content that matches their learning preferences, their belief in achieving successful results, and their degrees of satisfaction obtained from the learning process.

3. Methodology

3.1 Research design

The present research is a case study approach to examine the impact of flipped classroom pedagogy on the understanding of Engineering Mathematics among repeater students. A case study involves gathering and presenting in-depth information about a specific individual or small group, often including the perspectives of the participants themselves (Yin, 2003). A case study is a type of qualitative descriptive research that focuses on an individual or a small number of participants. It concludes specifically ab out that participant or group and only within the setting of the study (Thomas, 2011).

3.2 The participants and settings

In this study, four research participants were chosen, consisting of two polytechnic students and two senior polytechnic lecturers at Politeknik Tuanku Sultanah Bahiyah. The criteria used for choosing students are based on those who have failed in Engineering Mathematics and have experienced a flipped classroom approach during their second attempt in Engineering Mathematics. Meanwhile, the criteria for selecting lecturers are based on their expertise in teaching students who have repeated Engineering Mathematics in a flipped classroom setting. All participants were represented as Lecturer 1, Lecturer 2, Student 1, and Student 2.

3.3 Data collection

The researcher employed semi-structured interviews for data collection. The interview session was done using the internet platform Microsoft Teams with open-ended questions after verbal consent was obtained and confidentiality was assured. Before conducting the interview, the researcher provided the participants with a

concise overview of the research objectives. The researcher created an interview protocol and notified the participants one week in advance of the interview session. The participants must be well-prepared to respond to the questions. The duration of the interview was in the range of 10 to 20 minutes.

3.4 Data analysis

The process of data analysis consisted of producing a concise overview of each interview, followed by a thorough examination of the recorded interviews and transcribed recordings. The data analysis was performed using the qualitative methodology provided by Granheim and Lundman (Graneheim & Lundman, 2004). The data analysis method consisted of multiple steps. In the beginning, the interviews' audio recording was transcribed word for word into a text file. The responses to each question will be thoroughly assessed multiple times to gain a comprehensive understanding of the participants' responses. Subsequently, the researchers derived sub-themes from the descriptions and interpretations. Several sub-themes were agreed upon by the researcher, and appropriate headings were chosen to link these sub-themes into general themes. The summary of coding and thematic analysis of the interview transcript was discussed in detail in the finding and analysis part.

3.5 Data presentation

3.5.1 Basic demographic

In the interview, participants were asked to provide basic demographic details, including their name, age, gender, and teaching/study experience. Table 1 presents a summary of the relevant information provided by the participants.

Table 1: Summary of information related to the four participants

PARTICIPANT CRITERIA	**Participant 1 (Lecturer 1)**	**Participant 2 (Lecturer 2)**	**Participant 3 (Student 1)**	**Participant 4 (Student 2)**
Gender	Male	Female	Male	Male
Age	38 years old	42 years old	20 years old	20 years old
Position	Senior Lecturer	Senior Lecturer	Student Diploma of Electrical Engineering	Student Diploma of Electrical Engineering
Subject expertise	Engineering Mathematics 1 Engineering Mathematics 2	Engineering Mathematics 2 Engineering Science		
Teaching Experience /Current Semester Study	15 years	18 year	Year 2/ Semester 4	Year 2/ Semester 4

4. Finding and Analysis

4.1 Exploring the impact of flipped classroom pedagogy on the understanding of Engineering Mathematics Among Repeater Students

The impact of flipped classroom pedagogy on repeater students' understanding of Engineering Mathematics is multifaceted, as revealed in the interviews conducted with both lecturers and students. The flipped classroom model, which involves students engaging with learning materials such as videos, notes, and practice questions before class, has influenced both teaching practices and student learning outcomes. This section discusses how this pedagogical approach has contributed to students' understanding of th e subject, focusing on student engagement, self-paced learning, and improved performance.

4.1.1 Improved understanding

Both lecturers and students highlighted the flipped classroom's ability to improve the student's grasp of difficult mathematical concepts. By providing learning materials in advance, students can revisit the content as needed, facilitating better understanding. Student 1 emphasized how the flipped classroom helped with revision and allowed students to correct mistakes from previous semesters:

"*We will learn from our mistakes, and we'll know where we made them. I've found that the flipped classroom method aids in my revision of other subjects, particularly Engineering Mathematics 2, which I'm currently studying alongside Engineering Mathematics 3*."

This shows that the ability to access materials repeatedly allows repeater students to build a stronger foundational understanding, especially when they encounter similar mathematical concepts in multiple subjects.

Lecturer 1 echoed the importance of providing materials that students could use for independent learning, saying:

"*…the student doesn't have to rely on the lecturer in the classroom anymore*."

This self-reliance aligns with the flipped classroom's goal of fostering independent learning, giving students the tools, they need to take ownership of their education. As students access videos, practice exercises, and e-books, they are no longer constrained by traditional classroom time to grasp essential mathematical concepts. This was further supported by Lecturer 2, who noted that students who engage more positively with the flipped classroom tend to perform better academically:

"*Indeed, students who consistently demonstrate positivity in class perform exceptionally well after implementing the flipped classroom approach*."

4.1.2 Self-paced learning

One of the key impacts of the flipped classroom is the flexibility it provides, allowing repeater students to study at their own pace. Both students noted the benefit of being able to allocate their own time for learning, which is particularly useful for those with conflicting schedules. Student 2 explained:

"*When the lecturer practices in a flipped classroom, it is so much easier, so I can catch the topics that I want to study*."

This flexibility is crucial for repeater students who might be balancing their current coursework with previously failed subjects. The flipped classroom allows them to manage their time effectively by revisiting content on their schedule, rather than relying solely on in-class instruction. Student 1 also commented on the personalized learning schedule:

"*Yes, because students can allocate their own time to studying*."

By allowing students to learn at their own pace, the flipped classroom addresses the diverse learning needs of repeater students, many of whom may struggle with rigid class schedules or require more time to fully understand complex mathematical concepts.

4.1.3 Improved performance

The flipped classroom's impact on repeater students' academic performance was evident from the students' feedback. Student 2 mentioned a noticeable improvement in test scores after participating in the flipped classroom approach:

"*I noticed much better feedback than the second semester that I took…my previous test score was below 20/50. However, after repeating this subject through a flipped classroom approach, I was able to improve my score to over 40/50*."

This improvement in academic performance illustrates the effectiveness of the flipped classroom in helping students better understand the material, leading to measurable progress. By having access to materials before class and reviewing them at their own pace, students are better prepared for assessments and can engage more meaningfully during in-class activities. The use of formative assessments, as highlighted by Lecturer 2, further reinforces the effectiveness of this pedagogical model:

"*To evaluate the effectiveness of the flipped classroom approach with a student in a repetitive classroom, I use formative questions*."

This iterative process of assessment helps identify gaps in students' understanding early, allowing for timely intervention and support. The flipped classroom thus enhances both formative and summative learning outcomes by ensuring that students engage with the material more thoroughly.

4.1.4 Challenges and difficulties

Despite its advantages, the flipped classroom model is not without challenges. Both lecturers and students highlighted issues that may hinder its full impact on students' understanding. One of the significant challenges was the accessibility of technology and reliable internet connectivity. Student 2 pointed out:

"*…the internet is slow sometimes. It's like downloading; it takes time*."

This issue of slow or unreliable internet access can impede students' ability to fully engage with the pre - class materials, limiting the effectiveness of the flipped classroom approach. Similarly, Lecturer 1 mentioned that students often rely on smartphones for accessing learning materials, which may not always be ideal for reviewing complex mathematical content:

"*…we know that our students only use smartphones or smartphones to access whatever information is provided by the lecturer, whether video, e-book and so on*."

This presents a significant barrier to students who may not have access to more suitable devices such as laptops or tablets, thereby affecting the extent to which they can benefit from the flipped classroom pedagogy.

The flipped classroom approach also appears to have positively influenced students' motivation and sense of responsibility. Student 2 remarked on how the flipped classroom fostered a sense of accountability:

"*I feel more responsibility because the lecturer has given me tasks to be discussed in the next class. So, when I don't do that, it feels like I don't appreciate the lecturer*."

This increased responsibility translates into greater engagement with the material, as students are expected to come to class prepared to discuss the content they reviewed beforehand. The ability to learn independently and then bring questions or insights to the classroom creates a more active learning environment, in which students are not passive recipients of information but active participants in their education.

4.2 Examining the experiences and perceptions of lecturers in implementing the flipped classroom for repeater students in Engineering Mathematics

The experiences and perceptions of lecturers play a crucial role in shaping the effectiveness of this model. Through the interview data, key insights into their views on preparation, technology use, challenges, and the overall impact of this approach emerge.

4.2.1 Preparation

One of the main themes that surfaced in the interviews with both lecturers was the significant amount of preparation involved in creating an effective flipped classroom experience for students. Lecturer 1 emphasized the importance of organizing teaching materials in advance to ensure smooth implementation:

"*Okay, first of all, as a preparation to run this flipped classroom, I'm usually going to prepare teaching materials in advance, like teaching and learning modules for the Engineering Mathematics course …*"

This suggests that the success of the flipped classroom heavily relies on the lecturer's ability to provide well-structured and comprehensive learning materials that students can access before attending class. Lecturer 2 highlighted similar steps in their preparation process, focusing on how pre-class resources such as videos and practice questions help students build their knowledge independently:

"*My plan for the pre-class is to provide pre-teaching material where this material can help them understand before entering the class, such as videos, slides, and also some practice questions* ."

By preparing detailed materials like videos, slides, and practice exercises, lecturers create a scaffold for students to engage with content on their own, setting the stage for more meaningful in-class interactions. This preparation phase is critical for repeater students, who may need additional resources to build confidence in their understanding of complex mathematical concepts.

4.2.2 Technology

The implementation of the flipped classroom for repeater students in Engineering Mathematics relies heavily on technology, both for delivering pre-class materials and maintaining communication between lecturers and students. Both lecturers utilized various platforms to share teaching resources, ranging from formal learning management systems to informal channels like WhatsApp and Telegram. Lecturer 1 explained the use of institutional platforms and mainstream social media applications:

"*…we have full access to the Microsoft Teams application, and we also have our learning management system, namely CIDOS… Besides that, I also use a platform like YouTube* ."

Lecturer 2 shared similar practices but also noted the importance of using more accessible platforms to ensure students receive the materials:

"*After I make the preparation material, I send it to them through social media like WhatsApp, CIDOS, and even Telegram.*"

This flexibility in using various platforms highlights the need for lecturers to adapt to students' preferences

and technical limitations. While formal platforms like CIDOS provide a structured environment for learning, platforms like WhatsApp and Telegram offer students more immediate and user-friendly access to materials, particularly for those relying on smartphones.

However, despite the use of these platforms, lecturers acknowledged the challenges related to technology, particularly the limitations posed by students' access to appropriate devices and stable internet connections. Lecturer 1 pointed out that many students rely solely on smartphones, which can affect their ability to engage deeply with the learning materials:

"*…we know that our students only use smartphones or smartphones to access whatever information is provided by the lecturer, whether video, e-book and so on*."

This limitation in technology poses a challenge for repeater students, who may struggle to fully benefit from the rich content provided by lecturers, such as videos and e-books, due to the smaller screens and limited functionality of smartphones.

Both lecturers highlighted the importance of assessing the effectiveness of the flipped classroom through student engagement and performance. Lecturer 1 described a multi-faceted approach to evaluation, including quizzes, tests, and presentations:

"*…first of all, I'm going to look at the students' responses and feedback to the material I give. I will assess the students' responses by administering a quiz, test, or end-of-chapter quiz. I'm also going to ask the student to make a presentation of something so that when the student is present, I can assess the extent to which the student's understanding of a topic*."

This approach underscores the need for active student participation, where assessment goes beyond traditional testing and includes opportunities for students to demonstrate their understanding through presentations and discussions. Lecturer 2 also emphasized the importance of formative assessments in evaluating how well students are engaging with the flipped classroom materials:

"*To evaluate the effectiveness of the flipped classroom approach with a student in a repetitive classroom, I use formative questions*."

The focus on formative assessment allows lecturers to monitor students' progress in real time and make adjustments as necessary. For repeater students, this continuous feedback loop is essential, as it helps identify areas of misunderstanding early on and provides them with opportunities to correct their mistakes before moving forward.

4.2.3 Assessment and Engagement

Implementing the flipped classroom model, especially for repeater students, presents a unique set of challenges for lecturers. Both lecturers identified issues related to student motivation and technology access as key barriers to successful implementation. Lecturer 1 mentioned that while preparing the materials is a demanding task, engaging students and ensuring they access the content is an even bigger challenge:

"*The first is access to the internet... without internet access, we won't be able to connect with our students, so students can't even respond or give feedback to us*."

In addition to internet connectivity, Lecturer 1 highlighted the issue of student attitudes, which can be a significant hurdle in motivating repeater students to participate in the flipped classroom actively:

"*The last, and most important, is the attitude of the student*."

This points to a deeper challenge of student engagement, particularly for repeater students who may feel discouraged by previous academic failures. Lecturer 2 shared a similar observation regarding student awareness of the materials shared through social media:

"*The first problem is that these students are less aware of what we're sending or sharing on social media*."

In both cases, it is clear that while the flipped classroom provides the necessary resources and structure for students to succeed, some students may lack the intrinsic motivation or discipline to engage with the materials, highlighting the need for additional support and interventions to encourage active participation.

Despite these challenges, both lecturers perceived the flipped classroom as having a positive long -term impact on teaching and learning, particularly in fostering student independence and creativity. Lecturer 1 expressed optimism about the future of the flipped classroom in driving innovation among educators:

"*When all the lecturers have used the flipped classroom method in the teaching and learning sessions, they will be creating more creative materials*."

This perception suggests that the flipped classroom model not only benefits students but also encourages lecturers to develop more innovative teaching practices, which can lead to an overall improvement in the quality of education. Lecturer 2 echoed this sentiment, emphasizing that the flipped classroom could lead to a culture of innovation within the academic institution:

"*I believe if this flipped classroom is implemented into PdP, the lecturer will be more focused on the culture of innovation that impacts these students to use and to better understand something learned* ."

By fostering a culture of continuous improvement and innovation, the flipped classroom can contribute to both student success and the professional development of lecturers.

5. Conclusion

The findings of this research provide valuable insights into the impact of flipped classroom pedagogy on repeater students' understanding of Engineering Mathematics and the experiences of lecturers in implementing this approach. The flipped classroom model was found to positively influence repeater students' comprehension by offering pre-class resources such as videos, slides, and practice questions. This allowed students to learn at their own pace, enabling them to engage with the material repeatedly, whic h improved their grasp of complex mathematical concepts. One student noted,

"*If the lecturer gives us a video or a note, we can refer to it at any time… We will learn from our mistakes, and we'll know where we made them*."

This flexibility resulted in greater student confidence, with another student reporting significant improvement in test scores after experiencing the flipped classroom approach:

"*After repeating this subject through a flipped classroom approach, I was able to improve my score to over 40/50*."

From the lecturers' perspective, while the flipped classroom fostered creativity and independence among students, they also faced challenges. Both lecturers emphasized the importance of careful preparation in creating teaching materials and using diverse platforms like Microsoft Teams, WhatsApp, and Telegram to ensure accessibility. However, technological issues, such as unreliable internet access, were common obstacles. Lecturer 1 remarked,

"*The first is access to the internet... without internet access, we won't be able to connect with our students.*"

Despite these hurdles, the flipped classroom was seen as an effective tool for innovation in teaching, encouraging lecturers to develop more creative learning materials. Lecturer 1 observed, " *When all the lecturers have used the flipped classroom method in the teaching and learning sessions, they will be creating more creative materials*."

This method also promoted student independence, as students took responsibility for reviewing materials before attending class, reducing their dependence on lecturers during in-class time.

Despite these positive outcomes, the research identified several limitations. Students reported challenges in managing their time effectively, particularly when balancing multiple courses or dealing with technical issues like slow internet connections. Additionally, both lecturers and students noted the need for institutional support to improve infrastructure and provide better access to the necessary technology.

For future research, several recommendations emerge. First, further studies could explore strategies to enhance student motivation and engagement, particularly for repeater students. Investigating interventions such as structured time management guidance and personalized learning support could provide more effective solutions. Additionally, longitudinal studies tracking the long-term impact of the flipped classroom on student learning outcomes would offer deeper insights into its sustained benefits. Research could also explore how improved institutional infrastructure, such as better internet connectivity and device access, could enhance the flipped classroom experience. Comparative studies across different subjects would also be beneficial, as one student noted that while the flipped classroom worked well for mathematics, it might not be as effective for subjects like programming. Lastly, future studies could evaluate the role of formative assessment within the flipped classroom model, identifying which types of assessments best support student learning and engagement.

In conclusion, while the flipped classroom model shows great promise in improving repeater students' understanding of Engineering Mathematics, its full potential can only be realized with stronger institutional

support, enhanced student motivation strategies, and continued innovation in teaching practices. Further research is needed to address the challenges identified and to ensure that the flipped classroom can be adapted effectively across various educational contexts.

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Appendix A

Interview Protocol for the two lecturers that have been practicing the flipped classrooms among repeater students in the Engineering Mathematics course.

1. Can you explain the planning and preparation process involved in transitioning to a flipped classroom model?
2. What specific instructional strategies or resources did you incorporate into the flipped classroom to support repeater students' learning?
3. How did you assess the effectiveness of the flipped classroom approach in improving repeater students' academic performance and engagement?
4. What challenges, if any, did you encounter during the implementation of flipped classrooms for repeater students, and how did you address them?
5. Have you observed any changes in student engagement or participation during class sessions since adopting flipped classrooms?
6. What specific aspects of the teaching process do you believe have been most positively affected by the introduction of flipped classrooms?
7. Do you feel flipped classrooms have helped address the learning styles and challenges of repeater students in Engineering Mathematics?
8. From your perspective, do you believe that the adoption of flipped classrooms will have a positive impact on the long-term educational outcomes and student success within your institution?
9. Do you believe the widespread adoption of flipped classrooms could contribute to a culture of innovation and excellence in teaching and learning across the institution in the long run?
10. What strategies or measures do you think would be necessary to ensure the continued effectiveness and sustainability of flipped classrooms as a teaching approach within your institution?

Appendix B

Interview Protocol for the two repeater students that have been exposed to the flipped classrooms in the Engineering Mathematics course.

1. Can you explain how the process of implementing a flipped classroom has been practiced in the Engineering Mathematics course? Is the flipped classroom approach enjoyable to you?

2. How do you take advantage of resources provided in flipped classroom format like video recordings of learning or online material?

3. Could you share any challenges or obstacles encountered while practicing the flipped classroom, and how they were addressed?

4. How did the flipped classroom approach impact your engagement and participation in the course compared to traditional instruction?

5. Have you noticed any changes in the teaching style or interaction between the lecturer and students as a result of implementing flipped classrooms?

6. Did you feel that the flipped classroom model helped address any specific challenges you faced as a repeater student in Engineering Mathematics?

7. In your opinion, do you believe that the implementation of a flipped classroom model will have a positive impact on the long-term learning outcomes for Engineering Mathematics students at your institution?

8. How do you see flipped classrooms improving repeater Engineering Mathematics students' learning experience over the long term?

9. In your opinion, what are the challenges or concerns if the institution is implementing flipped classrooms on a broader scale within our institution, and how do you think they could be addressed?

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Properties of Ceramic Tile Waste Aggregates for the Sustainable Aggregates Replacement in Concrete

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Abstract

The construction industry is searching for environmentally friendly substitutions for concrete materials. The shortage and high cost of natural sources were the reasons for finding alternative waste materials in concrete production. Ceramic tile waste aggregates (CTWA) have a high potential for aggregate replacement in concrete. The objective of this study was to determine the properties of ceramic tile waste aggregates. Several tests on aggregates were conducted according to the relevant testing standard. CTWA differs in structure and composition, resulting in differences in aggregate properties. CTWA has a lower specific gravity when compared to natural aggregates (NA). The porous structure of CTWA causes a lower density and allows it to absorb a higher amount of water than NA. Although CTWA is flakier than NA, a test of impact resistance showed that CTWA was stronger than NA. The size restriction of 10 mm results in a lower elongation index than NA, making it have a proper particle packing arrangement. Particles with low elongation result in less void between aggregates and offer greater stability in the aggregate arrangement. The results show that CTWA is feasible as a recycled aggregate material to promote sustainable development in concrete production.

Keywords: - recycled aggregates, ceramic tile waste aggregates, aggregates properties

1. Introduction

Currently, the construction sector is searching for environmentally friendly substitutions to concrete materials to create an eco-friendlier environment for future generations (Jayaprithika & Sekar, 2016). The shortage and high cost of natural sources of building materials were the reasons to find alternative waste sources that could be put into concrete production (Alves et al., 2014). In this context, ceramic tile waste aggregates (CTWA) have potential as a replacement for natural aggregate (NA) in concrete (Anderson et al., 2016). The production of ceramic tiles can generate rejected material due to size variations, glaze defects, cracks and poor firing results (Elçi, 2016). In some factories, the amount wasted on discarded tiles reaches 7% of total production output (Pacheco-Torgal & Jalali, 2010). Ceramic waste is categorized as undegradable material because the biological degradation process of ceramics is extremely time-consuming, and it can last thousands of years (Halicka et al., 2013). Therefore, utilization of ceramic waste as coarse aggregate replacement reduces cost of construction and sustainable concrete can be produced (Gautam et al., 2020)

Ceramic tile waste typically has a glazed, smooth surface and an uneven shape. Natural coarse aggregate has a uniform shape and a rough texture. Aggregates with a smooth and flat surface affect the workability and performance of concrete (Elçi, 2016). Elongated and flaky aggregates fail more easily than uniform aggregates. In addition, the flaky shape weakens the bond between aggregates when subjected to pressure. When an elongated aggregate is subjected to pressure, it is more likely to crack or break than a uniform aggregate. Ceramic aggregates have flat and smooth surfaces, which produce less interfacial bonding than natural aggregates due to their flat and smooth surfaces (Anderson et al., 2016). Therefore, the size of ceramic tile aggregates should be reduced to achieve a rounder shape, addressing the challenges identified in previous studies. This study aims to evaluate the physical and mechanical properties of ceramic tile waste aggregates and compare them with natural aggregates to assess their potential for use in concrete.

2. Literature Review

The study carried out recently showed that ceramic waste is a promising aggregate substitute in concrete. However, ceramic waste's properties are different from those of natural aggregate. Natural aggregates are produced on their own, whereas ceramic products are manufactured in multiple steps, including shaping and firing at high temperatures (Monfort et al., 2014). At the end of its useful life, ceramic waste is typically discarded, contributing to environmental issues. Wastes from ceramic products are also a result of inadequate quality during production and poor workmanship, in addition to outdated furniture products (Andreola et al., 2016). As ceramic waste accumulates every day, ceramic industries have become burdened with finding a

viable disposal option. Disposing of these waste materials is a significant additional cost to the entire construction project. Industrial waste is great potential as raw materials for concrete production (Haque et al., 2021). Thus, using ceramic waste from factories and construction sites as aggregates in concrete is an environmentally sustainable solution. This is because it reduces natural resources degradation due to natural aggregate extraction. Additionally, it will reduce the volume of waste disposed of in landfills (Ray et al., 2021, Meena et al., 2022).

The compressive strength of concrete with ceramic aggregates increased at a substitution ratio of 20% and 50% for floor and wall tiles, respectively. However, it was discovered that the compression strength of concrete decreased at a 100% replacement ratio. Considering the texture of tile aggregates, it is understood that this drop-in strength was brought on by the relatively weak bond in the interfacial transition zone and poor particle distribution as shown in Figure 2.1 (Anderson et al., 2016). In addition, the density is experimentally shown to decrease with increasing substitution percentage due to the inferior density of the ceramic waste aggregates (Magbool, 2022). Nevertheless, Rashid et al. (2017) made a finding indicating that the porosity of the aggregate could also play a role in impacting the strength of the interfacial transition zone (ITZ). The presence of pores enabled the entry of hydrated materials, thereby aiding in chemical anchoring. Incorporating a higher proportion of this type of aggregate might have a positive effect on enhancing the concrete's mechanical characteristics. Figure 2.2 illustrate the ITZ model between ceramic tile waste aggregates and natural aggregates.

Figure 2.1: Distribution of ceramic tile aggregates (Anderson et al., 2016)

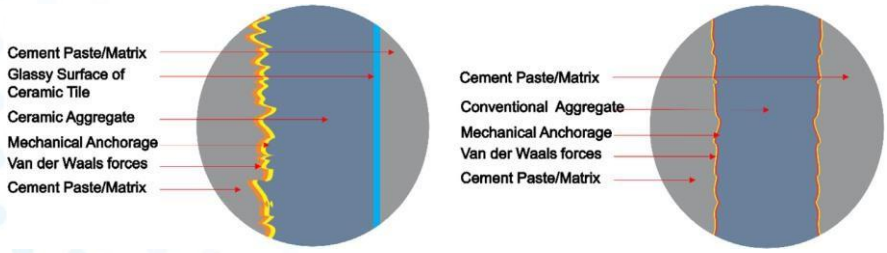


Figure 2.2: The ITZ model between ceramic waste and natural aggregates (Rashid et al., 2017)

According to Heidari et al. (2013), the concrete compressive strength was almost always greater than that of the control concrete. The samples with the best outcomes and highest compressive strength contained 10% ceramic coarse aggregates (CCA). The concrete's declining compressive strength may be caused by an increase in flaky particles (Heidari et al., 2013). Furthermore, Awoyera et al (2018) found that when the proportion CCA in the concrete increased, the 28-day compressive strength also increased. In both aggregate replacement, maximum compression strength was given in the case of a 100% replacement. Comparing the CCA concrete with the control concrete, 36.1% higher compressive strengths were obtained for the CCA concrete (Awoyera et al., 2018). It has been suggested that the irregularity and roughness of the CWA may improve the bond between the CWA and the cement paste, which may be responsible for superior strength of the ceramic coarse aggregate mixtures (Liu et al., 2015). In comparison to the reference concrete, the concrete with ceramic coarse tile and aggregates of red ceramic had a 41% and 29% increase in compressive strength, respectively. This is because both varieties of ceramic aggregates are harder than natural ag gregates (Keshavarz & Mostofinejad, 2019). Concrete with a higher proportion of flaky ceramic aggregates will become brittle and have a reduced compressive strength. A decreased density of ceramic aggregates results from the rough surface of the ceramic aggregates, which increases the porosity of the concrete. Some researchers identified a decrease in compressive strength in the case of ceramic tile aggregates (Daniyal &

Ahmad, 2015), but other researchers discovered a reasonable gain in compressive strength (Elçi, 2016; Heidari et al., 2013; Kara & Taner Yildirim, 2012; Anderson et al., 2016). The optimum outcome was achieved by replacing all of the coarse aggregate with tile aggregate.

Earlier studies have examined the use of ceramic waste as a replacement for natural aggregates in concrete, but many have reported challenges related to the shape of the ceramic aggregates. Flaky and flat aggregates, with their smooth surfaces, often weaken the bond between the cement paste and the aggregate, leading to reduced compressive strength. While some research shows that moderate replacement ratios can improve strength, high ratios tend to result in a loss of strength due to poor particle distribut ion and the roughness of the ceramic surfaces. The current study addresses these issues by focusing on reducing the size of the ceramic aggregates to produce a more rounded shape. This approach aims to enhance the bond between the cement and aggregate, thereby mitigating the negative effects associated with flaky and smooth aggregates, and improving the overall strength and durability of the concrete. By refining the aggregate shape, this study seeks to overcome limitations seen in previous research and contribute to a more reliable use of ceramic waste in construction.

3. Methodology

In this study, Ordinary Portland Cement (OPC) with a strength of 42.5 MPa was used. Granite sourced from a quarry served as the coarse aggregate, defined as particles larger than 4.75 mm. Ceramic tile waste, shown in Figure 3.1, was utilized as a replacement for coarse aggregates. Reusing ceramic waste in concrete helps reduce the demand for natural aggregates, thereby preserving resources like sand and granite, which are often extracted from environmentally sensitive areas. Compared to other waste aggregates, such as crushed glass or plastic, ceramic waste offers the added benefit of being highly durable and resistant to chemical reactions that can degrade concrete over time.

In the first place, the ceramic tile waste was crushed using a compactor and roller to reduce the size. After that, a smaller size of ceramic tile waste was obtained by using the crusher machine. In earlier studies, the smooth and flaky surfaces of ceramic tile waste have been shown to weaken the bond between the cement and aggregate, reducing the strength of the concrete. To solve this problem, this study uses a smaller aggregate size, with a maximum of 10 mm. By reducing the size, the aggregates become more rounded and less flaky, which helps them fit together better in the concrete mix. This improves the bonding between the cement and aggregates, leading to stronger concrete. Figure 3.2 shows the physical appearance of ceramic tile waste aggregates. Ceramic tile waste aggregates were used as a substitute for natural aggregates in varying proportions by weight of 25%, 50%, and 75% for coarse aggregates. A high percentage of replacement is taken to maximize the utilization of ceramic waste aggregate in concrete production. The concrete mix was designed according to the Building Research Establishment of 1988 as shown in Table 3.1. Each mixture was aimed at a slump range of 60-180 mm to achieve optimal workability. Accordingly, a water-cement ratio of 0.55 was employed.

Table 3.1: Proportions of the concrete mix (kg/m^3)

Mix no.	Cement	Water	Fine aggregate	Coarse aggregate	
			Normal sand	Granite	CTWA
RC	455	254	800	835	-
CCA25	455	256	800	625	210
CCA50	455	258	800	420	420
CCA75	455	260	800	210	625

Figure 3.1: A stockpile of ceramic tile waste was used in the study

Figure 3.2: A photograph of ceramic tile waste aggregates

4. Finding and Analysis

The following section addressed the basic properties of aggregates, including their specific gravity, water absorption, aggregate impact value, flakiness index and shape index. To ensure the accuracy of the results, every aggregate test was carried out in a controlled environment and followed the standards.

4.1 Specific Gravity

The results of the test for specific gravity are presented in Table 4.1. The values of 2.57, 2.55, and 2.61 are successively possessed by natural aggregates, NA. The ceramic waste aggregates, CTWA came in with significantly lower numbers of 2.20, 2.18, and 2.23 respectively. On average, the specific gravity for NA and CTWA is 2.58 and 2.20 respectively. The specific gravity of NA is generally 17.3% higher than CTWA which identify that the quality of NA is marginally superior than that of CTWA. Similar finding was observed by Rashid et al. (2017). Specific gravity plays a key role in determining the overall durability of concrete, especially when incorporating porous aggregates like ceramic tile waste. Specific gravity refers to the density of an aggregate relative to water, and it directly affects the weight, strength, and water absorption capacity of concrete. Aggregates with higher specific gravity generally contribute to stronger and more durable concrete due to their higher density and reduced porosity. Conversely, porous aggregates, such as ceramic tile waste, typically have a lower specific gravity, which means they absorb more water. Therefore, while ceramic waste can still be beneficial as an aggregate, measures like proper mix design, surface treatment, or minimizing the use of highly porous particles are important to mitigate the negative effects on durability.

Table 4.1: The results of specific gravity of aggregates

Specific Gravity	Natural Aggregates, NA	Ceramic Waste Aggregates, CTWA
Specimen 1	2.57	2.20
Specimen 2	2.55	2.18
Specimen 3	2.61	2.23
Average	2.58	2.20

4.2 Water Absorption

The values for the water absorption of the aggregates are given in Table 4.2. The percentage of water absorption of NA ranges from 1.36% to 1.4%. For CTWA, the water absorption is slightly higher than that of NA, ranging from 4.83% to 4.9%. From the results, the average water absorption of NA is 1.38%, while the water absorption of CTWA is 4.87%. The results show that the water absorption of CTWA is 3.5 times higher than NA. The ceramic waste aggregates are evidently more porous than the natural aggregates which also discovered by Anderson et al. (2016). The results are consistent with most previous studies, which also come to the same conclusion. Water absorption provides an indication of the internal structures of the aggregate and its strength. The main consideration in the water absorption of aggregates is the water-cement ratio. Higher water absorption of aggregates reduces the amount of water in the concrete mix and leads to insufficient hydration of the cement, which affects the strength of the concrete. Because the CTWA is made from clay and is hardened by a firing process, it is inherently more porous and is normally considered unacceptable unless it passes tests for strength, impact resistance and hardness.

Table 4.2: The results of water absorption of aggregates

Water Absorption	Natural Aggregates, NA (%)	Ceramic Waste Aggregates, CTWA (%)
Specimen 1	1.36	4.83
Specimen 2	1.40	4.87
Specimen 3	1.37	4.90
Average	1.38	4.87

4.3 Aggregate Impact Value (AIV)

The results of the aggregate value are shown in Table 4.3. The tests conducted in the dry state show that the natural aggregates have an impact value in the range of 18.95% to 19.59%. In contrast, the impact value of the ceramic waste aggregates ranges from 18.57% to 18.94%. On average, the impact value of NA and CTWA are 19.3% and 18.8 respectively. The natural aggregates perform 2.6% higher than aggregates from ceramic waste. It is indicated that CTWA is slightly harder than NA. The impact values differ only very slightly from each other, and the impact values for both types of aggregates are comparable. Both aggregates have an impact value that is below 30% according to the testing standards, indicating that they are suitable for use in concrete according to BS812-112:1990. Although it is known that CTWA has a porous structure compared to NA, CTWA has very good impact strength, as ceramic tiles are a very strong material in construction. By compacting and firing CTWA, it becomes very hard and durable and can be used as floor and wall finishes. In addition, elongation index of CTWA is slightly lower than NA. An elongated particle can hinder proper particle packing and supporting between aggregates. Therefore, CTWA have great potential as aggregates for concrete production due to their sufficient impact strength.

Table 4.3: The result of aggregates impact value

Impact Value	Natural Aggregates, NA (%)	Ceramic Waste Aggregates, CTWA(%)
Specimen 1	18.95	18.57
Specimen 2	19.59	18.94
Specimen 3	19.35	18.88
Average	19.30	18.80

4.4 Flakiness Index

The results of the coarse aggregate flakiness index are shown in Table 4.4. This test is carried out to determine the flakiness of the aggregates. While the natural aggregates had a flakiness index between 14.98% and 15.90%, the flakiness index of the ceramic aggregates ranged between 20.99% and 22.88%. The average flakiness index of NA is 15.56%, which is significantly lower than the flakiness index of CTWA, which is 21.70%. Both aggregates were found to meet the test requirements, which specify an index of no more than 30%. Ultimately, both types of aggregate can be used in concrete production. The properties of concrete that has been mixed can be affected by the particle shape. When it comes to the production of workable concrete, coarse-grained, angular, and elongated particles require more water than smooth, rounded, and compact aggregate does. The ceramic tile waste collected in this study has a thickness of 8 mm to 12 mm, which is normally used for floor and wall finishes. To reduce the flakiness of the aggregate, the size of the coarse aggregate was limited to 10 mm. Therefore, with an average flakiness of 21.7%, CTWA has a smaller size difference compared to NA, indicating that both aggregates can be used for concrete production.

Table 4.4: The result of flakiness index of aggregates

Flakiness Index	Natural Aggregates, NA (%)	Ceramic Waste Aggregates, CTWA(%)
Specimen 1	15.79	20.99
Specimen 2	15.90	21.23
Specimen 3	14.98	22.88
Average	15.56	21.70

(a) (b)

Figure 4.1: The aggregate samples (a) NA, (b) CTWA for the flakiness index test

4.5 Elongation Index

The occurrence of particles with an elongated shape is considered unfavourable due to their inherent fragility and the risk of failure under heavy loads. Therefore, it is necessary to evaluate the shape of the particles, especially with regard to their elongation. The results of the shape index of the aggregate are shown in Table 4.5. While the shape index for natural aggregates ranged from 24.94% to 26.93%, the elongation index for aggregates from ceramic waste ranged from 15.87% to 17.18%. It has been demonstrated that the elongation index of natural aggregates is much higher than that of aggregates from ceramic waste, which is 16.68%. Both aggregates were found to meet the test criteria, which provide for a maximum shape index of 30 %. The approach of limiting the CTWA size to no more than 10 mm has a significant impact on the production of well-shaped aggregates. In general, an elongated and flaky aggregate fails easily compared to a uniform aggregate. When an elongated aggregate is subjected to pressure, it is more likely to crack or break than a uniformly shaped aggregate. In this case, both aggregates have a shape index of less than 30%, ensuring good interlock between the aggregates themselves and a good bond with the hardened cement paste. This ensures that the concrete achieves the desired strength specified in the design mix.

Table 4.5: The result of elongation index of aggregates

Elongation Index	Natural Aggregates, NA (%)	Ceramic Waste Aggregates, CTWA(%)
Specimen 1	26.93	17.18
Specimen 2	25.88	15.87
Specimen 3	24.94	16.98
Average	25.92	16.68

Figure 4.2: The aggregate samples (a) NA, (b) CTWA for the elongation index test

4.6 Effects to the compressive strength of concrete

The average of the compressive strength for ceramic coarse aggregates (CCA) is shown in Figure 4.3. The development of strength from the third to the 28th day is the same for all concrete mixes, indicating that the sample was prepared in a consistent manner. Meanwhile, results show that the CCA25 and CCA50 series have lower compressive strength of 9% and 6% respectively. The concrete's declining compressive strength may be caused by an increase in flaky particles because flaky aggregates may decrease the compressive strength of concrete (Heidari et al., 2013). The impact value of aggregates discussed in the previous section shows a comparable value between NA and CCA. Therefore, the CCA concrete should be comparable to the reference concrete in terms of compressive strength. However, when the proportion of aggregate increases to 75 %, the compressive strength of CCA75 is 9 % higher than that of the reference. This is due to the dispersion of the aggregate for CCA75, which has good interlocking between the aggregates, as shown in Figure 4.4. The distribution of aggregate for CCA25 and CCA50 is not sufficient to achieve higher interlocking strength compared to the reference concrete. Overall, it was found that the percentage of substitution of coarse aggregate contributing to the increase in concrete strength is 75%.

Figure 4.4 shows the distribution of aggregates in concrete. The compressive strength of CCA75 is slightly higher than that of the reference concrete RC. It can be observed that the distribution of CTWA in CCA75 is fairly uniform and has a high degree of interlocking between the aggregates. Nevertheless, the CTWA was able to produce comparable concrete strength to the natural aggregate, although it is flakier. In the CCA series, reducing the size of the coarse aggregate to a maximum of 10 mm in order to obtain a surface with a rougher texture and thus limit the influence of a smooth surface on the material, results in increased interlocking bonding between the aggregates.

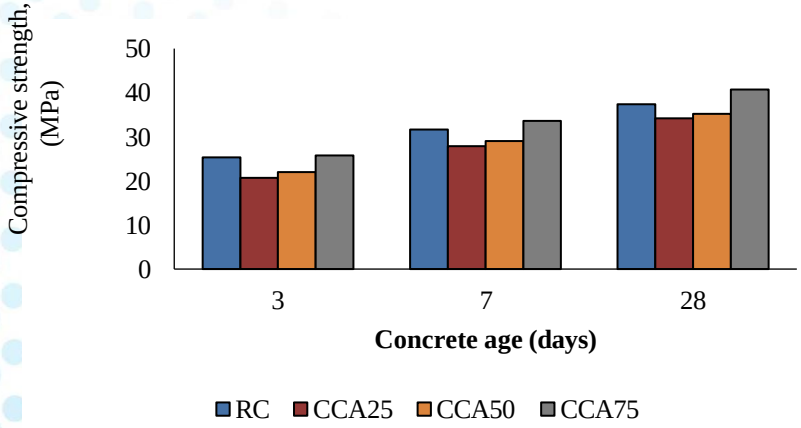
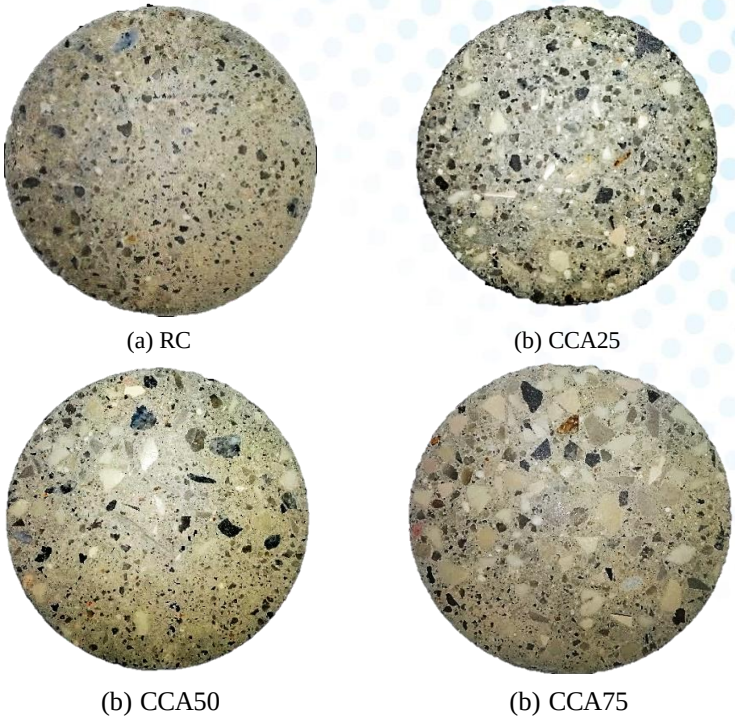


Figure 4.3: The average of cube compressive strength for CFA concrete



(a) RC (b) CCA25

(b) CCA50 (b) CCA75

Figure 4.5: Distribution of aggregates

5. Conclusion

In conclusion, the findings indicate that natural aggregates (NA) generally exhibit higher specific gravity and lower water absorption than ceramic waste aggregates (CTWA), which implies a marginally better material quality for NA. However, despite being more porous, CTWA demonstrates comparable strength and impact resistance, largely due to its hardness after the firing process. The flakiness and elongation indices for both aggregates meet the required standards, though CTWA has a higher flakiness index. Importantly, the compressive strength of concrete mixed with CTWA is comparable to that of concrete with NA, with optimal results achieved at a 75% substitution of coarse aggregate. Thus, CTWA holds significant potential for use in concrete production due to its sufficient strength and durability characteristics. Therefore, limitation of the size of CCA to 10mm, reduce the flakiness and improved interlocking between the aggregates. Overall, the differences in the properties of aggregate and concrete with CTWA are quite acceptable and promising to achieve sufficient concrete strength.

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Optimization of AISI 316LVM Austenitic Stainless Steel S Phase Layer for Medical Application

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Abstract

Previous efforts to enhance the surface hardness and wear resistance of austenitic stainless steels through surface treatments have often led to a decline in corrosion resistance due to chromium precipitation in the hardened layer. In this research, a series of systematic gas diffusion thermochemical treatments and characterizations were conducted on medical-grade austenitic stainless steel (AISI 316LVM) to identify optimal treatment conditions (temperature, duration, and gas mixture) that can improve the performance of the steel while maintaining its corrosion resistance. The hybrid S-phase layer was thoroughly examined using microscopy, microhardness testing, phase analysis, potentiodynamic polarization, and pin-on-disk testing in accordance with relevant standards. Based on the DOE optimization, the ideal parameters for the low-temperature hybrid heat treatment were found to be a temperature of 475°C with a holding time of 12 hours. The best gas composition was a combination of 10% methane, 80% ammonia, and 10% nitrogen. The nitrogen and carbon atoms dissolved into the austenitic structure, forming an interstitial supersaturated solid solution known as the hybrid S-phase layer. Microscopy analysis revealed a hybrid S-phase layer thickness of up to 13.3 µm. The characterization results indicated that this layer significantly increased surface hardness to 1461 $HV_{0.025}$, tripled wear resistance, and improved corrosion resistance compared to untreated material. Thus, applying the hybrid S-phase surface modification process to medical-grade austenitic stainless steel could be suitable for biomedical applications.

Keywords: - 316LVM stainless steel, hybrid treatment, optimization

1. Introduction

Stainless steel type 316L (316L SS) are most widely used for implant material due to its low cost compared to titanium and cobalt alloy. 316L stainless steel also has acceptable biocompatibility and good mechanical properties. The use of 316L stainless steel as a temporary implant also was approved by the Food and Drug Association of the United States (US FDA). Medical grade stainless steel type 316L are employed in orthopedic implants including application of intramedullary nail, total hip replacements and bone fracture plates and screws (Chen & Thouas, 2015). Although, the chromium element in the stainless steels results in the evolution of thin, chemically stable and passive oxide film (Cr_2O_3) upon the surface, however, the clinician's problem with 316L stainless steel implant is implant failure due to corrosion in adverse condition of the human body.

One way to reduce the corrosion of surgical implants is by selection of a suitable alloy with improved surface properties by adding alloying elements, which increase the nature, composition, and stability of the passive film. Surface-treatment techniques, such as plasma nitriding, thermochemical gas nitriding (Azmi et al., 2021), magnetron sputtering, physical vapor deposition (PVD) (Sivaprakasam et al., 2020) and ion implantation (de Oliveira et al., 2018), were common surface treatment techniques used to integrate nitrogen/carbon atom into the surface area of stainless steels. The hybrid gas diffusion thermochemical heat treatment process able to develop the hybrid S phase layer on medical grade stainless steel at the lower initial cost compared to other techniques. However, to gas nitride an austenitic stainless steel, the targeted surface should be activated to eliminate the oxide film to permit the nitrogen/carbon diffusion process (Saedon et al., 2020).

Further research on the S phase development using thermochemical gas diffusion techniques is needed due to the lack of literature on the characterization and biocompatibility of the material to be used as a biomedical device. Early observation also indicates that most of the study on S phase formation use the varying value of the process parameter and does not relate the influence of each parameter towards the characteristics of the S phase layer. This research mainly focuses based on fundamentally theoretical investigations on development and optimization of S phase layer of AISI 316LVM stainless steel for biomedical application using low- temperature thermochemical hybrid gas diffusion techniques. The investigation is to find the best optimum

parameters of developing S phase layer with improved hardness, wear resistance and corrosion resistance.

2. Literature Review

The biomedical implant is a device implanted in a human body purposely according to surgical procedures in a specified duration of time. The biomedical implant must possess specific characteristics such as biocompatible, good mechanical properties, high corrosion and wear resistance and osseointegration. Implant made from metallic material escalating due to the demand for long bones internal fracture fixation in the 1860s (Park & Lakes, 2007). Since then, implant from metal metallic has played a major role in orthopaedic surgery devices such as bone screws and pins, on lay bone plates, intramedullary bone nails and total joint prostheses (Hamidi et al., 2017). Applications of the metallic implant also have expanded to other medical division including cardiovascular (stent), dentistry (orthodontic wire), craniofacial (plate and screw) and otorhinology (artificial eardrum).

Austenitic stainless steel is the most common used stainless steel material in stainless steel family. The 300 series AISI standard stainless steel have the advantages of having a better mechanical property, offer higher strength and toughness at elevated temperature as well as provide excellent corrosion resistance and oxidation resistance due to the massive amount of chromium and nickel. austenitic stainless steel is non - magnetic with fcc (face-centred cubic) atomic lattice configuration. Application of stainless steel in the biomedical industry starts as early in the 1920s when 18-8 stainless steel was introduced to replace vanadium steel as medical implant. The 18-8 now are commercially known as AISI 304 stainless steel (X5CrNi18 -10). When molybdenum added to the 18-8 stainless steel to intensify the corrosion resistance properties, it develops new categories of stainless steel known as 316 stainless steel.

The 316L stainless steel application authorized by the Food and Drug Association (FDA) for medical devices and implant and become the most common used alloy for medical applications to date (Ibrahim et al., 2017). American Society for Testing and Materials (ASTM) acclaims Stainless steel type 316L as implants material due to lower possibility of chromium carbide appearance which reduces the risk of intergranular corrosion. Majority of stainless-steel applications are in the orthopaedic department as in **Error! Reference s ource not found.**. The implant in orthopaedic usually is bone fractures fixation device such as fracture plates, intramedullary nail, screw, pin and wires. Next, a stainless steel implant also can be used as joint replacement material such as a hip implant. Two types of hip implant currently being used for osteoarthritis patient are total hip arthroplasty (THA) and surface replacement type (Karachalios et al., 2018). Different stainless-steel implant application used in orthopaedic are shown in *Error! Reference source not found.*. In orthopaedic p ractice, the most commonly used stainless steel is AISI 316LVM, nickel free austenitic stainless steel (ASTM F2581) and high nitrogen austenitic stainless steel (ASTM F1586).

In biomedical application, corrosion of stainless steel implant occurs slowly as a result of electrochemical interaction at a finite rate in the human body system (Asri et al., 2017). The human body extracellular tissue fluid environment contains water, dissolved oxygen, chloride and sodium ion, bicarbonate, phosphate, complex organic compounds, etc. During the implantation process, the tissue ecology is disturbed, affecting the blood flow to the lymphatic system and the ionic equilibrium. The corrosion initiation resulted from of various circumstances originating from the implant surface; it's either the formation of localized electrochemical cells causing pitting attack or crevice corrosion at the contact face between a fixation plate and screws (Borgioli et al., 2018; Bottoli et al., 2018). The addition of nitrogen element would improve the corrosion resistance of treated material. Nitrogen occupancy in S phase structure will widen the passive range and prevent pitting. This will avoid the stress corrosion cracking and intergranular corrosion (C. X. Li & Bell, 2004). Nitrogen addition helps to stabilize austenite and increase the corrosion resistance (X. Y. Li & Dong, 2003).

Several authors reported the wear resistance of the treated steel has significantly improved. The nitrogen S phase wears resistance is slightly better than the carbon-rich S phase (Thaiwatthana et al., 2003). The most utilized wear test tribological evaluation used by the previous researcher are pin on disk with very low loads (Sun et al., 2014). An average improvement of wear resistance for nitrided and carburized 316L stainless steel by factors of 78 and 75 respectively. For simultaneous nitrogen and carbon heat treatment, the S phase also recorded wear resistance improvement comparable to individual nitriding or carburizing.

3. Methodology

3.1 Material and Surface Treatment

The hot-rolled bar of medical-grade austenitic stainless steel 316LVM was cut into ⌀25 x 6 mm sections,

with the flat surface ground and polished to 0.1 μm. This AISI 316LVM austenitic stainless steel consists of a chemical composition of 17.67% Cr, 14.76% Ni, 0.002% Ti, 1.86% Mn, 0.017% C, and the remainder being Fe. The steel samples underwent a hybrid heat treatment in a customized tube furnace. Before treatment, the samples were soaked in a 37% hydrochloric acid (HCl) fuming solution for 10 minutes to activate the surface. The hybrid heat treatment involved introducing nitrogen and carbon species simultan eously from ammonia (NH_3) and methane (CH_4), using nitrogen (N_2) as a carrier gas. The furnace chamber was pre-heated from room temperature to 425 °C to 475 °C at a rate of 5 °C per minute, with nitrogen gas flowing at 1.05 m^3 per hour to purge oxygen. Once the target temperature was reached, ammonia and methane were introduced at 0.63 m^3 per hour, with a gas composition of 80% ammonia and 5 -10% methane and nitrogen, as specified in the experimental layout in Table 3.2.

After the treatment, the specimen was slowly cooled in the furnace for four hours. Eight tests were conducted to examine how treatment time, gas composition, and temperature affected the development of the expanded austenite or S-phase layer. Using a full factorial method, the optimization process explored the interactions between these factors to suggest optimal parameters for medical implant applications. A Hitachi Quantax 70 scanning electron microscope (SEM) with Energy Dispersive X-Ray (EDX) capability was used to examine corrosion, wear tracks, layer thickness, and microhardness indentation. For S-phase layer analysis, specimens were cut and hot mounted in conductive bakelite, ground with 240 to 1200 SiC grit paper, polished to 1 μm with Al_2O_3 powder, etched using Kalling reagent No. 2, and dried in a fume hood. Samples were mounted on carbon tape in a vacuum chamber, and images were obtained using a secondary electron (SE) detector. The EDX analysis determined elemental composition and quantity post-treatment.

Table 0.1 Experimental Layout of Hybrid Heat Treatment Process

Hybrid Heat Treatment Parameter			
No of experiment	Time (Hours)	Temperature (° C)	Gas (% CH^4)
Test 1	6	425	5
Test 2	12	425	5
Test 3	6	475	5
Test 4	12	475	5
Test 5	6	425	10
Test 6	12	425	10
Test 7	6	475	10
Test 8	12	475	10

Microhardness test was used to measure the hardness of the hybrid heat treated specimens by using indentation method. For this study, the Vickers hardness test machine of model MVK-H, Mitutoyo and the same specimen used in microstructural analysis was used. The specimen placed under an optical microscope to ensure the quality of the surface, before placed on the Vickers hardness test machine. When the specimen was fixed on the machine using a fixture, the 25 g load was applied to the specimen for 10 seconds using Vicker's indenter. Hardness measurement was conducted according to ASTM E384.

To determine the wear properties of the hybrid treated specimen, a pin-on-disk experimental procedure was conducted following the ASTM G99-05 standard. This wear test was performed under non-lubricated and non-abrasive conditions. Each experiment required a pin and a flat circular disk. Before testing, both the pin and disk were cleaned and dried to remove contaminants. The specimen's initial conditions, including weight and dimensions, were recorded using a Shimadzu AUW320 analytical weight balance. The pin and disk were then placed in the holder, ensuring they were perpendicular and in contact with each other. A 10 N counterweight was attached to the lever arm to apply pressure on the pin against the disk. The motor was started, controlling the rotation speed to a specified value. Once the required sliding distance was reached, the motor was turned off, and the specimen was removed, cleaned, re-measured, and re-weighed to gather results. The pins were made from 316LVM stainless steel, measuring 30 mm in height and 5 mm in diameter, while the disk was made of EN31 bearing steel with a hardness of 58-60 HRC, a diameter of 165 mm, and a thickness of 8 mm.

The anodic polarization test, in accordance with ASTM G5-94, was used to evaluate the corrosion characteristics of both treated and untreated specimens. This test utilized a flat cell configuration with a three -electrode setup: the specimen as the working electrode, a silver chloride (Ag/AgCl) reference electrode, and a graphite auxiliary electrode. To avoid contamination, the test cell was made from non-corrosive materials. A Gamry Reference 600 potentiostat was employed to control the electrode potential with a precision of 1 mV over a wide range of applied currents. The specimen was placed in a glass electrochemical cell and

encased in cold mounting resin, exposing a theoretical surface area of 3.14 cm² to the solution. The open circuit potential (OCP) was monitored until a stable value was achieved, followed by a potentiodynamic sweep scan at a rate of 1 mV/s within a 0.1 V range.

4. Finding and Analysis

Effect of Heat Treatment Parameters on Hybrid S Phase

The influence of varying hybrid heat treatment parameters such as temperature, treatment time and gas composition in low temperature hybrid gas diffusion heat treatment was investigated. The responses evaluated include the S phase layer thickness, hardness, corrosion rate and wear rate. Statistical analysis, ANOVA was employed to investigate the influence of each heat treatment parameters with their interactions on each response by using Design Expert software. The optimum heat treatment parameters were determined based on generating main effect plots.

Thickness

The results of mean hybrid S phase layer thickness are shown in Figure 0.1. The values of the layer thickness were extracted from the scanning electron microscopy from five different spots. In general, the layer thickness is ranging from 1.19 µm to 13.3 µm. It can be noticed the sample Test 8 recorded the highest mean layer thickness followed by sample Test 4. The substantial difference between Test 8 and the lowest recorded layer thickness is about ten times. This due to the difference in all three-parameter used between those to samples. Meanwhile, for sample Test 8 and the second highest recorded S phase layer thickness (Test 4), only 14% difference recorded.

From the ANOVA analysis, all three main parameters were found to be statistically significant influence on the formation of the S phase layer thickness. The heat treatments temperature gives highest influence towards at 67% percentage contribution ratio (PCR). Meanwhile, treatment time is the second at 26%. However additional of 5% CH_4 in the system only influence the S phase layer thickness at 3% PCR. Thus, this justifies the minimal difference between Test 4 and Test 8 due to them having the same treatmen t temperature and holding time. This finding is in agreement with previous studies where increase in temperature will increase the thickness of the S phase layer (Satomi et al., 2017). However, the temperature increased must be controlled under the threshold value in order to avoid the formation of chromium precipitation that depletes the corrosion resistance of the hybrid treated stainless steel. The processing temperature has the most dominant consequence on the development of the S phase layer (Sun, 2005). The S phase layer thickness has a linear relationship with temperature until the threshold value where beyond, it will react to formed a dark phase near the surface region associated to the formation of chromium precipitation (Buhagiar & Dong, 2012).

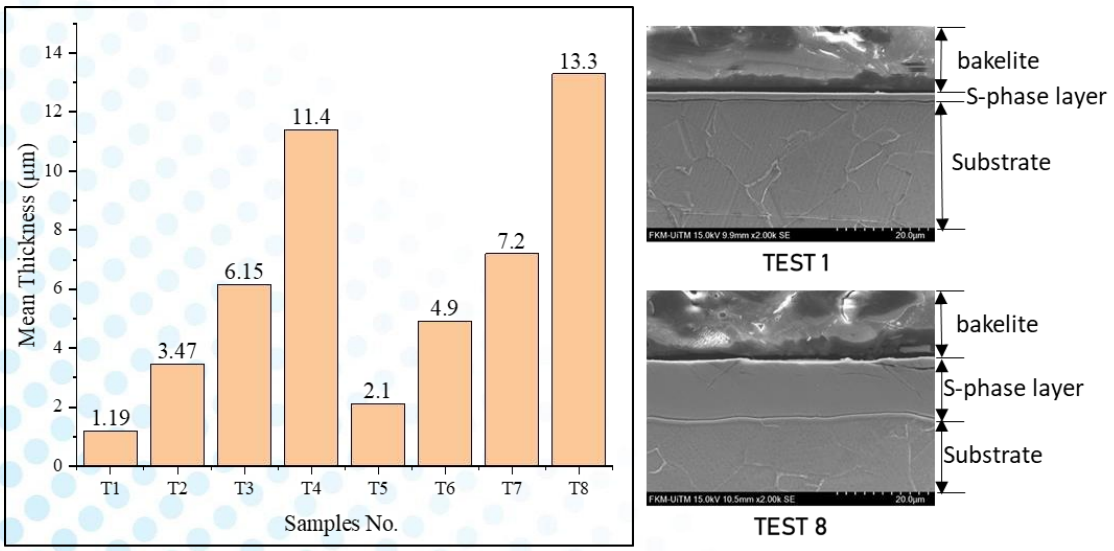

Figure 0.1: Hybrid S phase layer thickness

Microhardness

The results of mean hardness obtained from Vickers microhardness test are presented in Figure 0.2. It can be observed that the average maximum surface hardness was recorded by sample Test 8 at 1461 $HV_{0.025}$ and the lowest recorded by sample Test 1 at 252.77 $HV_{0.025}$. Generally, the graph trends show an increase of the

surface hardness from Test 1 to Test 4 and Test 5 to Test 8. According to the ANOVA analysis, the temperature shows the highest PCR at 64%, treatment time at 19% and CH_4 composition at 5%. The surface hardness corelates with atomic diffusion of nitrogen and carbon during the low temperature hybrid diffusion process. With increase in temperature and treatment time, the difussion rate of the hybrid atoms increased causing lattice expansion which restricts the motion of dilocations thus resulting increased in hardness (Lee, 2016). Meanwhile addition of CH_4 during the heat treatment process also will increase the hardness of the hybrid S phase layer altough it is not as influential as the treatment temperature and treatment duration. However, the additional CH_4 content play a vital role in improving the hardness gradient which decreasing gradually when moving away from the surface thus benefited the treated samples by enhancing the load bearing capacity and the toughness (Sun & Haruman, 2006).

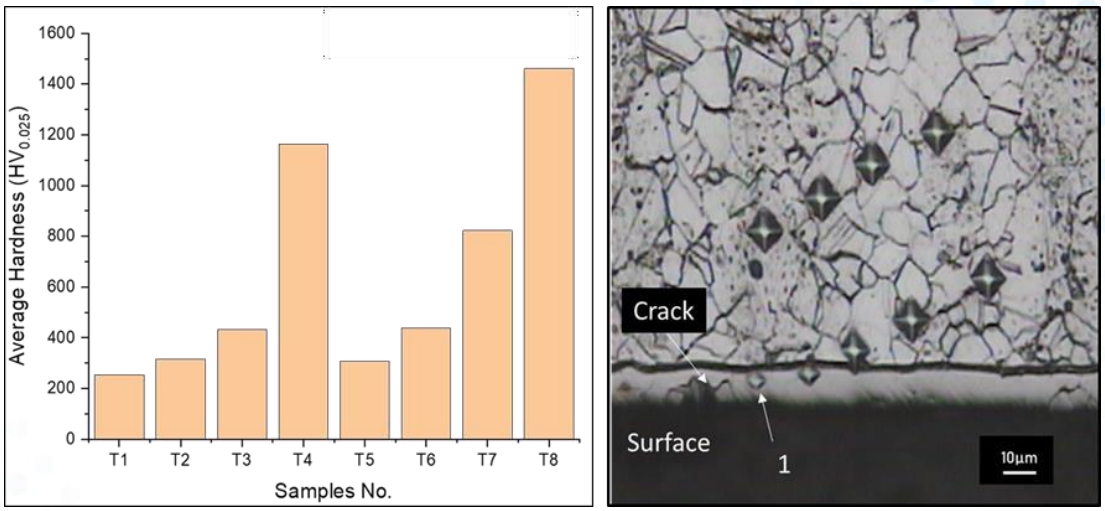

Figure 0.2 Mean hardness results

The main effect plot of the hybrid layer microhardness associated with three operating parameters of treatment time, temperature and methane composition. From the diagram, it can be suggested which parameter influence the hybrid S phase layer hardness the most. The treatment temperature shows the highest slope gradient when the temperature increased from 425 °C to 475 °C suggesting the temperature play most crucial factor in affecting the hardness. It is then followed by treatment time and lastly methane gas composition.

Corrosion rate

The results of mean corrosion rate are presented in Figure 0.3. The value of the mean corrosion rate was obtained from three potentiodynamics test when the hybrid treated sample immersed in a NaCl solution. From the plot, the mean corrosion rate obtained from sample Test 1 shows the lowest corrosion rate at 0.006130 mmpy indicating sample test 1 has the best corrosion resistance compared to other samples. Meanwhile, sample Test 8 recorded the highest corrosion rate at 0.007783 mmpy. According to the ANOVA analysis, all three parameters were found to be statistically significant in influencing the corrosion rates of the hybrid treated samples. Treatment temperature recorded the highest PCR at 79% followed by treatment time and gas composition at 15 % and 5% respectively. This indicates that temperature play major role in influencing the corrosion rate of the hybrid treated samples.

The correlated main effect plot of the corrosion rate indicate that the corrosion rate was at the lowest when the temperature was set at 425 °C and increasing the temperature to 475 °C will increase the corrosion rate to 0.007368 mmpy which is about 15% increment. Meanwhile, increasing the length of treatment time from 6 h to 12 h also will increase the mean corrosion rate of the hybrid treated sample by 6.4 %. The same trend of result can be observed for the gas composition where the increase in methane composition will marginally increase the corrosion rate of the material. The treatment above the critical temperature value led to formation of chromium precipitation which results in deterioration in corrosion resistance of the layer. It was also reported that prolonged treatment of the austenitic stainless steel at relatively high temperature tend to induce the chromium precipitation. Thus, the corrosion resistance properties will be reduced. The increase in CH_4 composition also found to increase the hybrid S phase layer corrosion rate. This can be supported by the finding by the study where it concludes that introduction of high content of methane during the low temperature hybrid heat treatment will facilitate nitride precipitation in the nitrogen enriched layer (Sun & Haruman, 2006).

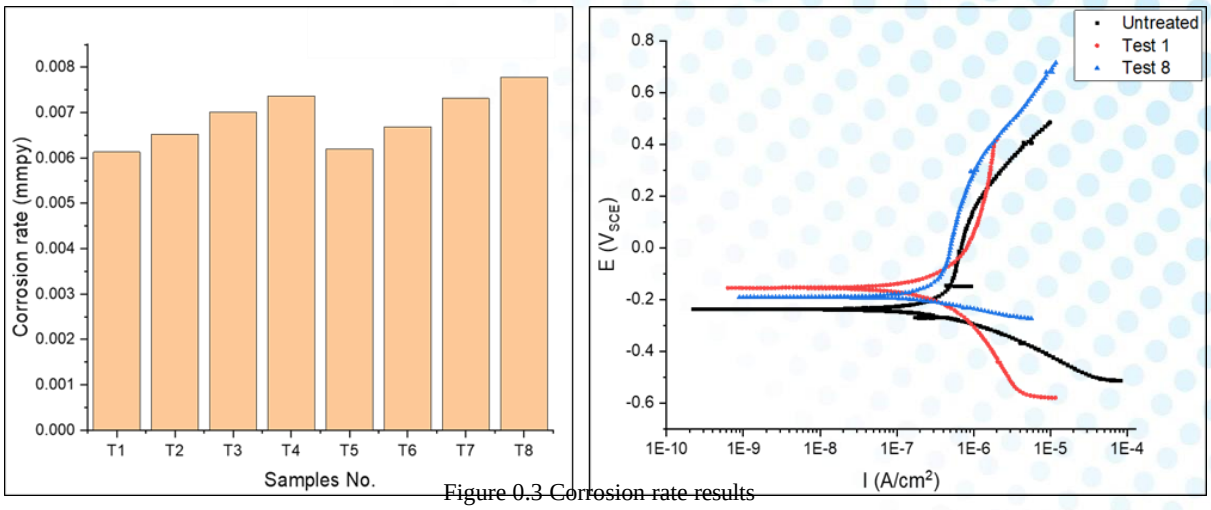

Figure 0.3 Corrosion rate results

Wear Rate

The results of mean wear rate are presented in Figure 0.4. A good indication of material wear response is when the wear rates were kept at minimum. It was found that the sample Test 8 produced the lowest wear rate followed by Test 4 as the second best at 4.9873 and 5.5691 micron respectively. Meanwhile, Test 1 r ecorded the highest mean wear rate at 9.0771 micron. The difference in wear rate between test 1 and test 8 is 42%. This suggest that optimal hybrid treatment parameter help to improve the wear rates of the hybrid treated sample. The ANOVA analysis shows all treatment parameters of methane composition, time and temperature are significant in influencing the result of the wear rates. The treatment temperature recorded the highest PCR at 70% followed by treatment time at 23%. Although the methane composition statistically significant in improving the wear resistance of the hybrid treated material where but only 3% PCR recorded.

When the temperature increased from 425 °C to 475 °C, the wear rates reduced 8.45 micron to 6.164 micron. Thus, increasing the temperature by 50 °C will improve the wear resistance by 27 %. Same trend of result can be observed for treatment time where increasing the duration of the treatment will lead to improvement of wear resistance. Meanwhile, the 5 % additional methane during the low temperature hybrid heat treatment also led to wear resistance improvement. However, the effect is marginal with only 6.7 % improvement. At higher temperature, the hybrid S phase formed is thicker and higher in hardness thus it capable to resist plastic deformation (Trimby et al., 2015; Yetim & Yazici, 2014). This explain the reduction of wear rate of the hybrid S phase layer when the temperature increased from 425 °C to 475 °C. Same explanation also can be applied for the treatment time and methane gas composition.

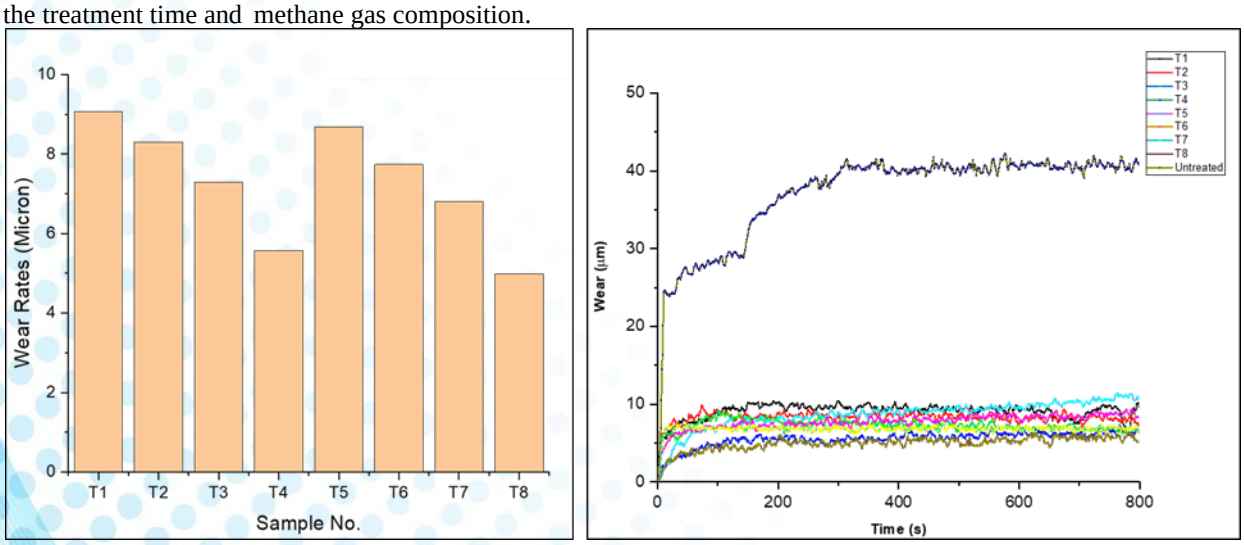

Figure 0.4 Average wear rate

5. Conclusion

The optimized treatment parameters for low temperature hybrid gas diffusion heat treatment tailoring improved mechanical properties of AISI 316LVM. Nitrogen and carbon dissolved in the austenitic lattice of

the medical grade austenitic stainless steel during low temperature gas diffusion heat treatment forming an interstitial supersaturated solid solution called the hybrid S phase layer. The hybrid S phase layer improves the tribological behavior by increasing the wear resistance coefficient and lowering the coefficient of friction consistent with the Archard's dry wear theories. The corrosion resistance also found to be improved as long as the threshold sensitization temperature is not achieved. Low temperature hybrid gas diffusion heat treatment can increase the localized corrosion resistance of medical grade austenitic stainless steels.

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POLITEKNIK KOTA KINABALU

Pengaruh Biomekanik Dan Psikofizikal Dalam Aktiviti Restoran Komersial Berkaitan Dengan Kejadian Tergelincir Dan Terjatuh

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Abstrak

Bekerja di bahagian dapur restoran komersial adalah merupakan perkara yang menarik untuk dikaji kerana persekitaran yang terdedah kepada kemalangan tergelincir dan terjatuh (SNF). Pekerja menghabiskan hampir 8 jam dengan bekerja postur berdiri dan berjalan dalam tempoh yang lama dan kadang-kadang terpaksa bekerja dalam keadaan tergesa-gesa bagi menyelesaikan pesanan pelanggan turut menyumbang kepada kejadian SNF. Fasiliti di tempat kerja itu sendiri dilengkapi dengan pelbagai peralatan dengan pelbagai saiz, berat dan ukuran, ditambah pula laluan kerja yang terhad juga berpotensi menyumbang kepada kejadian SNF. Tujuan utama kajian ini adalah untuk mengenal pasti faktor-faktor utama yang menyumbang kepada kejadian SNF di Restoran Komersial dengan mengembangkan analisis statistik menggunakan faktor biomekanik dan psikofizik dalam kejadian SNF. Kajian ini menggunakan soalselidik di kalangan 30 pekerja (lelaki dan wanita; berumur 23-60 tahun) dengan minimum 1-3 tahun pengalaman dalam aktiviti dapur restoran komersial. Korelasi soalselidik ini dianalisis menggunakan SPSS. Analisa statistik dijalankan untuk mengenal pasti kepentingan aktiviti dapur restoran komersial kepada faktor biomekanikal dan psikofizikal terhadap SNF. Dapatan menunjukkan lantai adalah faktor utama yang menyumbang kepada SNF, diikuti oleh kasut. Seterusnya didapati posisi kerja secara berjalan dan berdiri mempunyai korelasi yang positif dan menyumbang kepada keletihan semasa bekerja dan selepas bekerja. Ini menunjukkan bekerja dengan berjalan berpanjangan, berdiri dan pada masa yang sama membawa beban terutamanya pekerja yang lebih berusia akan mewujudkan postur kerja yang kurang selesa dan menyebabkan keletihan dan keadaan ini tidak sihat dan berpotensi untuk mewujudkan bahaya SNF. Kesimpulan didapati daripada tinjauan yang dijalankan dalam kalangan responden menunjukkan korelasi positif antara umur, pengalaman bekerja, papan tanda SNF, tempoh waktu bekerja dan postur bekerja.

Kata kunci: tergelincir dan terjatuh (SNF), Dapur Restoran Komersial, berjalan lama, berdiri, keletihan

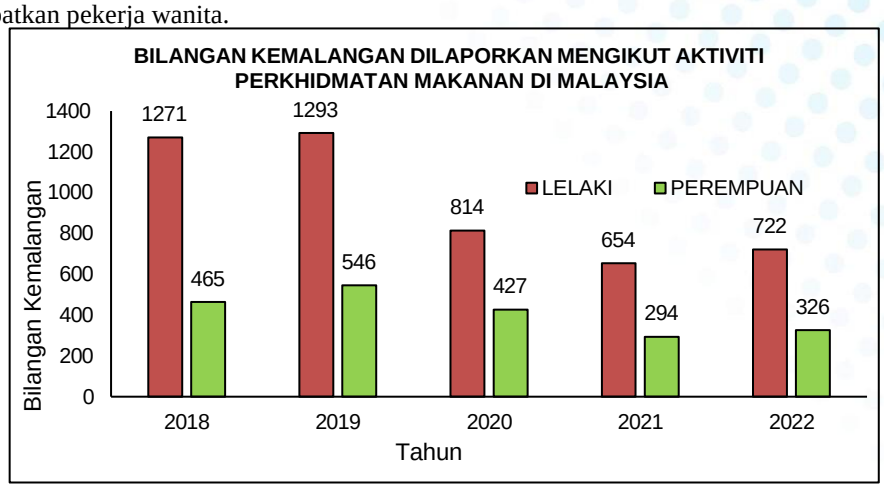
Abstract

Working in a commercial restaurant kitchen is an interesting subject to study because of the environment that is prone to slip and fall (SNF) accidents. Employees spend almost 8 hours working in a standing and walking posture for long periods and sometimes must work in a hurry to complete customer orders also contribute to the occurrence of SNF. Workplace facilities themselves are equipped with a variety of equipment of various sizes, weights, and measures; plus, restricted work paths also potentially contribute to SNF incidents. The main purpose of this study is to identify the main factors that contribute to the occurrence of SNF in Commercial Restaurants by developing a statistical analysis using biomechanical and psychophysical factors in the occurrence of SNF. This study used a questionnaire among 30 workers (men and women; aged 23-60 years) with a minimum of 1-3 years of experience in commercial restaurant kitchen activities. The correlation of this questionnaire was analysed using SPSS. Statistical analysis was conducted to identify the importance of commercial restaurant kitchen activities to biomechanical and psychophysical factors on SNF. The findings show that flooring is the main factor contributing to SNF, followed by footwear. Next, it was found that walking and standing work positions have a positive correlation and contribute to fatigue during work and after work. This shows that working with prolonged walking, standing and at the same time carrying loads especially older workers will create a less comfortable work posture and cause fatigue and this condition is unhealthy and has the potential to create SNF hazards. Conclusions obtained from a survey conducted among respondents showed a positive correlation between age, work experience, SNF signage, working hours and working posture.

Keywords: Slip and Fall (SNF), commercial restaurant kitchen, prolonged walking, standing, fatigue

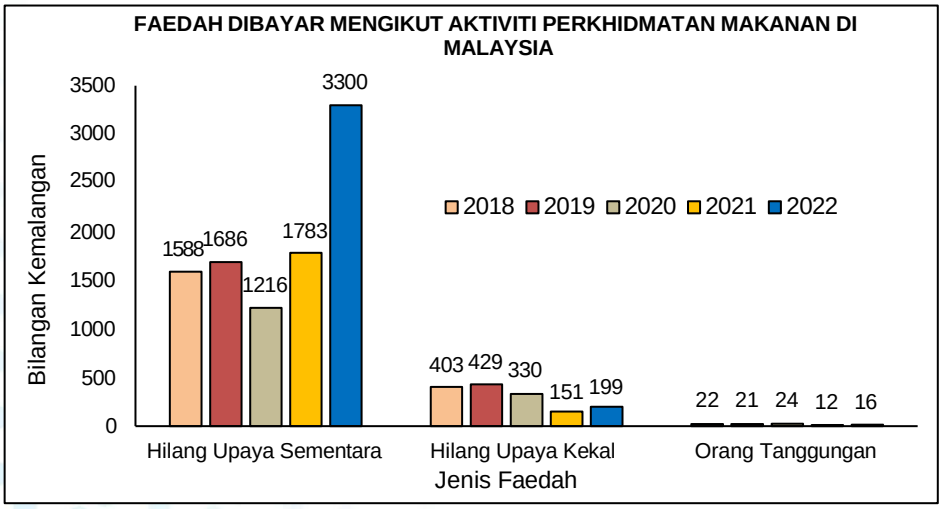
1. Pengenalan

Kemalangan tergelincir dan terjatuh (SNF) adalah perkara yang menarik untuk dikaji kerana berlaku tanpa mengira usia, tempat, dan masa. Kemalangan SNF bukan sahaja menyebabkan kemudaratan atau kecederaan yang serius, malahan membawa kepada insiden maut. Rajah 1 menunjukkan sejumlah 6812 kes kemalangan dalam sektor Aktiviti Penginapan dan Perkhidmatan Makanan di Malaysia telah dilaporkan kepada Pertubuhan Keselamatan Sosial (PERKESO) dari tahun 2018 hingga 2022. Sejumlah 4754 kes melibatkan pekerja lelaki dan 2058 kes melibatkan pekerja wanita.



Rajah 1: Kadar kemalangan dari PERKESO dari 2018-2022

Sebaliknya Rajah 2 menunjukkan Faedah tertinggi dibayar ialah 86% untuk Hilang Upaya Sementara berbanding dengan Hilang Upaya Kekal 14% dan Orang Tanggungan 1%. Ini jelas menunjukkan sektor Aktiviti Penginapan dan Perkhidmatan Makanan di Malaysia berisiko tinggi dan boleh menyebabkan kemalangan kepada pekerja kerana sering terdedah kepada bahaya.



Rajah 2: Faedah Dibayar dari PERKESO dari 2018-2022

Menurut Jeong, (2015) bekerja di dapur, pekerja menghabiskan masa berjam-jam dengan kawasan kerja yang terhad dan beban kerja yang berbeza. Apabila pekerja cuai atau tidak mengamalkan peraturan keselamatan atau peralatan keselamatan yang betul, mereka mungkin menjadi mangsa kemalangan SNF. Oleh sebab itu, pihak pengurusan perlu mengambil tindakan serius terhadap sikap cuai dan kurang bertanggungjawab pekerja serta mendidik pekerja secara serius dalam menangani kesedaran tentang ergonomik di dapur (Deros, Da ruis, & Basir, 2015; Lundgren & McMakin, 2018).

Bekerja di bahagian dapur terhad kerana dilengkapi dengan peralatan memasak pelbagai saiz, tempat penyimpanan bahan mentah dan peralatan dan tugasan pekerja seperti menyediakan bahan mentah, memasak, mencuci peralatan, menyediakan pinggan mangkuk, pinggan, mengemas dan menghantar kepada pelanggan. Menurut Shete et al. (2015), pekerja perlu untuk membawa barang di tangan dan bergerak dengan pantas semasa bekerja di dapur komersial. Akibatnya, pekerja hotel dan restoran kerap dilaporkan mempunyai tanda-tanda penyakit yang memerlukan rawatan berterusan (Jahangiri M. et al., 2019). Keadaan ini jelas menunjukkan bahawa

faktor seperti kawasan tempat kerja, beban kerja dan kelajuan semasa bekerja mempengaruhi tahap kesukaran menyiapkan tugasan (Jeong dan Shin, 2016) kerana pekerja terus bergerak dari satu tempat ke tempat lain sepanjang bekerja.

Postur berdiri merupakan postur utama yang kerap digunakan di dapur komersial. Postur ini berpotensi menyebabkan risiko sakit pada bahagian kaki dan badan manusia. Postur berdiri menyebabkan keresahan dan ketidakselesaan di bahagian pinggul, lutut, bahagian bawah kaki, buku lali dan khususnya kaki (T. R. Waters et al., 2015). Menurut Rose et al. (2017) keletihan adalah apabila seseorang berasa kurang tenaga, menjadi lemah dan memerlukan rehat segera untuk proses pemulihan dan mengelakkan keletihan sepanjang hari. Apabila wujudnya Kelesuan bekerja yang tinggi akan mengurangkan sistem imunisasi dan akhirnya berisiko tinggi dalam masalah kesihatan (H. Abdul Rahman et al., 2017). Bekerja dalam postur yang berbeza akan menyebabkan risiko kesakitan pada bahagian badan disebabkan oleh perubahan postur bagi penyesuaikan dengan tugas kerja dengan sewajarnya. Ini disokong oleh Kristin Indriyani et al. (2018) menegaskan bahawa postur bekerja yang tidak sesuai akan meningkatkan gejala fizikal pada sendi, otot dan tendon.

Oleh itu tujuan utama kajian ini adalah untuk mengenal pasti faktor-faktor utama yang menyebabkan SNF di Restoran Komersial seterusnya objektif kedua adalah mengenalpasti parameter biomekanikal dan psikofizikal yang berkaitan dengan kejadian SNF.

2. Kajian Literasi

Kajian literasi ini akan berfokuskan kepada empat pendekatan utama iaitu epidemiologi, tribologi, biomekanik dan psikofizik dalam industri restoran komersial bagi mengenalpasti faktor-faktor utama yang berkaitan dengan SNF (Li et al., 2019).

Jadual 1: Empat Pendekatan Utama Kajian

Epidemiologi	**Tribologi**
Populasi pekerja Jantina Umur BMI	Persekitaran kerja
Biomekanik	**Psikofizikal**
Postur kerja Kelajuan bekerja	Keletihan/kelesuan

Jadual 1 menunjukkan empat jenis pendekatan utama kajian iaitu epidemiologi, tribologi, biomekanikal dan psikofizikal akan digunakan untuk mengkaji kemalangan SNF. Pendekatan epidemiologi adalah merangkumi populasi pekerja di bahagian dapur komersial seperti jantina, umur pekerja dan kategori BMI sama ada pekerja normal, berat badan berlebihan atau obesiti. Pendekatan kedua ialah tribologi yang meliputi permukaan yang berinteraksi seperti jenis kasut, jenis lantai dan bahan cemar yang terdapat di tempat kerja. Melalui pendekatan epidemiologi dan tribologi, faktor utama SNF di tempat kerja dapur komersial dan hubungannya dengan sumbangan di antara setiap peringkat faktor akan dihasilkan. Walau bagaimanapun, biomekanik ialah berfokus kepada postur pekerja sema sa melakukan pekerjaan dan termasuk kelajuan dalam menjalankan tugas mereka. Psikofizikal merujuk kepada hubungan antara rangsangan fizikal dan fenomena mental seperti aktiviti otot semasa bekerja. Gabungan Biomekanik dan Psikofizik akan dianalisis untuk melihat perkaitan menggunakan melalui korelasi antara setiap pendekatannya khasnya dalan kejadian SNF di dapur komersial akan dibincangkan.

Dalam kajian ergonomik, soal selidik digunakan secara meluas dengan pelbagai tujuan dan faktor. Jeong, (2015) melaporkan bahawa tinjauan soal selidik telah dijalankan dalam kajian berkaitan kecederaan pekerjaan semasa proses memasak di dapur restoran komersial. Manakala Ahmad et al. (2015) menggunakan tinjauan untuk menyiasat faktor SNF berdasarkan kajian lepas. Tinjauan ialah metodologi ulasan dalam mengumpul data kajian. Menjalankan tinjauan dengan menggunakan soal selidik Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) juga dipertimbangkan secara meluas dalam kajian ergonomik dan kecederaan pekerjaan dalam mengenal pasti tahap keterukan dan kesan gejala muskuloskeletal dalam pekerjaan (A. Shariat et al., 2016).

3. Metodologi

Kajian ini dijalankan secara kuantitatif iaitu menggunakan teknik persampelan rawak. Kajian kuantitatif ini menggunakan instrumen soal selidik yang diedarkan semasa pemerhatian yang dilakukan sepanjang kajian dan responden akan mengisinya secara atas talian iaitu melalui *Google Forms.* Bagi mencapai objektif kajian, instrument soal selidik yang dibangunkan merujuk kepada adalah berkaitan pendekatan Epidemiologi, Tribologi, Biomekanikal

dan Psikofizikal. Soal selidik di bangunkan kepada tiga bahagian utama untuk mendapatkan maklumat daripada responden seperti berikut:

i. Bahagian A: Demografi
Bahagian ini adalah berkaitan maklumat peribadi yang diperlukan untuk menyokong bahagian demografi soal selidik. Dalam bahagian ini terdiri daripada 12 soalan yang perlu dijawab oleh responden.

ii. Bahagian B: Faktor menyumbang kepada kejadian tergelincir dan terjatuh (SNF)
Bahagian ini akan mengupas faktor-faktor yang menyumbang kepada insiden SNF yang mana maklumbalas responden tentang pengetahuan, pengalaman dan kesedaran dalam mengendalikan isu SNF. Soalan dalam Bahagian B ini terdiri daripada 10 soalan yang perlu dijawab oleh responden.

iii. Bahagian C: Pengalaman pekerja berdasarkan tempat kerja.
Bahagian ini pula akan mengumpulkan data pengalaman responden yang menyumbang kepada Kesihatan dan keselamatan. Aktiviti yang dilakukan oleh responden dipertimbangkan dalam bahagian ini. Input ini diperlukan untuk menganalisis pengetahuan pekerja tentang unsur-unsur yang boleh menyebabkan SNF dalam persekitaran kerja responden. Soalan dalam Bahagian C ini terdiri daripada 13 soalan yang perlu dijawab oleh responden.

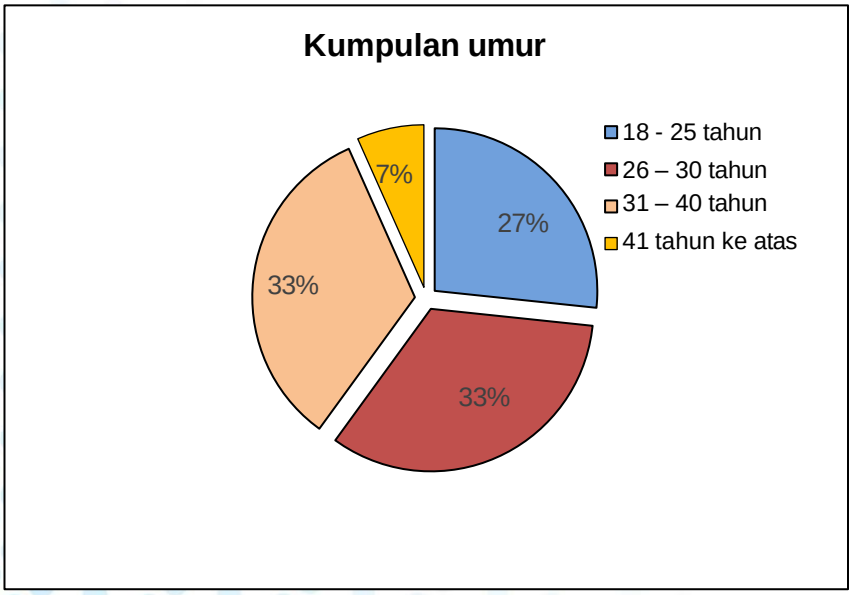
Soal selidik ini diedarkan di kalangan 30 responden yang berpengalaman sekurang-kurangnya 1 tahun bekerja di Restoran Komersial di sekitar Kota Kinabalu. Berdasarkan kajian yang telah dijalankan saiz sample 30 orang responden boleh diterima dalam kajian yang berkaitan dengan kajian ergonomik (Perneger et al., 2015; Herdian, 2015; Ismail et al., 2021).

Data yang dikumpul akan dianalisis dengan menggunakan perisian *Statistical Package for the Social Sciences (SPSS)* versi 22.0 (IBM SPSS statistics 22.0, IBM Corp.) (Ulusoy dan Çolakoğlu, 2018; Ismail et al., 2021). SPSS digunakan secara meluas untuk membuat hipotesis dalam menganalisa data yang sesuai dengan pembolehubah. Kajian daripada Malloy et al., (2015) menegaskan bagi menentukan hubungan dan kaitan pada pembolehubah dalam dapatan soal selidik adalah dengan menggunakan Korelasi Pearson. Melalui korelasi pembolehubah yang dipilih boleh ditakrifkan untuk mengenal pasti kekuatan interaksi.

4. Dapatan Dan Perbincangan

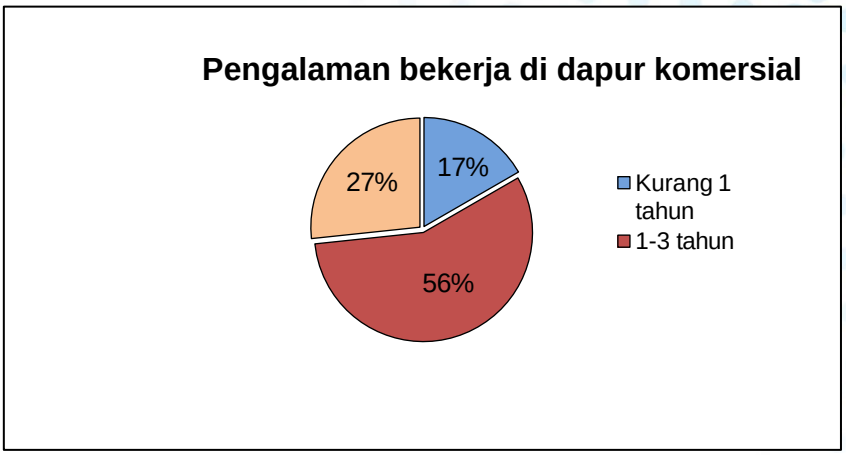
4.1 Bahagian A: Demografi

Sejumlah (N=30) Responden pekerja Restoran Komersial terdiri daripada 15 lelaki dan 15 perempuan seperti yang ditunjukkan dalam Rajah 3 yang menunjukkan bahawa 33% daripada responden berumur masing-masing dari 26 hingga 30 dan 31 hingga 40, 27% daripada responden berumur dari 18 hingga 25. Manakala hanya 7% daripada responden berumur 41 tahun ke atas iaitu 7% daripada responden. Laporan tahunan PERKESO (2018 -2022) menunjukkan trend bilangan penerima manfaat hilang upaya sementara dan penerima manfaat hilang upaya kekal adalah lebih tinggi bagi kumpulan umur 20 hingga 40 tahun dan menurun bagi kumpulan umur bawah 20 tahun dan ke atas. 44 tahun.



Rajah 3: Umur Responden

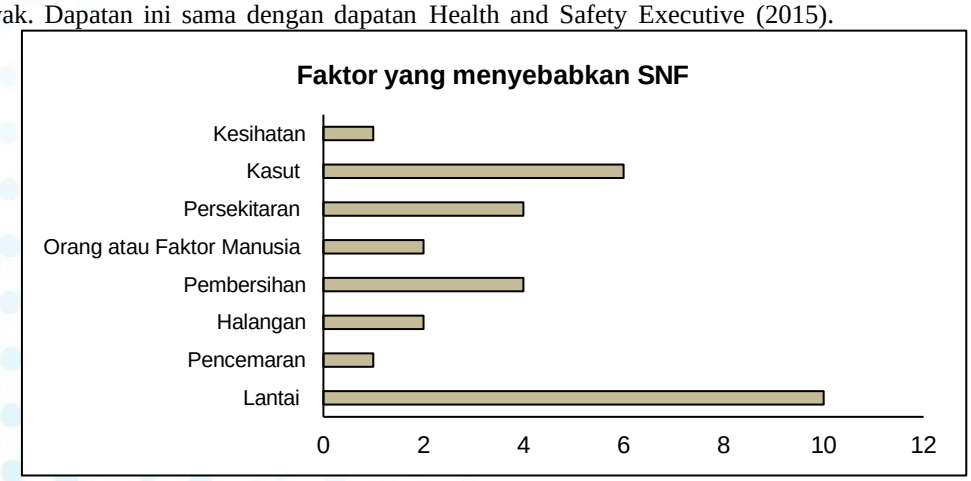
Rajah 4 menunjukkan bahawa 56% daripada responden mempunyai pengalaman 1 hingga 3 tahun bekerja di dapur komersial. Manakala 27% daripada mereka mempunyai pengalaman bekerja melebihi 3 tahun. Walau bagaimanapun, 17% responden mempunyai pengalaman kurang daripada 1 tahun dalam dapur komersial.



Rajah 4: Pengalaman bekerja di dapur komersial

4.2 Bahagian B: Faktor yang menyumbang kepada insiden SNF

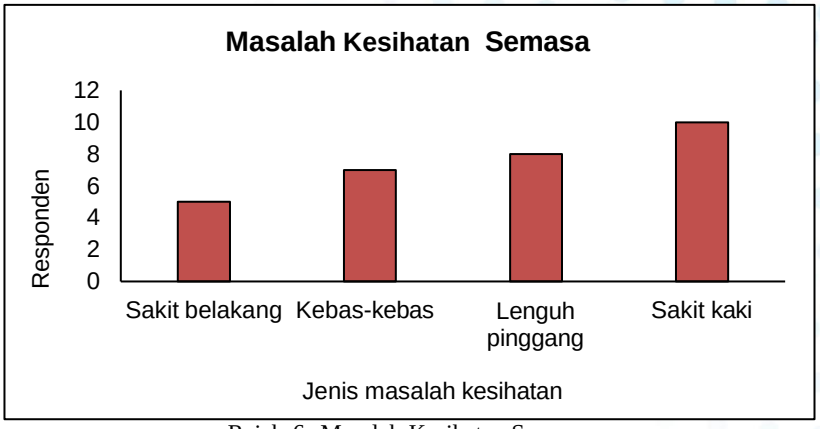
Rajah 5 mewakili maklumbalas responden terhadap faktor utama yang menyumbang kepada SNF dengan min dan SD (3.93 ± 2.518). Sejumlah 33% daripada responden menyatakan lantai adalah faktor tertinggi yang menyumbang kepada SNF, diikuti oleh kasut (20%), persekitaran dan pembersihan (13%), Faktor manusia dan halangan (7%), dan keadaan kesihatan dan pencemaran (3%). Keadaan persekitaran di tempat kerja merujuk kepada kawasan kerja seperti suhu dan tahap pencahayaan yang tidak sesuai sekiranya terdapat beberapa kotak atau peralatan yang tidak disusun dengan cara yang betul dan sebagainya. Sementara itu, bahan cemar merujuk kepada beberapa cecair di laluan berjalan seperti air, sabun atau minyak. Dapatan ini sama dengan dapatan Health and Safety Executive (2015).



Rajah 5: Faktor utama menyumbang kepada SNF

Rajah 6 menunjukkan keadaan kesihatan semasa responden. Kesakitan di bahagian kaki adalah kesakitan tertinggi yang direkodkan. Empat responden menghadapi masalah dengan kaki atau kaki mereka. Bagaimanapun, tiga daripada mereka memilih masalah kebas dan pinggang sebagai gangguan sepanjang tempoh bekerja. Kebas merujuk kepada seseorang yang mengalami kehilangan sensasi atau perasaan di bahagian badan mereka. Orang yang mengalami masalah kebas ini mungkin mengalami kerosakan, kerengsaan atau mampatan saraf. Sesetengah masalah kebas mungkin disebabkan oleh satu dahan saraf atau beberapa saraf mungkin terjejas, seperti cakera tergelincir di bahagian belakang atau sindrom carpal tunnel di pergelangan tangan. Masalah pinggang berkaitan dengan otot belakang yang tegang. Ia berlaku kerana gejala sakit belakang bawah. Aktiviti fizikal seperti mengangkat berat berulang kali atau postur janggal yang berulang. Dan yang terakhir, sakit belakang adalah masalah yang mereka hadapi secara

berterusan.



Rajah 6: Masalah Kesihatan Semasa

Jadual 2: Korelasi Umur, Pengalaman Bekerja, Tempoh waktu bekerja dan Posisi Semasa Bekerja

	Umur	Pengalaman bekerja	Tempoh Waktu Bekerja	Posisi Semasa Bekerja
Umur	1	0.699**	0.492**	0.224
Pengalaman Bekerja	0.699**	1	0.206	0.174
Tempoh Waktu Bekerja	0.492**	0.206	1	0.403*
Posisi Semasa Bekerja	0.224	0.174	0.403*	1

*Korelasi adalah signifikan pada tahap 0.05 (2-tailed).
** Korelasi adalah signifikan pada tahap 0.01 (2-tailed).

Jadual 2 menunjukkan perkaitan Umur, Pengalaman Bekerja, Tempoh Waktu Bekerja dan Posisi Semasa Bekerja dalam kalangan responden dapur komersial. Pembolehubah menunjukkan interaksi yang kuat dengan korelasi positif pada signifikan 0.01. Umur menunjukkan korelasi yang paling tinggi dengan pengalaman bekerja dengan r = 0.699, diikuti dengan waktu bekerja r = 0.492. Walau bagaimanapun, korelasi pada signifikan 0.05 bagi kedudukan bekerja dan waktu bekerja ialah r = 0.403.

Jadual 3: Korelasi pengalaman bekerja di dapur komersial dengan tanda SNF

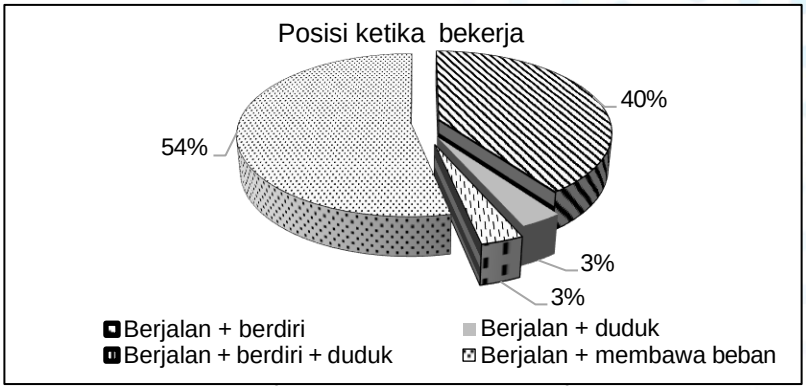
	Pernah Melihat Rajah 1 Dan Rajah 2 (Soal selidik)	Mengetahui Tentang Gambar Tersebut	Pengalaman bekerja	Pernah Tergelincir, Tersungkur Atau Terjatuh seperti Rajah 1 Dan Rajah 2 (Soal selidik)
Pernah Melihat Rajah 1 Dan Rajah 2 (Soal selidik)	1	0.272	0.745**	0.000
Mengetahui Tentang Gambar Tersebut	0.272	1	0.365*	-0.144
Pengalaman bekerja	0.745**	0.365*	1	-0.063
Pernah Tergelincir, Tersungkur Atau Terjatuh seperti Rajah 1 Dan Rajah 2 (Soal selidik)	0.000	-0.144	-0.063	1

* Korelasi adalah signifikan pada tahap 0.05 (2-tailed).
** Korelasi adalah signifikan pada tahap 0.01 (2-tailed).

Jadual 3 menunjukkan korelasi pengalaman bekerja di dapur komersial, respons pada tanda SNF dan pengalaman dalam SNF. Pembolehubah menunjukkan interaksi yang kuat dengan korelasi positif pada signifikan 0.01. Pengalaman bekerja di dapur komersial menunjukkan korelasi tertinggi dengan lihat tanda SNF (Rajah 1 dan Rajah 2) dengan r = 0.745, diikuti dengan interaksi dengan korelasi positif pada signifikan 0.05 dengan r = 0.365. Ini kerana responden adalah pekerja berpengalaman di dapur komersial dan tahu tentang tanda SNF.

4.3 Bahagian C: Pengalaman pekerja berdasarkan tempat kerja

Rajah 7 menunjukkan posisi pekerja semasa melakukan kerja. Didapati 54% responden menyatakan bahawa mereka menggunakan postur berjalan dan membawa beban diikuti oleh 40% dengan postur berjalan-berdiri. Manakala masing-masing 3% responden menggunakan postur berjalan-berdiri-duduk dan berjalan-duduk.



Jadual 4 menunjukkan perkaitan Umur, Pengalaman Bekerja, Tempoh Waktu Bekerja dan Posisi Semasa Bekerja dalam kalangan responden dapur komersial. Pembolehubah menunjukkan interaksi yang kuat dengan korelasi positif pada signifikan 0.01. Umur menunjukkan korelasi yang paling tinggi dengan pengalaman bekerja dengan r = 0.699, diikuti dengan waktu bekerja r = 0.492. Walau bagaimanapun, korelasi pada signifikan 0.05 bagi kedudukan bekerja dan waktu bekerja ialah r = 0.403.

Jadual 4: Korelasi Pengalaman Keletihan

Pengalaman Keletihan	Mengalami keletihan semasa	Rasa letih (sebelum bekerja)	Bahagian badan anda Rasa letih (sebelum bekerja)	Rasa letih semasa bekerja	Bahagian rasa badan keletihan (semasa bekerja)	Rasa keletihan selepas bekerja	Bahagian badan berasa letih (selepas bekerja)
Mengalami keletihan semasa	1	0.526	0.638*	0.786**	0.364	0.908**	0.586*
Rasa letih (sebelum bekerja)	0.526	1	0.197	0.444	0.423	0.447	0.394
Bahagian badan anda Rasa letih (sebelum bekerja)	0.638*	0.197	1	0.738**	0.594*	0.706*	0.513
Rasa letih semasa bekerja	0.786**	0.444	0.738**	1	0.629*	0.765**	0.375
Bahagian rasa badan keletihan (semasa bekerja)	0.364	0.423	0.594*	0.629*	1	0.367	0.300
Rasa keletihan selepas bekerja	0.908**	0.447	0.706*	0.765**	0.367	1	0.529
Bahagian badan berasa letih (selepas bekerja)	0.586*	0.394	0.513	0.375	0.300	0.529	1

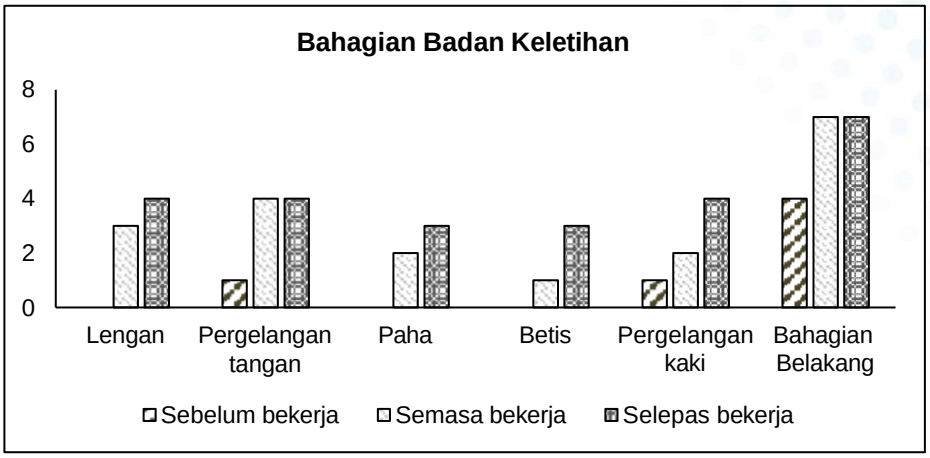
* Korelasi adalah signifikan pada tahap 0.05 (2-tailed).

** Korelasi adalah signifikan pada tahap 0.01 (2-tailed).

Untuk pengalaman keletihan maklumat yang diperlukan untuk mengetahui status keletihan yang dialami. Jadual 5 menunjukkan korelasi pengalaman keletihan. Pembolehubah menunjukkan interaksi yang kuat dengan korelasi positif pada signifikan 0.01. Keletihan semasa yang berpengalaman menunjukkan korelasi tertinggi dengan Rasa keletihan selepas bekerja dengan r = 0.908. Diikuti dengan kelesuan semasa yang berpengalaman menunjukkan korelasi yang kuat dengan Rasa keletihan semasa bekerja dengan r = 0.786. Seterusnya, Rasa letih semasa bekerja menunjukkan hubungan kuat dengan Rasa letih selepas bekerja dengan r = 0.765 dan Rasa letih semasa bekerja menunjukkan hubungan kuat dengan Bahagian badan anda Rasa letih (sebelum bekerja) dengan r = 0.738

Bagi pembolehubah menunjukkan interaksi yang kuat dengan korelasi positif pada signifikan 0.05. Mengalami Keletihan semasa menunjukkan korelasi tertinggi dengan Bahagian badan anda Rasa keletihan (sebelum bekerja) dengan r = 0.638. Diikuti dengan Rasa keletihan semasa bekerja menunjukkan korelasi yang kuat dengan Sebahagian badan anda berasa letih (semasa bekerja) dengan r = 0.629. Seterusnya, Bahagian Badan Rasa keletihan (sebelum bekerja) menunjukkan korelasi yang kuat dengan Bahagian rasa badan keletihan (semasa bekerja) dengan r = 0.594 dan kelesuan semasa yang berpengalaman menunjukkan korelasi yang kuat dengan Bahagian badan berasa letih (selepas bekerja) dengan r = 0.586.

Rajah 8 menunjukkan bahagian badan yang mengalami keletihan untuk waktu kerja yang berbeza. Terdapat enam bahagian badan yang disenaraikan berdasarkan bahagian bawah kaki bahagian badan. Bahagian belakang adalah bahagian badan yang paling banyak mengalami keletihan, diikuti oleh pergelangan tangan dan kaki. Beberapa responden menyatakan mereka mengalami keletihan sebelum memulakan kerja terutamanya di bahagian belakang badan, kaki dan pergelangan tangan. Semasa bekerja, responden berkata mereka mengalami keletihan di semua bahagian badan yang disenaraikan.



Rajah 8: Sebahagian daripada keletihan bahagian badan yang dialami di tempat kerja

5. Kesimpulan

Hasil daripada kajian ini menunjukkan lantai dan kasut merupakan faktor utama yang menyumbang kepada kejadian SNF. Terdapat korelasi positif di kalangan umur dan pengalaman bekerja. Didapati pengalaman bekerja juga berkorelasi dengan papan tanda SNF. Umur juga berkolerasi positif dengan tempoh waktu bekerja. Jumlah jam kerja turut mempunyai korelasi dengan kedudukan kerja. Tinjauan awal ini menunjukkan umur merupakan faktor penting kepada pengalaman bekerja dan pengalaman responden menyebabkan mereka mengetahui papan tanda SNF. Umur adalah ketara dengan waktu bekerja yang diwakili oleh responden yang biasa dengan dapur komersial dan sememangnya mempunyai lebih banyak pengalaman dan pastinya menghabiskan lebih banyak masa bekerja untuk memenuhi tugasan tersebut. Bekerja dengan lebih banyak pengalaman dan waktu bekerja berkait langsung dengan postur bekerja. Kebanyakan responden menjawab bahawa 54% menggunakan postur berjalan dan membawa beban diikuti oleh 40% dengan postur berjalan-berdiri. Bekerja dengan berjalan lama, berdiri dan pada masa yang sama membawa beban terutamanya pekerja yang lebih tua akan mewujudkan postur kerja yang janggal dan keadaan ini tidak sihat dan berpotensi mewujudkan bahaya SNF.

Pengakuan

Penyelidikan ini sepenuhnya di jalankan dengan kebenaran Politeknik Kota Kinabalu yang menjadikan penyelidikan penting dan berdaya maju.

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Utilizing Ceramic Tile Waste for the Production of Eco-Tile Bricks: A Sustainable Construction Material

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Abstract

The increasing depletion of natural resources has intensified the need for alternative construction materials. Ceramic tile waste, arising from issues such as size inconsistencies, glazing defects, cracks, and poor firing, poses significant disposal challenges due to its non-biodegradable nature. This study investigates the potential of utilizing ceramic tile waste in the production of Eco-Tile Bricks (ETB) and evaluates their performance relative to conventional construction materials, specifically Red Clay Bricks (RCB) and Cement Bricks (CB). The assessment focuses on key parameters including density, water absorption, and compressive strength. While the density of all brick types was found to be comparable, ETB exhibited lower water absorption compared to RCB and CB. Notably, ETB achieved an average compressive strength of 34.7 N/mm², which is substantially higher than the 15.1 N/mm² recorded for RCB and the 6.7 N/mm² for CB. These findings suggest that utilizing ceramic tile waste to produce eco-efficient bricks is a feasible and sustainable option in the production of construction materials.

Keywords: - Ceramic tile waste, Eco-efficient brick, Sustainable construction

1. Introduction

Sustainability in construction includes using waste materials as part of building materials. This paper discusses the idea of turning construction waste into new types of building materials. Currently, there are many construction projects and building activity in the country, which helps to support the domestic market for ceramic tiles. Accordingly, construction project values increased by 15.7% in Q4 of 2022, a follow-up to growth of 23.2% in Q3. Civil engineering works, commercial building, and industries related to special trade contributed to economic growth. In comparison to the previous year, the residential building subsector increased by 5.3% (DOSM, 2022).

Ceramic tiles are one of the most commonly used materials in building construction. The production of ceramic tiles can generate rejected material due to size variations, glaze defects, cracks and poor firing results (Elçi, 2016). In some factories, the amount wasted on discarded tiles reaches 7% of total production output (Pacheco-Torgal & Jalali, 2010). Ceramic waste is categorized as undegradable material because the biological degradation process of ceramics is extremely time-consuming, and it can last thousands of years (Halicka et al., 2013). Therefore, it is very difficult to find a place to dispose of this construction waste. This study examines the use of ceramic tile waste in producing Eco-Tile Bricks (ETBs) and compares their properties, such as density, water absorption, and compressive strength, with those of conventional bricks, specifically red clay bricks (RCBs) and cement bricks (CBs), to assess the quality and suitability of ETBs as a construction material.

2. Literature Review

2.1 General Brick Specifications

The general brick specifications in Malaysia are primarily based on the Malaysia Standard MS 7.6: 1972 and the British Standard BS 3921: 1985, which outline the essential qualities and classifications of bricks used in construction. These standards set guidelines for brick properties such as size, shape, compressive strength, water absorption, and durability to ensure consistency and safety in building structures. According to the Malaysian Standard MS 7.6: 1972, the weight of a common brick typically ranges between 2.5 kg to 3.5 kg, depending on the size and density of the brick. Tables 2.1 and 2.2 present the general specifications of bricks.

Table 2.1: Dimensions and Tolerances of Brick (MS 7.6: 1972)

Specified Dimensions	**Overall Measurement of 24 Bricks**
Height: 65 + 1.875 mm	1560 + 45 mm
Width: 102.5 + 1.875 mm	2460 + 45 mm
Length: 215 + 3 mm	5160 + 75

Table 2.2: Strength and Water Absorption of Brick (MS 7.6: 1972)

Designation	**Class**	**Ave. Compressive Strength, N/mm^2 (min)**	**Ave. Water Absorption, % (max)**
Engineering Brick	A	69.0	4.5
	B	48.5	7.0
Load bearing Brick	15	103.5	No Specific Requirements
	10	69.0	
	7	48.5	
	5	34.5	
	4	27.5	
	3	20.5	
	2	14.0	
	1	7.0	
Brick for Damp-proof Courses	DPC	As required	4.5

2.2 The Use of Ceramic Waste in Construction

Currently, the utilization of ceramic waste is predominantly concentrated on its application as fine and coarse aggregates in concrete production. Various studies have explored the effects of substituting natural aggregates with ceramic waste, focusing on both fresh and hardened concrete properties. Medina et al. (2012) and Zegardło et al. (2016) highlighted the beneficial impact of ceramic sanitary ware on concrete microstructure. The inclusion of these materials led to a denser Interfacial Transition Zone (ITZ) and reduced porosity, resulting in significant improvements in compressive and tensile strength. This enhanced microstructure contributes to the overall durability of the concrete.

The freeze-thaw resistance of recycled concrete was observed to be superior when ceramic aggregates were used, as noted by Medina et al. (2013). Similarly, Siddique et al. (2018) found that concrete containing bone china ceramic exhibited better resistance to freeze-thaw cycles and chloride penetration compared to conventional concrete. These findings suggest that ceramic waste aggregates can enhance concrete durability, particularly in harsh environmental conditions. Halicka et al. (2013) reported that concrete incorporating ceramic sanitary ware maintained its strength and shape at high temperatures. This indicates that ceramic waste aggregates can improve the fire resistance of concrete, making it a viable option for structures exposed to elevated temperatures.

Research has also explored optimal replacement ratios for ceramic waste in concrete. Etxeberria and Vegas (2015) demonstrated that substituting 50% ceramic waste for natural sand was practical and beneficial for concrete strength. On the other hand, Nepomuceno et al. (2018) observed that increasing the replacement ratio of brick coarse aggregates led to a decrease in density and mechanical strength, although the workability remained comparable. Several studies have compared the performance of concrete containing ceramic waste to that of conventional concrete. For instance, Elçi (2016) found that concrete with floor tile aggregates performed comparably to limestone concrete, while wall tile aggregates resulted in lower performance. Conversely, Awoyera et al. (2018) demonstrated that concrete with 100% ceramic waste aggregates outperformed conventional concrete in overall performance.

Introducing ceramic waste into brick production has strong potential, as supported by the benefits observed in concrete applications. Studies show that ceramic waste improves the microstructure of concrete, enhancing compressive and tensile strength, durability, freeze-thaw resistance, and even fire resistance. These improvements in concrete suggest that similar benefits could be realized in brick production, particularly in terms of strength and durability under harsh conditions. Furthermore, the sustainability of repurposing ceramic waste aligns with eco- friendly construction practices, making it a promising material for producing high-performance, sustainable bricks.

3. Methodology

The primary binder used in the production of Eco-Tile Bricks was Ordinary Portland Limestone Cement, possessing a compressive strength of 32.5 MPa. Ceramic tile waste, as shown in Figure 3.1, was employed as the primary aggregate. Ceramic tile waste was obtained from a local tile supplier. The tile waste was first crushed to achieve a maximum particle size of 5 mm using the Los Angeles Abrasion Test apparatus. The resulting crushed ceramic tile waste is shown in Figure 3.2. The mix design utilized for the Eco-Tile Bricks followed a ratio of 1:8, with a cement content of 200 kg/m³ and 0.5 water-cement ratio. The final bricks produced measured 103 x 215 x 65 mm, as shown in Figure 3.3.

For the purposes of testing, cube specimens measuring 50 x 50 x 50 mm were prepared. Three cubes were produced for each type of brick. For red clay and cement bricks, the cubes were obtained by cutting existing bricks to the specified dimensions. The density of the prepared cubes was measured in accordance with ASTM C138/C138M. Water absorption properties were evaluated following the guidelines outlined in ASTM C1585. The compressive strength of the cubes was determined using the procedure detailed in ASTM C109/C109M -11b. The cube compression test was conducted after 28 days of curing using a compression testing machine, as depicted in Figure 3.4. This methodology ensures consistent preparation and testing of the Eco-Tile Bricks, facilitating accurate comparisons of their properties with conventional brick materials.

Figure 3.1: Ceramic tile waste

Figure 3.2: Crushed ceramic tile waste

Figure 3.3: Eco-Tile brick

Figure 3.4: Compression strength test of cube specimens

4. Finding and Analysis

4.1 Density

The results of the average densities of various brick types reveals significant differences, which have implications for both the structural performance and economic aspects of construction. Eco-Tile Bricks (ETB) had an average density of 1710.64 kg/m³, sitting between Red Clay Bricks (RCB), with the highest average density at 1779.9 kg/m³, and Cement Bricks (CB), which had the lowest density at 1633.66 kg/m³.

The density of a material is a critical factor influencing its behavior under load, which, in turn, affects the overall stability and durability of a building. ETB, with a density that lies between RCB and CB, presents a balance between weight and strength. Its innovative use of recycled ceramic tile waste not only makes it a sustainable option but also offers a moderate dead load, which may reduce the demand for extensive structural reinforcement. ETB offers an interesting economic advantage due to its use of recycled materials. The incorporation of ceramic tile waste not only helps reduce environmental impact but may also lower material costs. Furthermore, its moderate density could strike a balance between minimizing structural load and ensuring sufficient strength, potentially leading to a cost-effective and sustainable building solution.

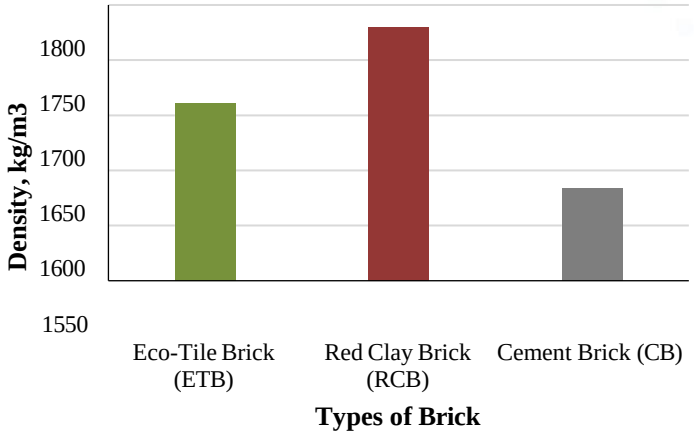

Figure 4.1: Density of bricks

4.2 Water Absorption

The examination of water absorption rates for various brick types reveals distinct differences, each of which carries implications for the performance, durability, and structural integrity of buildings. Water absorption is a critical factor influencing the longevity and resilience of brickwork, particularly in environments exposed to moisture.

The water absorption rates for the Eco-Tile Brick (ETB) are at 4.08%, Red Clay Brick (RCB) at 11.5%, and Cement Brick (CB) at 9.22%. Among these, ETB demonstrates the lowest water absorption rate, while RCB shows the highest. Compared to the standard, Eco-Tile bricks have a lower water absorption rate of 4.08%, which is better than the 4.5% water absorption rate of Class A engineering bricks. A lower water absorption rate, as seen in ETB, suggests that the brick is less porous and less likely to retain moisture. This characteristic is particularly advantageous in environments prone to moisture exposure, as it reduces the risk of water infiltration into the brickwork. The water absorption characteristics of brick materials are a vital consideration in construction, directly impacting both structural load and durability. ETB's low absorption rate offers significant advantages in terms of moisture resistance and longevity, making it a suitable choice for structures where these factors are critical. While RCB and CB are common in construction, their higher absorption rates necessitate careful consideration of their applications, particularly in environments where moisture exposure is a concern.

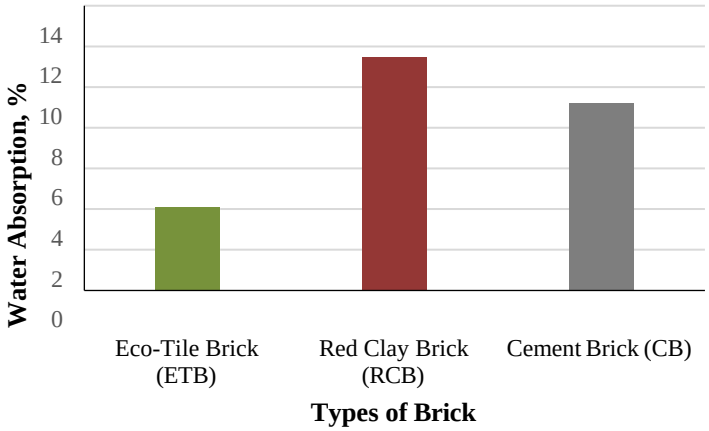

Figure 4.2: Water absorption of bricks

4.3 Compressive strength

The compression test results, presented in Table 4.1, reveal significant differences in the strength of the various brick types. Eco-Tile Bricks (ETB) exhibited the highest compressive strength, ranging from 32.8 N/mm² to 34.4 N/mm², with an average of 34.7 N/mm². This performance far surpasses that of Red Clay Bricks (RCB) and Cement Bricks (CB), which recorded average compressive strengths of 15.2 N/mm² and 6.7 N/mm², respectively. The superior strength of ETB can be attributed to the high density of 1710.64 kg/m³, compared to 1779.9 kg/m³ for RCB and 1633.66 kg/m³ for CB. Despite ETB having a slightly lower density than RCB, its compressive strength is more than double, suggesting that the material composition and the use of ceramic tile waste significantly contribute to its structural integrity. Furthermore, ETB demonstrated the lowest water absorption rate at 4.08%, compared to 11.5% for RCB and 9.22% for CB. The lower water absorption in ETB indicates a denser and less porous structure, which likely enhances its durability and contributes to its higher compressive strength. In contrast, the higher water absorption rates in RCB and CB reflect more porous structures, which may account for their lower strength. Overall, the findings suggest that Eco-Tile Bricks offer a superior balance of density, compressive strength, and low water absorption, making them a more robust and durable option compared to traditional brick materials.

According to Malaysia Standard MS 76:1972 and British Standard 3921:1985, the minimum average compressive strength for load-bearing bricks ranges from 7.0 N/mm² to 103.5 N/mm². ETB have an average compressive strength of 34.7 N/mm², classifying them as Class 5 load-bearing bricks according to the standards.

Table 4.1: Compressive strength of bricks

Types of Brick	Samples	Load (kN)	Compressive Strength (N/mm²)	Average Compressive Strength (N/mm²)
Eco-Tile Brick (ETB)	ETB-1	87	34.8	34.7
	ETB-2	87	34.8	
	ETB-3	86	34.4	
Red Clay Brick (RCB)	RCB-1	39	15.6	15.1
	RCB-2	37	14.8	
	RCB-3	37	14.8	
Cement Brick (CB)	CB-1	18	7.2	6.7
	CB-2	16	6.4	
	CB-3	16	6.4	

5. Recommendation for future study

For future studies, it is recommended to investigate the mix proportion of Eco-Tile Brick to maximize the content of ceramic tile waste aggregates, thereby creating a lighter brick that can significantly reduce the load on structural members. This research should focus on determining the optimal percentage of ceramic tile waste that can be incorporated without compromising the brick's strength and durability. By exploring various mix designs and assessing their mechanical properties, the study aims to enhance the performance of Eco-Tile Brick while promoting sustainable building practices through the effective use of waste materials.

6. Conclusion

The study demonstrates that Eco-Tile Bricks (ETB), made using recycled ceramic tile waste, offer a well-rounded performance in terms of density, compressive strength, and water absorption when compared to traditional Red Clay Bricks (RCB) and Cement Bricks (CB). ETB's moderate density of 1710.64 kg/m³, combined with its high compressive strength of 34.7 N/mm² and low water absorption rate of 4.08%, indicates a material that is both strong and durable, while also being environmentally friendly and potentially cost-effective. The balance of these properties suggests that ETB is a viable alternative for construction, particularly in applications where structural integrity, sustainability, and moisture resistance are critical considerations. The findings underscore the potential of ETB to contribute positively to modern construction practices, offering a sustainable building material without compromising on performance.

Acknowledgment

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POLITEKNIK KOTA KINABALU

Kesan Pengisaran Terhadap Mikrostruktur Komposit Poliester Bertetulang Gentian Kaca

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Abstrak

Kajian ini meneliti keupayaan pemesinan komposit Poliester Bertetulang Gentian Kaca menggunakan mesin pengisaran konvensional. Penggunaan Kawalan Berangka Komputer (CNC) untuk pemesinan komposit polimer adalah mahal, menyebabkan penyelidik memilih mesin pengisar konvensional sebagai alternatif. Komposit yang digunakan adalah poliester bertetulang gentian kaca, yang dikenali dengan kekuatannya dan berat yang lebih ringan berbanding logam. Eksperimen dijalankan untuk memerhatikan perubahan mikrostruktur pada komposit selepas pemesinan pada dua kelajuan pemotongan berbeza: 1000 rpm dan 500 rpm. Hasil kajian menunjukkan bahawa pada kelajuan 1000 rpm, perubahan mikrostruktur pada komposit adalah minimum, menunjukkan bahawa kelajuan ini sesuai untuk mengekalkan integriti struktur bahan. Sebaliknya, pada kelajuan 500 rpm, kemerosotan mikrostruktur yang ketara diperhatikan, menunjukkan kelajuan pemotongan yang lebih rendah boleh menyebabkan kerosakan pada komposit. Kesimpulan dari kajian ini adalah pemotongan berkelajuan tinggi adalah lebih sesuai untuk pemesinan komposit poliester bertetulang gentian kaca, kerana ia mengekalkan sifat fizikal yang baik dan mengurangkan risiko kerosakan mikrostruktur. Penemuan ini memberi panduan kepada industri dalam memilih parameter pemesinan yang optimum untuk bahan komposit, khususnya dalam aplikasi yang memerlukan ketahanan struktur dan ketepatan.

Kata Kunci : Komposit Polimer, Mesin Kisar, Gentian Kaca, Perubahan Mikrostruktur, Poliester.

1. Pengenalan

Polimer ialah molekul besar yang terdiri daripada unit-unit kecil yang berulang, dikenali sebagai monomer. Monomer-monomer ini boleh diubahsuai melalui penambahan atau penggantian kumpulan kimia, yang seterusnya mempengaruhi sifat-sifat polimer seperti keterlarutan, kelenturan, dan kekuatan mekanikal (Callister & Rethwisch, 2020). Apabila dua atau lebih bahan asas yang berbeza digabungkan, ia membentuk bahan yang dikenali sebagai komposit. Komposit menggabungkan sifat-sifat unik bahan-bahan asasnya untuk menghasilkan bahan dengan sifat mekanikal, ciri terma, dan keupayaan lain yang lebih baik (Chawla & Sharma, 2021).

Komposit adalah hasil gabungan dua atau lebih komponen yang berbeza secara makroskopik, yang mempunyai antara muka untuk meningkatkan sifat fizikal dan mekanikal (Hull & Clyne, 2019). Salah satu komposit yang sering digunakan dalam pelbagai industri adalah komposit poliester bertetulang gentian kaca, yang menawarkan kombinasi antara kekuatan tinggi, ringan, ketahanan terhadap kakisan, dan keberkesanan kos (Jawaid et al., 2020).

Dalam proses pemesinan, pengisaran adalah langkah penting yang digunakan untuk mencapai permukaan akhir yang diingini pada bahan komposit. Walau bagaimanapun, proses ini boleh memberi kesan ketara kepada mikrostruktur komposit, terutama pada gentian kaca dan matriks poliester yang membentuk bahan tersebut. Pengisaran yang tidak sesuai boleh menyebabkan kerosakan mikrostruktur seperti delaminasi, keretakan matriks, dan penipisan gentian, yang seterusnya menjejaskan kekuatan mekanikal dan prestasi keseluruhan komposit (Shokrani et al., 2021).

Oleh itu, kajian ini bertujuan untuk menyiasat kesan parameter pengisaran terhadap kekasaran permukaan dan perubahan mikrostruktur komposit poliester bertetulang gentian kaca. Memahami kesan ini adalah penting untuk mengoptimumkan proses pengisaran, memastikan integriti struktur dan prestasi bahan dalam aplikasi industri (Luo et al., 2022).

2. Kajian Literatur

Pemesinan merupakan proses utama dalam pembuatan yang digunakan untuk menghasilkan bentuk dan dimensi yang dikehendaki pada bahan mentah. Dalam konteks komposit Glass Fiber Reinforced Polymer (GFRP), pengisaran digunakan untuk menghasilkan permukaan yang licin dan tepat, dengan toleransi yang ketat. Pengisaran merupakan proses pemesinan yang melibatkan penyingkiran bahan menggunakan roda pengisar. Kualiti permukaan yang dihasilkan melalui pengisaran memainkan peranan penting dalam aplikasi akhir komposit, di mana kekuatan lesu,

ketahanan kakisan, dan kestabilan jangka panjang bahan adalah kritikal (Hayajneh et al., 2007).

Mikrostruktur komposit GFRP dipengaruhi oleh pelbagai parameter dalam proses pengisaran, termasuk kelajuan roda pengisar, kadar suapan, dan kedalaman potongan. Pengisaran yang tidak terkawal boleh menyebabkan kecacatan mikro seperti delaminasi, retakan, dan serat yang terputus, yang seterusnya mengurangkan kekuatan mekanikal dan ketahanan bahan. Oleh itu, pemahaman yang mendalam tentang bagaimana setiap parameter ini mempengaruhi mikrostruktur komposit adalah penting untuk mengoptimumkan proses pemesinan dan memastikan prestasi bahan yang terbaik.

Kajian terdahulu menunjukkan bahawa pengisaran dengan roda berbutir halus dan teknik pengisaran sejuk dapat mengurangkan kesan negatif terhadap mikrostruktur komposit. Sebagai contoh, Singh dan Verma (2023) menyatakan bahawa pengoptimuman parameter pengisaran dapat mengurangkan kekasaran permukaan dan mengekalkan integriti mikrostruktur. Selain itu, Zhou et al. (2022) menunjukkan bahawa perubahan dalam parameter pengisaran boleh membawa kepada evolusi mikrostruktur yang berbeza, yang boleh memberi kesan langsung kepada sifat mekanikal bahan.

3. Metodologi

3.1 Prosedur Pemesinan

Proses pemesinan pengisaran dilakukan pada bahan kerja gentian kaca poliester bertetulang. Semasa proses pemesinan, parameter pemesinan direkodkan seperti kehausan alatan, kelajuan pemesinan, kadar suapan pemesinan dan bentuk tartar yang terhasil.

Langkah 1

Sediakan semua peralatan yang akan digunakan semasa pemesinan dilakukan. Pastikan semua peralatan berada dalam keadaan baik sebelum memulakan eksperimen.

Rajah 1: Peralatan yang digunakan

Langkah 2

Mengukur saiz benda kerja ditetapkan dan menandanya untuk memudahkan proses pemesinan dijalankan.

Rajah 2: Mengukur bahan kerja

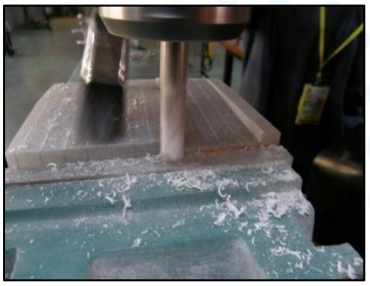
Langkah 3

Pasang ragum pada mesin pengisar, pasangkan alat dalam chuck dan pasangkan bahan kerja dalam ragum

Rajah 3: Ketatkan Ragum

Langkah 4

Mengisar permukaan pertama pada bahan kerja ke permukaan pertama rata. Biarkan 10mm di atas permukaan sebagai rujukan untuk membuat perbandingan kekasaran permukaan selepas pemesinan.



Rajah 4: Proses Mengisar

Langkah 5

Tetapkan mesin pengisar pada kedudukan 0.0 sebagai titik permulaan pemesinan. Lakukan proses pengisaran pada bahan kerja dengan kedalaman potongan sebanyak 2 mm untuk setiap aras. Lebar setiap aras adalah 10 mm. Laksanakan pemesinan pengisaran pada bahan kerja dalam bentuk berlapis untuk 10 aras pertama, di mana setiap aras mempunyai perbezaan ketinggian sebanyak 2 mm.

Rajah 5: Kemasan kerja

3.2 Mikroskop Imbasan Elektron (SEM) jenis Alat Variable Pressure (Zeiss Evo LS 10) adalah sejenis mikroskop elektron yang menghasilkan imej sampel melalui pengimbasan rasuk elektron yang tertumpu. Elektron berinteraksi dengan sampel, menghasilkan pelbagai isyarat yang dapat dikesan dan mengandungi maklumat mengenai topografi permukaan sampel serta komposisi kimia. Alur imbasan elektron biasanya mengikuti corak raster, dan kedudukan rasuk dipadankan dengan isyarat yang dikesan untuk menghasilkan imej. SEM boleh mencapai resolusi melebihi 1 nanometer. Sampel boleh diperhatikan dalam pelbagai keadaan tekanan: vakum tinggi, vakum rendah, dan dalam keadaan alam sekitar SEM, termasuk keadaan basah.

Rajah 6: Alat Mikroskop Pengimbas Elektron

4. Dapatan dan Analisa

4.1 Pemesinan Bahan Kerja

Keputusan bagi eksperimen adalah seperti Jadual 1 adalah berdasarkan kepada parameter – parameter yang telah ditentukan dalam jadual pemesinan bahan kerja mengunakan mesin mengisar. Parameter – parameter yang ditetapkan adalah bagi memperoleh keputusan kehausan mata alat, kelajuan pemesinan, kadar suapan pemesinan dan bentuk tartar yang terhasil.

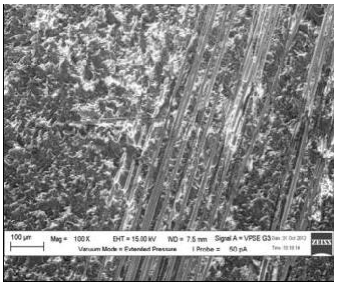
Jadual 1: Jadual Pemesinan Mengisar

Parameters	Kedalaman Pemotongan = 2mm											
	1	2	3	4	5	6	7	8	9	10	11	12
Kehausan Mata Alat (mm)	9.2											
Kelajuan Pemesinan(rpm)	1000			800			600			500		
Kadar Suapan (mm/rev)	0.03											
Bentuk Tartar yang Terhasil	Sangat Halus			Halus			Kasar			Sangat Kasar		

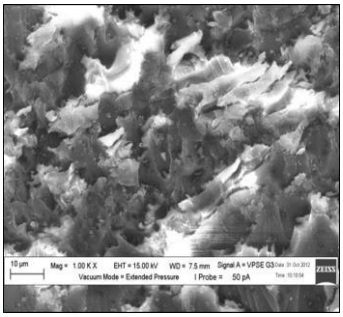
4.2 Perubahan Mikrostruktur

Keputusan ujian eksperimen perubahan mirostruktur berdasarkan ujian yang dilakukan dengan menggunakan Alat Pengimbas Elektron Statik (SEM-Scanning Electron Microscope) adalah seperti di bawah. . Ia menunjukkan keputusan yang diambil daripada ujian perubahan mikrostruktur dengan menggunakan SEM. Daripada keputusan yang diambil, didapati setiap kelajuan pemotongan yang berbeza memberikan perubahan yang berbeza pada setiap perubahan mikrostruktur

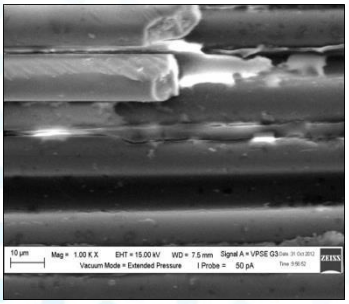
4.2.1 Berikut adalah kelajuan pemotongan pada 1000ppm



Rajah 7: Foto SEM dalam pembesaran 100X

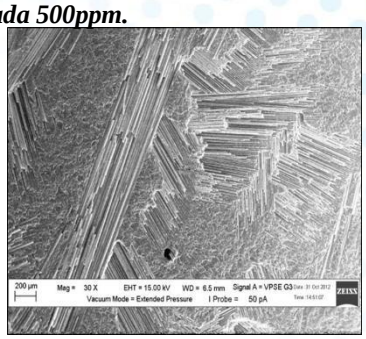


Rajah 8: Foto SEM dalam pembesaran 100K bagi Poliester

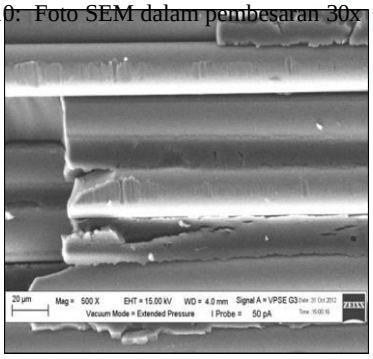


Rajah 9: Foto SEM dalam pembesaran 100Kx bagi Gentian Kaca

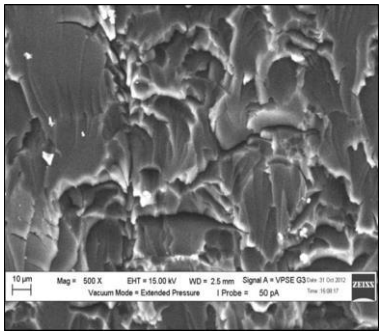
4.2.2 Berikut adalah kelajuan pemotongan pada 500ppm.



Rajah 10: Foto SEM dalam pembesaran 30x



Rajah 11: Foto SEM dalam pembesaran 500x bagi Gentian Kaca



Rajah 12: Foto SEM dalam pembesaran 500x bagi Poliester

Daripada ujian perubahan mikrostruktur yang telah dijalankan didapati bahawa perubahan yang berlaku pada mikrostruktur adalah dipengaruhi oleh parameter setiap kelajuan yang telah dijadualkan. Berdasarkan pada rajah 7, 8 dan rajah 9, dapat diperhatikan bahawa struktur poliester dan gentian kaca kurang mengalami kemusnahan pada mikrostrukturnya. Laju pemotongan pada tahap ini adalah 1000ppm.

Pada kelajuan pemotongan 500ppm, dapat diperhatikan bahawa berlaku kemusnahan yang ketara pada struktur polyester dan juga gentian kaca pada rajah 10 manakala pada rajah 11 ia menunjukkan struktur gentian kaca mengalami kemusnahan yang besar pada mikrostruktur setiap gentiannya dan pada rajah 12 struktur poliester juga mengalami kemusnahan yang besar pada mikrostrukturnya.

Dalam ujian perubahan mikrostruktur, pada kelajuan pemotongan 500 ppm, diperhatikan bahawa terdapat kemusnahan yang ketara pada struktur polyester dan gentian kaca. Sebaliknya, pada kelajuan pemotongan 1000 ppm, perubahan yang berlaku pada struktur poliester dan gentian kaca adalah minimum.

5. Kesimpulan

Kesimpulannya, keputusan menunjukkan penemuan ketara daripada pemesinan poliester bertetulang gentian kaca dengan menggunakan alat keluli berkelajuan tinggi pada pemotongan parameter yang berbeza. Ia menunjukkan keupayaan pemesinan dari segi perubahan mikrostruktur gentian kaca bertetulang poliester dengan menggunakan mesin pengisar konvensional. Proses pemotongan terbaik adalah pada kelajuan 1000rpm, kadar suapan 0:03min/rev. Keputusan dan analisis menunjukkan bahawa proses pemesinan mengisar konvensional mempunyai keupayaan untuk melakukan pemesinan poliester bertetulang gentian kaca. Beberapa cadangan penambahbaikan dicadangkan untuk dilaksanakan pada masa hadapan. Kajian lanjut akan memfokuskan kepada pembolehubah lain seperti dengan

menggunakan kaedah reka bentuk Taguchi dalam operasi mengisar. Ia adalah untuk mengkaji ciri pemotongan bahan komposit bertetulang gentian dengan menggunakan matalat berkelajuan tinggi dan karbida.

Perhargaan

Penulis ingin merakamkan penghargaan yang setinggi-tingginya kepada Politeknik Sultan Mizan Zainal Abidin (PSMZA) dan SIRIM Kulim, Kedah, atas sokongan dan kebenaran menggunakan kemudahan penyelidikan bagi melaksanakan kajian ini. Penulis juga ingin mengucapkan terima kasih kepada rakan-rakan penyelidik atas kerjasama dan sumbangan yang berharga sepanjang pelaksanaan kajian ini.

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POLITEKNIK KOTA KINABALU

Comparative Study of The Optimum Water Content for Soil at Politeknik Kota Kinabalu Using the Atterberg Limit Method

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Abstract

The optimal water content, liquid limit, plastic limit, and plasticity index of soil samples are all determined in this study. The Atterberg Limit is a common name for this limit. Classification of soil such as clay and silt can be distinguished from one another using the Atterberg limit too. To gather the various kinds of soil that were used, two different locations were selected. 16 soil samples from the Politeknik Kota Kinabalu Campus area (behind the football field and behind the lecturer's quarters) were included in the study sample. In this investigation, the traditional Casagrande cup method (ASTM, 2017b) was utilized to obtain the liquid limit. The study's findings indicate that depending on the type of soil, the optimum water content is between 100 and 125 millilitres. Meanwhile, the calculated values of liquid limit, plastic limit and plasticity index from the soil sample behind the football field are 37, 22 and 15 compared to 16, 10 and 6 for the soil sample from the back of the lecturer's quarters. The test soil samples were identified as samples of clay with medium and low plasticity based on these computed data and in accordance with Unified Soil Classification System (USCS) criteria.

Keywords: Liquid Limit, Plastic Limit, Plasticity Index, Unified Soil Classification System

1. Introduction

The Atterberg limits (Liquid Limit-LL and Plastic Limit-LL) and the Plasticity Index-PI of soils, originally proposed by Atterberg (1911), are crucially important for civil engineering, environmental, and agronomic applications. (Emmanuel Arthur, Hafeez Ur Rehman, Markus Tuller, Nastaran Pouladi, Trine Norgaard, Per Moldrup, Lis Wollesen de Jonge, 2021). For example, the Atterberg limits serve as the basis for quantifying the swelling and or shrinkage potential of engineering materials (Sivakumar, Glynn, Cairns, Black, 2009), and in agronomy, the PL is often used as a measure for the optimum water content for tillage (Keller and Dexter, 2012; Obour, Jensen, Lamande, Watts, Munkholm,2018). There are several approaches to measuring the Atterberg limits, and each has advantages and disadvantages of its own. The drop cone penetrometer method (BS, 2018) or the traditional Casagrande cup method (ASTM, 2017b) are popular techniques for establishing the LL. Casagrande (1932) described a process that involved placing a brass bowl onto a hard rubber base that had a pat of soil in it that covered about 2/3 of the cup surface and was grooved into two pieces via a set distance. After the bowl is lifted and dropped, the number of blows required to close the grove along about 13 mm is noted, and the sample's moisture content is ascertained (E. Díaz, R. Tom´as, A. Rabat, J.L. Pastor, 2021). The Atterberg limit lab sheet (refer Figure 1) is deficient in provi ding information on the ideal water content for determining the liquid and plastic limits. Students will find this challenging as they will have to estimate how much water is needed for the Casagrande bowl, which will waste time.

A. Determination of Liquid Limit

1) Prepare about 250g of soil passing through 0.425 sieve.

2) Check the drop of the Casagrande bowl using the spacer gage on the grooving tool handle. This 10mm steel block should just pass between cup and base when the cup is at its maximum height. Tighten the locknut after adjustment and recheck the maximum height with gage.

3) Th soil used for Atterberg limits should not be dried prior to testing but may be air-dried if necessary. Mix the soil sample with distilled water on a glass plate by using a spatula until the mixture is uniform and behaves as a soft paste that can be shaped with a spatula. Separate approximately 30g soil mixture and place in a closed container for liquid limit determination.

4) Put some of the soil-water mixture into the Casagrande bowl and level the surface using spatula.

Figure 1: Lab sheet page 5/12 Geotechnical Engineering Laboratory

Therefore, this study aims to facilitate students, lecturers and lectures in the future with the right optimal water content to avoid wasting time when doing experiments in the laboratory later.

The following are the objectives of this study;

i. To determine the optimum water content, liquid limit, plastic limit and plasticity index for soil at Politeknik Kota Kinabalu.

ii. To determine the soil classification and suggest the optimal water content that should be used to carry out experiments on the same soil in the future.

2. Literature Review

A soil will eventually reach a point where it stops acting as a plastic material and basically becomes a viscous fluid if it is combined with ever-increasing amounts of water (Ennio Polidori, 2007; E. Diaz, 2021). Its liquid limit is the soil's current water content, as proposed by Atterberg (1911) in his definition of this transition. According to Atterberg, the soil's plastic limit is reached at this time when its water content reaches that threshold from a plastic to a semi-solid condition. E. Diaz, 2021 states that there are two standardized methods for its liquid limits determination, the Casagrande cup and the fall cone test. These techniques, which Casagrande (Musbah, A., Mohammed, M. and Alfghia, A., 2024) later expanded, are accepted as standard international testing procedures for determining the liquid and plastic limits. The traditional Casagrande cup method was used for this study because the equipment was easy to handle and available at the time. The research data obtained is also easy to analyse using existing formulas. It is highly helpful to describe, categorize, and forecast the behavior of fine soil engineering using these boundaries and the numerical difference between them, known as the plasticity index.

According to Angel U. Gacutan(2011) the following formulas are used to evaluate the gathered data:

i. Percent Water Content

$$\%\ Water\ Content = \frac{(A-B)}{B}\ x\ 100 \qquad (1)$$

Where: A = (Mass of wet soil + can) – (mass of can)

B = (Mass of dried soil + can) – (mass of can)

ii. Plastic Limit, PL

$$Plastic\ Limit, PL = \frac{(S_1^n)_{PL}}{n} \qquad (2)$$

Where: $(S_1^n)_{PL}$ = summation of water content of sample tested for Plastic Limit

n = number of trials

iii. Liquid Limit, LL

$$Trend\ Line\ Funtion; y = a(x) \pm b \qquad (3)$$

Where: a, b = contstants

y = Liquid Limit, LL

x = 25 (number of drops)

Below are some research highlights related to the research topic to discuss some of the existing research gaps. The first, Vedran Jagodnik (2023) reports that his study, which involved using a fall cone device to determine the Atterberg limits on low plasticity silty sands, found a solid and expected linear trend of high precision, with correlation between the results of liquid limit testing and the available data, suggesting that the Fall cone method is a unique way to test liquid limits for mixtures of low plasticity clays with sand. Furthermore, the plastic limit determination approach reveals a variation from the result obtained using the traditional Casagrande thread rolling method, which may be related to bias in the equipment or kind of soil being tested. The plastic limit value obtained for the K100 sample in this study deviates from expected ranges for comparable soils and from the results of the classical Casagrande thread rolling method. This suggests that there may be a research gap in understanding the factors causing the deviation, whether they are related to the type of soil or the apparatus used. Next, in their paper titled "Determination of Atterberg limits using the vane shear test method to determine both liquid and plastic limit of fine-grained soils," Kamil Kayabali, H.b. Nagaraj, Deniz Yilmaz, and Muhammad Beyhan (2024) establish correlations between undrained strength and water content over a range of consistencies between liquid and plastic states. The findings demonstrate that this approach offers a more effective and dependable way to evaluate the engineering behavior of soils by doing away with the necessity to calculate liquid and plastic limits independently. The lack of agreement on the depth of penetration needed to identify the end of the plastic state when utilizing the cone method as an alternative for identifying the plastic limit was identified as a research gap in this study. Since the laboratory vane shear test method only permits the evaluation of undrained strength and water content correlations, further research and development of alternative test methods for evaluating both liquid and plastic limits of soils is required. In addition, the Atterberg limits are important geotechnical tests for cohesive soils. A paper titled " Experimental study of the factors of variation of Atterberg limits" by Chahra Yellas, Riad Benzaid, Hassiba Kherrouba, and Mustapha Tekkouk (2023) highlights that the Atterberg limits can be significantly influenced by factors like operator accuracy, mater ial quality and wear, and sample preparation method. Additionally, their study highlights how crucial it is to maintain a rigorous operating mode during these tests in order to guarantee consistent and dependable results from various operators. The study's identified research gap was the need for additional investigation into the relative significance of the variables affecting Atterberg limits, suggesting a possibility to comprehend the ways in which these variables interact and give rise to variances in test results. Next, paper entitles experimental study of the factors of variation of Atterberg limits by Chahra Yellas, Riad Benzaid, Hassiba Kherrouba & Mustapha Tekkouk (2023) highlits that the Atterberg limits, which are crucial geotechnical tests for cohesive soils, can be significantly influenced by factors like operator accuracy, material quality and wear, and sample preparation method. Their study also, emphasizes the importance of adhering to a strict operating mode during these tests to ensure reliable and comparable results across different operators. The research gap found in this study was the need for further research on the relative importance of factors influencing Atterberg limits, indicating a potential in understanding how these factors inte ract and contribute to variations int test results. Finally, the proposed method for estimating the Atterberg limits of soil based on the hygroscopic water content showed good agreement with the conventional methods for determining the Atterberg limits of soils, according to Emmanuel Arthur, Hafeez Ur Rehman, Markus Tuller, Nastaran Pouladi, Trine Norgaard, Per Moldrup, and Lis Wollesen de Jonge's 2021 study. Since they don't discuss how soil composition may affect the estimate of Atterberg limits from hygroscopic water content, there may be a substantial research gap that needs to be filled. Another research gap in this study was the absence of discussion on the practical ramifications of estimating Atterberg limits in real-world soil testing scenarios using hygroscopic water content.

3. Methodology

The researcher intends to employ an experimental design for their research. The experimental approach is preferred by researchers since it requires less time to collect data and makes data processing simpler. Gathering information on the ideal water content for various soil types is the aim of the experiment. It was decided to gather different types of soil at two distinct locations. A total of 16 soil samples were collected from different points across the study site at Politeknik Kota Kinabalu campus area (behind of the lecturer quarters and the football field). The region was chosen due to its relevance for construction projects and agricultural activities in the area. Samples were taken at varying depth, typically 0.5 to 1 meter, to capture the most representative soil profile for construction and farming needs. The depth range ensures that the results are applicable to shallow foundations and surface -level agricultural practices. Before the measurements, the samples were sieved to a size of 0.425mm in or der to determine the Atterberg limits. First, the collected data are displayed on a semi-logarithmic graph. Next, using Microsoft Excel, the Trend Line (a linear function) of the shown LL data series is obtained. The choice of using Microsoft Excel for the trend line was chosen because it is easier, faster and more user-friendly in data analysis than statistical or geotechnical software. Mentioning why Excel is preferred can explain this choice.The values of the LL at 25 drops are found using the Trend Line function (refer Equation 3). The device rolling method was used to determine the PL of the samples in quadruplicate (ASTM, 2017; Bobrowski and Griekspoor, 1992). A 30 g sample was combined with water to a plastic state that allowed for easy ball moulding. Initially, two short threads, each 5 to 10 mm thick, were manually rolled from the sample. After positioning the soil threads on the rolling device's bottom plate, the top plate was utilized to roll and provide downward force simultaneously until it touched the 3 mm side rails (refer Figure 2).

The process was repeated until the soils crumbled after the soils were taken out and remoulded. The crushed samples' gravimetric water content was used to determine the purity level. The samples were oven dried at 105 °C for at least 48 hours to determine the gravimetric water content for both LL and PL measurements. LL - PL was the formula used to determine the samples' PI.

Figure 2: Preparation of sample and testing

4. Data & Result

4.1 Optimal water content

The comprehensive table of optimal water content are shown in Table 1 below for each trial specimen used in this study. Generally speaking, the appropriate water content ranges from 100 to 125 millilitres. This suggest that 100ml of water is the recommended starting point when preparing soil samples for Atterberg limit tests, particularly for fine - grained soils similar to those found at these locations.

Table 1: Comprehensive table of optimal water content

No.	LOCATION	WATER CONTENT (ml)			
		S1	S2	S3	S4
1	Football field	100	105	110	115
2	Lecturer's Quarters	105	110	115	125

4.2 Liquid Limit (LL), Plastic Limit (PL) and Plasticity Index (PI)

The data from the soil sample examined at Politeknik Kota Kinabalu's geotechnical laboratory from the football field and lecturer quarters is displayed in Tables 2 and 3 below.

Table 2: Football field data specimen

TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					42	38	22	12
Can Number	---	---	1	2	3	4	1	2	3	4
Mass of Empty Can	M_C	(g)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Mass Can & Soil (Wet)	M_{CMS}	(g)	32.60	33.10	32.80	33.20	36.20	35.80	36.40	35.60
Mass Can & Soil (Dry)	M_{CDS}	(g)	31.90	32.80	32.20	32.80	34.90	34.01	34.70	34.00
Mass of Soil	M_S	(g)	1.90	2.80	2.20	2.80	4.90	4.01	4.70	4.00
Mass of Water	M_W	(g)	0.70	0.30	0.60	0.40	1.30	1.79	1.70	1.60
Water Content	*w*	(%)	36.8	10.7	27.3	14.3	26.5	44.6	36.2	40.0
Average		(%)	22				37			

Table 3: Lecturer quarters data specimen

TEST			PLASTIC LIMIT				LIQUID LIMIT			
Variable	NO		1	2	3	4	1	2	3	4
	Var.	Units								
Number of Blows	N	blows					40	36	24	10
Can Number	---	---	1	2	3	4	1	2	3	4
Mass of Empty Can	M_C	(g)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Mass Can & Soil (Wet)	M_{CMS}	(g)	32.66	33.10	32.84	33.80	35.20	35.80	35.40	35.60
Mass Can & Soil (Dry)	M_{CDS}	(g)	32.42	32.90	32.40	33.60	34.90	34.88	34.70	34.45
Mass of Soil	M_S	(g)	2.42	2.90	2.40	3.60	4.90	4.88	4.70	4.45
Mass of Water	M_W	(g)	0.24	0.20	0.44	0.20	0.30	0.92	0.70	1.15
Water Content	*w*	(%)	9.9	6.9	18.3	5.6	6.1	18.9	14.9	25.8
Average		(%)	10				16			

The average liquid limit (LL) for soil samples from the football field was 37%, while the plastic limit (PL)was 22%, resulting in a plasticity index (PI) of 15 (see Figure 4a and 4b). Based on these values and the Unified Soil Classification System (USCS), the soil from this location can be classified as CL (low -plasticity clay). For the soil samples from the lecturer's quarters, the average liquid limit (LL) was 16%, and the plastic limit (PL) was 10%, giving a plasticity index (PI) of 6 (see Figure 5a and 5b). According to the USCS classification, the soil from this location was categorized as CL-ML (dual-classification of low-plasticity clay and silt). Figures 3a and 3b below show the data of plastic limit and liquid limit versus no. of trials for samples from the football field and lecturer quarters.

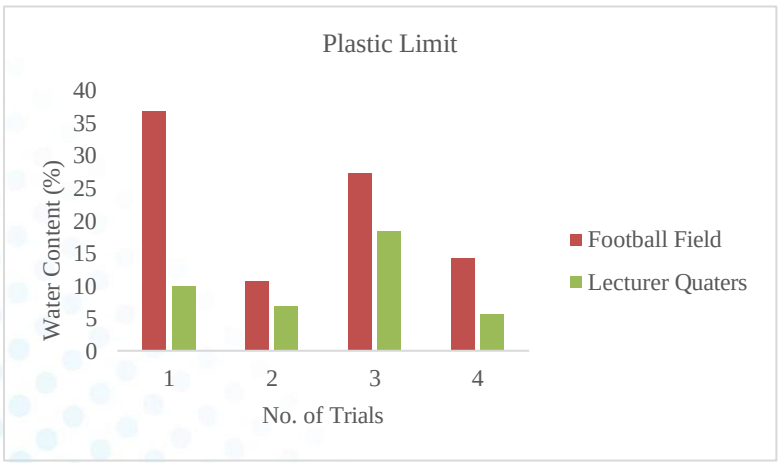

Figure 3a Plastic limit versus No. of trials

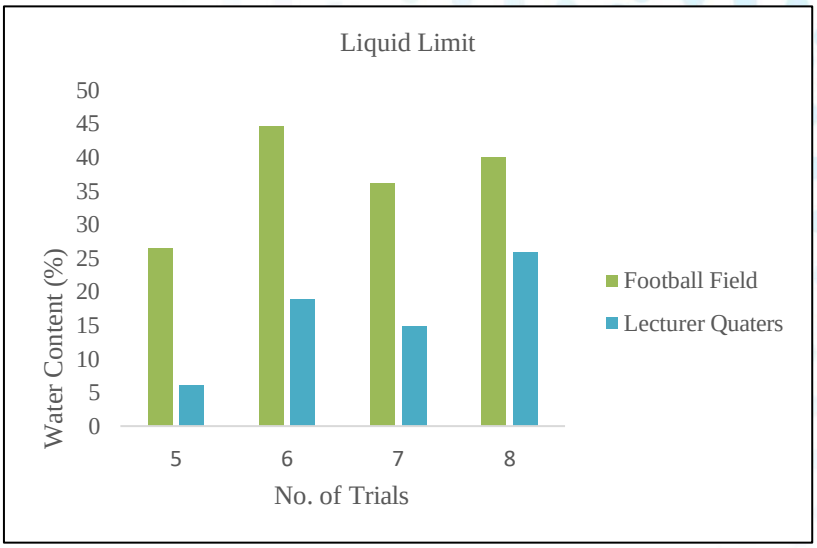

Figure 3b Liquid limit versus No. of trials

The optimal water content results indicate that the soil from both locations requires similar amounts of water for testing, with an optimal water content range of 100 ml to 125 ml. However, the soil from the lecturer's quarters showed a slightly higher demand for water content to reach its liquid and plastic limits. The liquid limit and plastic limit of the soils from the football field were significantly higher compared to the soils from the lec turer's quarters, indicating that the football field soil retains more water before transitioning from a plastic to a liquid state (K.Malki and Y.Abed, 2024) This suggests that the soil behind the football field has higher plasticity and may behave more plastically under varying moisture conditions compared to the soil behind the lecturer's quarters. The calculated plasticity index for the football field soil was 15, indicating moderate plasticity, whereas the lecturer's quarters soil had a lower plasticity index of 6, suggesting that this soil has low plasticity and is less likely to deform significantly under changes in moisture content.

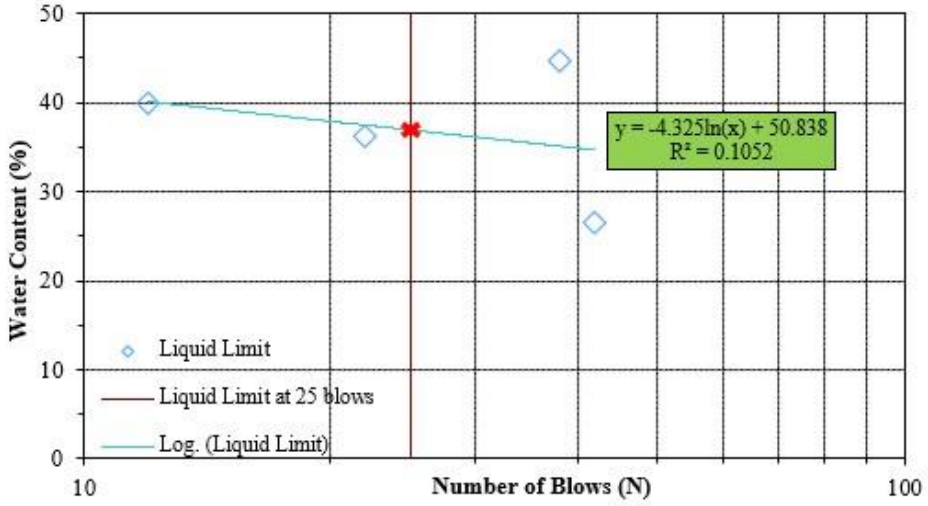

Figure 4(a) Water Content(%) vs Number of Blows (N)

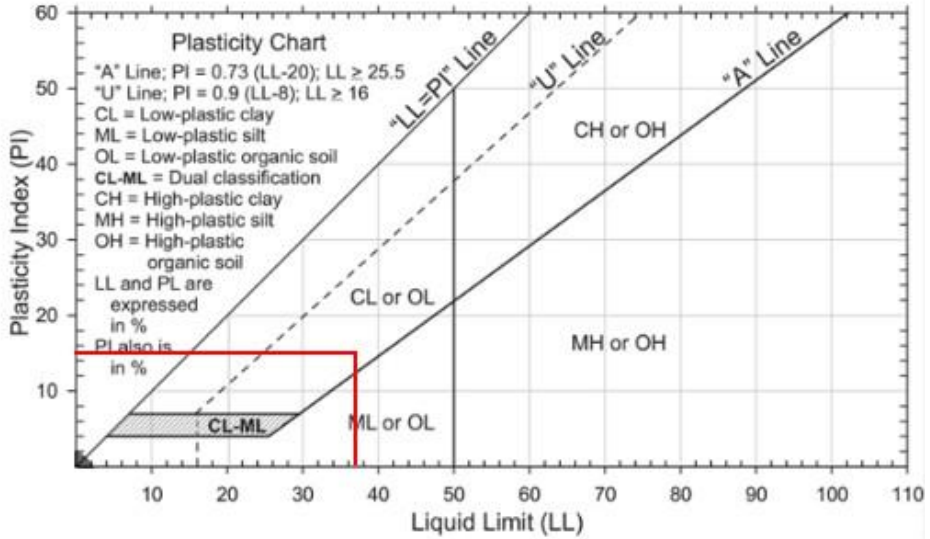

Figure 4(b) Plasticity Index(PI) vs Liquid Limit(LL)(Source:Braja M.Das)

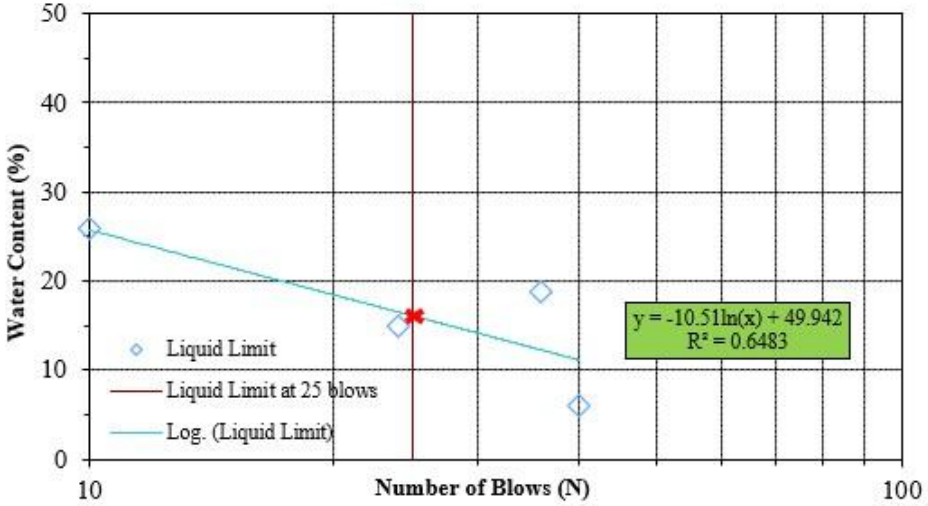

Figure 5(a) Water Content(%) vs Number of Blows (N)

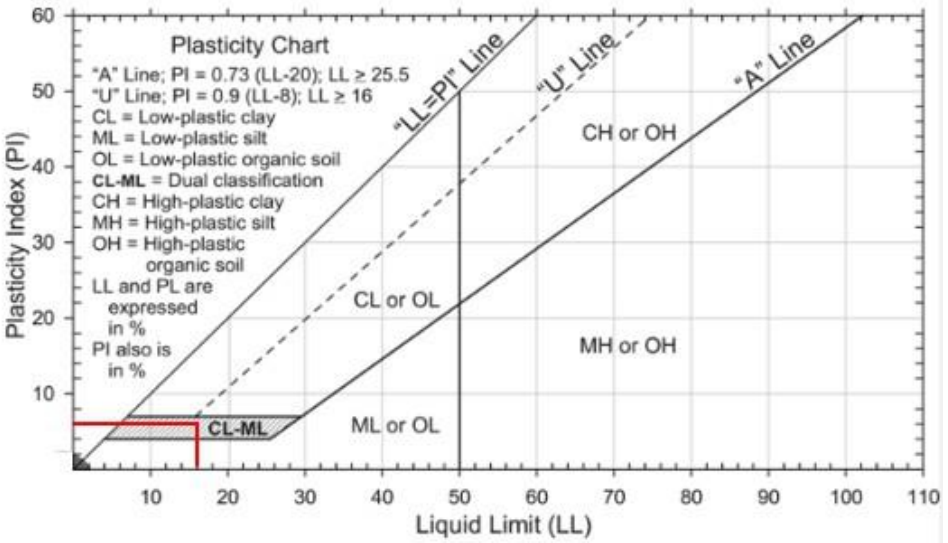

Figure 5(b) Plasticity Index(PI) vs Liquid Limit(LL)(Source:Braja M.Das)

5. Discussion

The consistency of the soil can be used to classify different types of soils. It's critical to forecast how well soil will work as a building material. The soil behind the football field and the lecturer quarters is classified as CL=low- plastic clay and CL-ML=dual classification (low plastic clay and silt), respectively by using a USCS (Y.Gui., Q.Sang. and J.Yin., 2024) (see Figure 4b & 5b). Based on the results, the soil at Politeknik Kota Kinabalu shows the typical characteristics of low plastic and clay and silt respectively. This confirms that the site soil is suitable for both construction and agricultural activities without additional treatment. For both the liquid limit and plastic limit tests, samples were oven dried for a minimum of 24 hours. These samples were collected both prior to and following the oven-drying procedure. With this data, the researcher may now determine the masses and water content of the soil samples. For the liquid limit test, a linear trend line was created from the soil's number of blows against water content plot. The trend line equation is now used to find the soil's liquid limit by calculating the moisture at which 25 drops are needed to bring the two sides of the soil pat into contact (see Figure 4a & 5a). The computed liquid limits for the soil sample behind the football field and the lecturer quarters were 37 and 16, respectively. For the purposes of determining the plastic limit, a material is considered to be on its plastic behavior if it can be rolled into a solid, thread-like shape with an approximate diameter of 3.2 mm. Without using a mechanical rolling instrument, the soil sample is manually rolled and kneaded. To compute the plastic limit, the average water content of the four sample tests in Tables 2 and 3 was ascertained. The investigation indicates that the plastic limit values are, respectively, 10 and 22. The obtained plastic limit for this sample is valid when compared to ASTM standards because the test specimens' mass of water did not exceed 1.4% during any tr ial. Moreover, if the plastic limit is greater than or equal to the liquid limit, the soil is not plastic. Stated differently, the soil sample used in this study seems to be plastic because the plastic limit's computed value is lower than the liquid limit (PL<LL).

6. Conclusion

According to the study's findings, the ideal water content limit for both soil samples collected from the area of Politeknik Kota Kinabalu is between 100 - 125 millilitres. In contrast, the soil in the lecturer quarters has the following values: (16,10,6) for the liquid limit, plastic limit and plasticity index and the soil behind the football field (37, 22, 15). However, the soil sample from behind the football field was classified as low-plastic clay (CL), and the soil sample behind the lecturer quarters was classified as dual-classification (CL-ML). This study shows that the Atterberg Boundary provides important data that helps engineers, architects and agricultural planners make informed decisions about land use, ultimately reducing the risks associated with improper land management around the Kota Kinabalu Polytechnic campus in particular.

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POLITEKNIK KOTA KINABALU

Pembangunan Prototaip Mesin Pemotong Rumput Robotik

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Abstrak

Mesin pemotong rumput adalah mesin yang digunakan untuk memotong rumput di halaman rumah. Mesin ini biasanya dikuasakan oleh enjin pembakaran dalaman atau motor elektrik dan dipotong secara manual. Kajian prototaip mesin pemotong rumput robotik ini dibangunkan untuk memotong rumput di halaman rumah dengan mudah dan selamat. Prototaip ini mengandungi komponen seperti Arduino Uno, PS2 controller, PS2 controller starter kit, DC motor driver, relay driver, caster wheels, 12 volt lead acid bateri boleh dicaj semula dan tiga buah motor 12 volt sebagai roda dan pisau pemotong. Prototaip ini dikawal secara tanpa wayar dengan menggunakan radio frekuensi (RF) dan jarak maksimum isyarat adalah 10 meter. Masa yang diambil untuk memotong kawasan seluas 10 kaki x 20 kaki adalah dalam lingkungan satu jam.

Keywords: Arduino Uno, PS2 Controller

1. Pengenalan

Mesin pemotong rumput merupakan satu peralatan yang digunakan untuk memotong rumput yang popular berbanding memotong rumput secara manual dengan menggunakan parang, sabit dan alatan memotong yang lain. Penggunaan mesin pemotong rumput adalah lebih mudah, cepat dan rapi (M. Khairul, Reza & Ridho, 2019). Pelbagai jenama, bentuk, saiz mesin rumput yang ada di pasaran pada masa kini. Bagi kegunaan industri, mesin rumput yang digunakan adalah jenis beroda dan berat kerana menggunakan enjin untuk menghidupkannya . Bagi kegunaan domestik pula, kebanyakannya adalah dari jenis galas dan menggunakan minyak untuk menghidupkannya.

Kerja pemotongan rumput pada halaman yang luas dan terbuka memerlukan tenaga dan keadaan fizikal yang kuat. Hal ini membuatkan pengendali cepat penat dan keletihan sehingga berlakunya penurunan produktiviti. Selain dari itu, pengendali juga mungkin terdedah kepada risiko kecederaan. Pengendali mesin memerlukan tenaga untuk menggalas dan memerlukan kos pembelian bahan bakar secara berterusan. Manakala bagi prototaip ini, pengendali tidak perlu menggalas mesin tersebut kerana ianya di kawal menggunakan ala t kawalan jauh. Saiz yang besar dan jisim yang berat turut menyumbang kepada masalah kesihatan seperti sakit belakang dan penat. Berbanding dengan prototaip yang dihasilkan ianya adalah bersaiz kecil berukuran 26cm x 17.5 cm x 36.5 cm (LxTxP) dengan berat 3.5 kg . Mesin jenis galas memiliki getaran yang tinggi di mana penggunaan mesin dalam waktu yang lama dan berulang-ulang akan menyebabkan terjadinya hematuria. Hematuria terjadi karena getaran akibat hemolisis intravaskuler yang timbul akibat adanya jejas mekanik terhadap eritrosit terdapat pada pembuluh darah telapak tangan dan lengan (Asman Sinaga, 2000). Selain dari itu, pencemaran bunyi juga berlaku melalui enjin yang digunakan pada mesin tersebut.

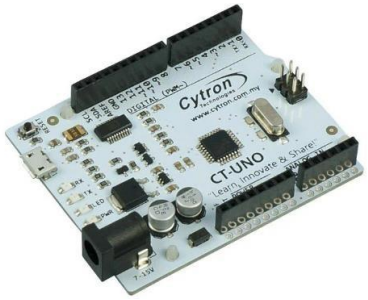
Perkembangan teknologi dalam bidang sistem pengendalian banyak membangunkan mesin-mesin automatik yang mampu meringankan pekerjaan manusia, menjimatkan masa, serta mengelakkan manusia daripada terdedah kepada bahaya (Setya, Edi & Dickiy, 2020). Bagi mengatasi masalah tersebut, satu prototaip mesin pemotong rumput robotik telah dibangunkan untuk memotong rumput di halaman rumah yang kecil seperti di rumah teras atau berkembar. Prototaip ini menggunakan kuasa bateri 12V DC. Dengan penggunaan bateri, kos pe mbelian bahan bakar dapat dikurangkan kerana bateri tersebut boleh diguna semula melalui pengecasan. Penggunaan bateri ini dapat bertahan selama 1 jam apabila digunakan secara berterusan. Melalui prototaip ini juga, pengendali tidak perlu mengalas mesin kerana ia mempunyai roda dan dikawal secara tanpa wayar menggunakan radio frekuensi 2.5GHz dengan kawasan liputan isyarat sejauh 10 meter. Pengendali hanya berada di satu tempat dan dapat mengawal pergerakan mesin tersebut untuk bergerak. Prototaip ini boleh memotong rumput dalam masa satu jam bagi keluasan 10 kaki x 20 kaki. Melalui pembangunan prototaip ini, isu berkaitan kesihatan, terdedah kepada bahaya, penggunaan masa yang banyak dan penggunaan kos bahan bakar dapat diatasi kerana ianya selamat, menjimatkan masa dan kewangan serta mudah untuk dikendalikan.

2. Kajian Literature

Beberapa tahun kebelakangan ini, penggunaan mesin rumput robotik telah menarik perhatian dan menjadi pilihan pengguna kerana keupayaannya untuk memotong rumput secara automatik atau di kawal dari jarak jauh oleh pengguna. Ianya juga menjadikan penyelenggaraan rumput lebih cekap dan kurang memerlukan tenaga kerja. Integrasi beberapa komponen elektronik seperti mikropengawal Arduino Uno, *PS2 Controller, PS2 Controller Starter Kit, DC Motor Driver, Relay Driver, Caster Wheels, lead acid battery 12V, DC geared motor* dan pisau pemotong, memainkan peranan penting dalam meningkatkan fungsi dan prestasi mesin rumput robotik. Kajian literatur ini menerangkan penggunaan komponen elektronik dalam reka bentuk pembangunan prototaip mesin pemotong rumput robotik, dengan menekankan kelebihan yang berkaitan dengan komponen – komponen ini.

2.1. Arduino Uno

Arduino Uno adalah papan mikropengawal berdasarkan ATmega328P yang banyak digunakan berdasarkan kemudahan pengaturcaraan yang dimuat turun ke dalamnya menjadikannya pilihan ideal untuk mengawal sistem robotik. Kajian menunjukkan bahawa Arduino Uno boleh menguruskan pelbagai input dan output dengan berkesan, menjadikannya sesuai untuk mengawal motor, sensor, dan periferal lain dalam mesin pemotong rumput robotic. (Sunardi, Giovani Toldo, & Aripin Triyanto3, 2022) . Sifat sumber terbuka Arduino juga membolehkan penyesuaian yang meluas dan sokongan komuniti, yang memudahkan pembangunan sistem robotik yang kompleks.



Rajah 1: Arduino Uno

2.2. PS2 Controller

PS2 Controller merupakan input yang diterima daripada pengguna bagi membolehkan robot melaksanakan arahan seperti di dalam aturcara. Ianya digunakan kerana rekabentuk yang ergonomik menyebabkan ia selesa dan mudah dikendalikan. *Joystik* PS2 merupakan kontroler wireless yang digunakan untuk mengawal robot secara manual. Kajian menunjukkan *Joystick* PS2 terdiri dari *transmitter* dan *receiver* yang berfungsi sebagai pengirim dan penerima, penerima PS2 memiliki frekuensi yang sama sehingga membuat setiap *joystick* yang dalam jangkauan penerima akan berhubung secara automatik ke penerima yang sama. (Nurul Syafika, Yasdinul Huda, Muhammad Anwar, & Dedy Irfan, 2024)

Rajah 2 : PS2 Controller

2.3. DC Motor Driver

Pengunaan *DC motor driver* adalah penting untuk menentukan arah dan kelajuan motor dalam mesin pemotong rumput robotic. Pemacu akan menukar isyarat kawalan dari Arduino Uno kepada isyarat elektrik yang diperlukan

untuk menggerakkan motor DC. Menurut R. Kumar dan S. S. Kumar (2019), menggunakan IC pemacu motor seperti L298N memberikan kawalan yang cekap ke atas motor, memastikan prestasi yang boleh dipercayai dan tindak balas yang baik dalam pelbagai keadaan operasi.

Rajah 3 : DC Motor Driver

2.4. Relay Driver

Relay driver digunakan untuk mengawal operasi motor elektrik. Ia berfungsi untuk mengawal membuka atau menutup litar kuasa bagi menghidupkan atau mematikan motor elektrik. Kajian membincangkan kepentingan litar *relay driver* dalam sistem robotik, menekankan peranannya dalam meningkatkan ketahanan dan kestabilan sistem keseluruhan dengan mengawal bekalan kuasa ke motor dan komponen lain (R.S.Khandpur, 2006).

Rajah 4 : Relay Driver

2.5. Bateri Asid Plumbum 12 Volt

Bateri asid plumbum 12V menyediakan kuasa yang diperlukan bagi membolehkan mesin pemotong rumput robotik beroperasi. Jenis bateri ini dipilih kerana kemampuannya untuk memberikan output kuasa yang konsisten. (Sunardi, Giovani Toldo, & Aripin Triyanto3, 2022) menekankan kepentingan pemilihan bateri yang sesuai untuk sistem robotik, dengan menyatakan bahawa bateri asid plumbum menawarkan keseimbangan yang baik antara kos, kapasiti, dan ketahanan untuk banyak aplikasi robotik.

Rajah 5 : Bateri Asid Plumbum 12 Volt

2.6. Motor DC 12 Volt

Motor DC merupakan sejenis motor elektrik yang menukarkan tenaga elektrik arus terus (DC) kepada tenaga mekanikal. Motor DC berfungsi berdasarkan daya yang dihasilkan oleh medan magnet. Ianya dapat digunaan untuk menggerakkan robot . Kelebihan motor jenis ini ialah ia mempunyai kecekapan yang tinggi dan hampir tidak memerlukan penyelenggaraan. Magnet kekal menghasilkan medan magnet yang tetap, jadi kawalan kelajuan

hanya dilakukan dengan mengatur voltan bekalan. Berdasarkan kajian menunjukkan motor DC 12v s esuai digunakan kerana dapat menghasilkan tork dan kelajuan yang diperlukan untuk mesin pemotong rumput robotic. (M. Khairul, Reza & Ridho, 2019)

Bagi menentukan kelajuan robot motor RPM *(Revolution per minute*) dan menentukan diameter roda, formula bagi Persamaan 1 dan 2 berikut boleh digunakan

Lilitan roda

Jarak yang dilalui dalam satu putaran adalah sama dengan lilitan roda

$$Lilitan\ roda = \pi\ x\ diameter \qquad (1)$$

Di mana :

Π ≈ 3.1416

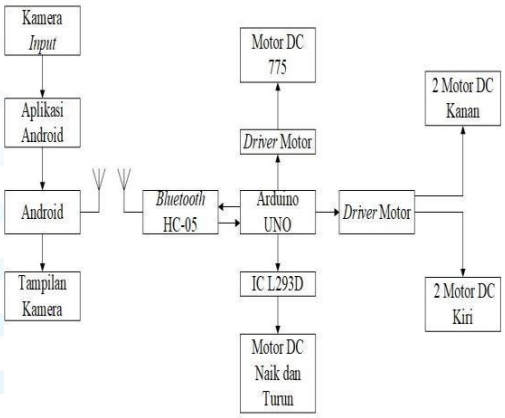
Diameter = diameter roda (dalam meter, sentimeter dan lain-lain)

Kelajuan dalam jarak persaat:

$$Speed\ (\frac{m}{s}) = \frac{lilitan\ roda\ x\ RPM}{60} \qquad (2)$$

2.7. Mesin Pemotong Rumput Kendalian Jarak Jauh Menggunakan Aplikasi Android dan Bluetooth

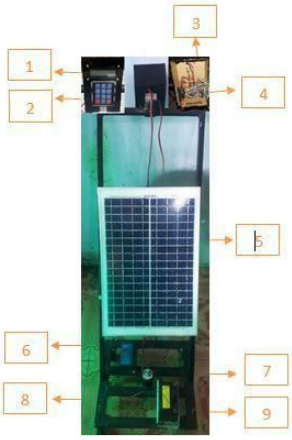
Mesin pemotong rumput dengan kendalian jarak jauh menggunakan aplikasi android dihubungkan dengan Bluetooth menggunakan komponen seperti sistem penggerak roda dan pemutar pisau, modul bluetooh, pengendali Arduino uno dan smartphone android (M. Khairul, Reza & Ridho, 2019). Rajah 6 di bawah menunjukkan diagram blok sistem pemotong rumput kendali jarak jauh ia dikendalikan sehingga jarak 80 meter pada ruang terbuka dan 10.45m pada ruang tertutup dengan menggunakan bantuan kamera pada telefon android, kecekapan motor dipengaruhi oleh beban di mana kecekapan motor akan berkurang jika semakin dekat dengan ketinggian rumput . (M. Khairul, Reza & Ridho, 2019)



Rajah 6 : Diagram blok sistem pemotong rumput kendali jarak jauh

2.8. Alat pemotong rumput menggunakan kawalan Arduino

Rajah 7 di bawah menunjukkan prototype alat pemotong rumput menggunakan kawalan Arduino. Alat ini menggunakan motor DC untuk menggerakan mata pisau. Kecepatan motor DC untuk pemotong rumput ini diatur oleh Driver L298N yang diprogram menggunakan Arduino uno Dimana pengguna perlu mengatur kecepatan pemotong rumput dengan menekan keypad dan automatic akan muncul di LCD dengan nilai PMW sehingga 225 dan ketahanan bateri menjadi rendah jika adanya beban (Sunardi, Giovani Toldo, & Aripin Triyanto3, 2022)



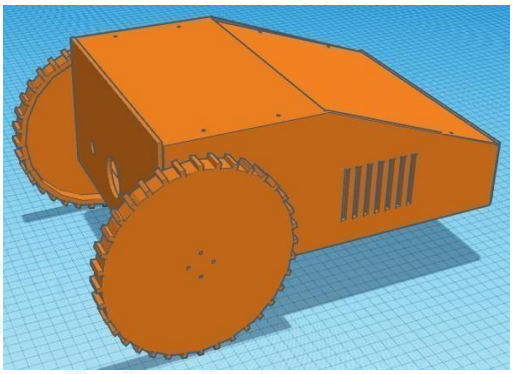
Rajah 7 : Portotype alat pemotong rumput dengan Arduino

3. Metadologi

Metadologi yang digunakan dalam kajian pembangunan prototaip ini dibahagikan kepada dua bahagian iaitu pembangunan perkakasan dan pembangunan pengaturcaraan.

3.1 Pembangunan Perkakasan

Seiring dengan kemajuan teknologi, 80% struktur mesin dibina dengan menggunakan mesin CNC pencetak 3D. Panel bahagian depan, belakang, kiri, kanan dan atas struktur robot menggunakan bahan *polylactic*. Pencetakan 3D atau *additive manufacturing* (AM) merupakan proses mencipta objek tiga dimensi di mana bahan diacu berlapis-lapis di bawah kawalan komputer untuk membentuk objek. Objeknya boleh datang dalam pelbagai jenis rupa bentuk dan selalunya dihasilkan dengan menggunakan data model digital dar ipada model 3D ataupun sumber data elektronik yang lain seperti Fail Pembuatan Tambahan (*Additive Manufacturing File*, AMF)(Deny, Hari, Wahyu, 2021) . Rekabentuk panel direka dengan menggunakan web based *thinkercad.com*. Hanya panel bawah yang menggunakan bahan dari kepingan aluminium dengan ketebalan 3mm. Rajah 8 di bawah menunjukkan hasil rekaan 3d mesin pemotong rumput robotik.

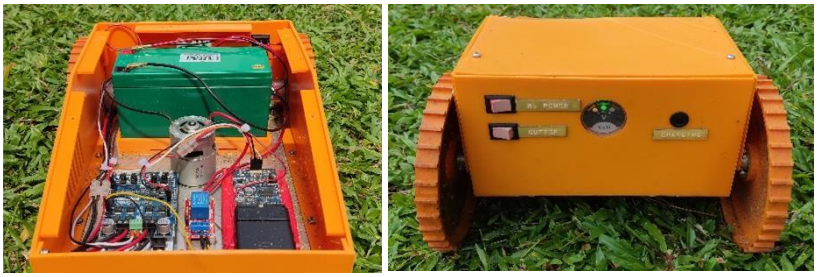


Rajah 8 : Rekabentuk Prototaip

Selanjutnya, panel-panel yang telah dicetak akan dipasang mengikut rekabentuk yang telah ditetapkan. Saiz mesin adalah 26cm(lebar) x 17.5cm(tinggi) x 36.5cm(Panjang)((Asman Sinaga, 2000) (Setya, Edi & Dicky, 2020) (M. Khairul, Reza & Ridho, 2019) (Deny, Hari Din & Wahyu, 2021)). Pemasangan panel aluminium di pasang pada bahagian bawah prototaip dan ditambah *cutter* bersaiz 148mm x 32mm yang digunakan untuk memotong rumput. Penambahan roda yang boleh berputar 360° juga dibuat pada bahagian bawah robot untuk membolehkan mesin bergerak dengan lebih lancar.

Rajah 9: Prototaip yang telah dipasang

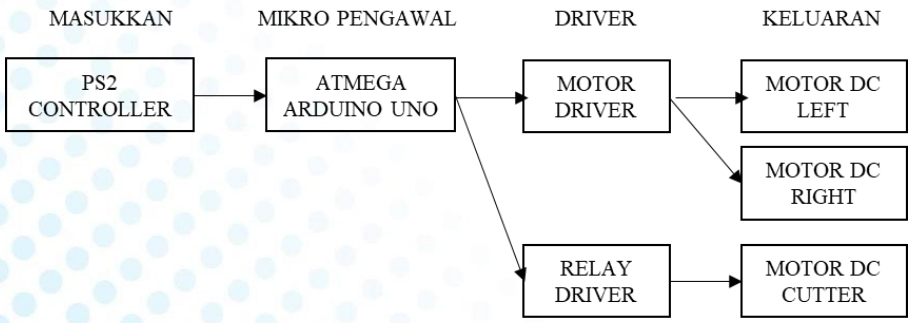
Komponen seperti *Arduino uno*, *relay driver*, *motor driver*, *motor DC*, *bateri* 12V adalah komponen utama yang digunakan untuk mengerakkan mesin ini. Selain itu *push button switch* turut digunakan untuk menghidupkan motor dan cutter. Voltage *indicator* digunakan sebagai paparan untuk melihat tahap *voltage* yang ada samada *high*, *low* atau *normal*.



Rajah 10: Komponen yang terdapat pada mesin

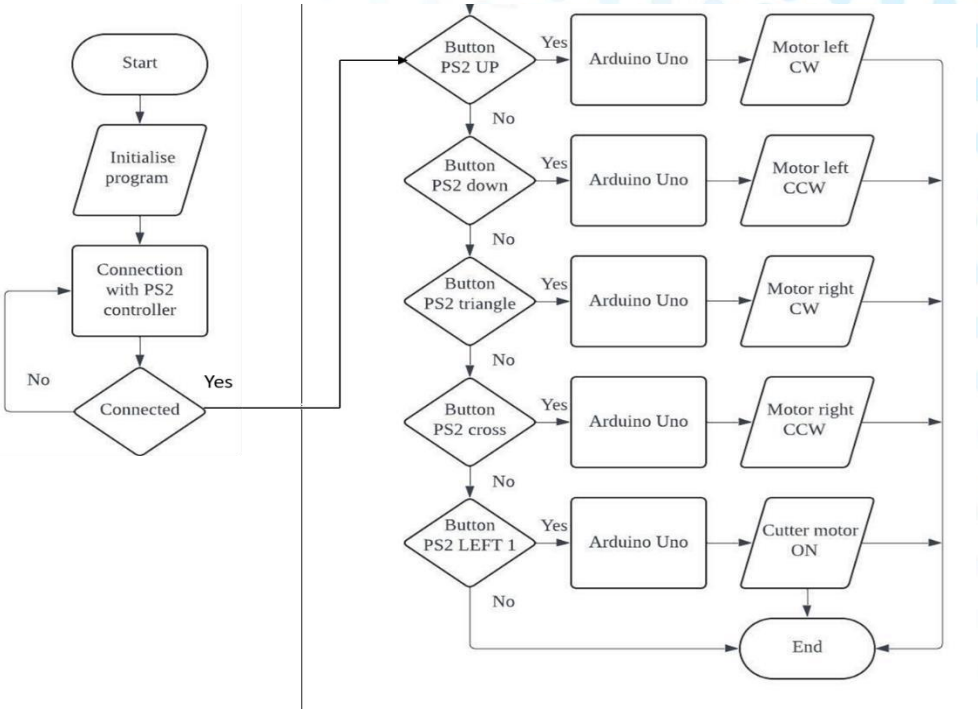
3.2 Pembangunan Pengatucaran

Di dalam proses pembangunan aturcara, ianya boleh dibahagikan kepada 4 bahagian iaitu masukkan, mikropengawal, driver dan keluaran seperti rajah di bawah. Gambar rajah blok litar menunjukkan isyarat masukan akan diterima oleh papan mikro pengawal *Arduino Uno* daripada *PS2 controller*. Seterusnya Arduino Uno akan mengeluarkan isyarat keluaran kepada *motor driver* untuk menggerakkan motor.



Rajah 11 : Gambarajah Rekabentuk Litar

Bagi pembangunan aturcara, ianya dibangunkan dengan mengguna *Arduino IDE* seperti cartalir di bawah. Aturcara ini akan bermula apabila mikro pengawal dan PS2 berhubung menggunakan radio frekuensi 2.5GHz. Seterusnya arahan akan diberikan oleh PS2 *controller* melalui mikro pengawal *Arduino Uno* untuk menggerakkan motor. Terdapat 5 arahan yang diprogramkan iaitu *Motor left clockwise, motor left counter clockwise, Motor right clockwise, motor right counter clockwise dan cutter motor ON*.



Rajah 12 : Cartalir Kendalian Aturcara

4. Dapatan dan Analisis

Jadual 1 menunujukkan analisis penggunaan arus mengikut situasi. Berdasarkan kepada ujikaji yang dijalankan, terdapat lima keadaan robot yang diuji iaitu ketika *idle current* iaitu 0.08A menunjukkan robot sangat cekap ketika tidak bergerak. Bagi situasi kedua, apabila motor pemotong tersekat, keadaan ini merupakan satu keadaan yang kritikal kerana penggunaan arus boleh melonjak sehingga 18A. Manakala pada keadaan robot bergerak dan pemotong dihidupkan penggunaan arus adalah antara 2.5A hingga 10A. Hasil daripada bacaan ini menunjukkan penggunaan arus dalam setiap situasi adalah sangat penting untuk merancang kapasiti bateri dan memastikan keselamatan sistem elektrik bagi mengelakkan masalah berkaitan pemanasan dan kerosakan pada komponen robot.

Jadual 1 : Analisis Penggunaan Arus mengikut situasi

Bil	Situasi operasi	Penggunaan Arus
1.	Idle current (robot dihidup tetapi tidak bergerak dan motor pemotong dimatikan	0.08A
2.	Pergerakkan motor roda tersekat, arus lebih tinggi digunakan	2.5A
3.	Motor pemotong dihidupkan, robot tidak bergerak	1.2A
4.	Motor pemotong tersekat, arus akan naik dengan ketara	18A
5.	Kedua – dua motor roda dan pemotong dihidupkan, robot bergerak dan pemotong on	2.5A – 10A

Jadual 2 menunjukkan jenis-jenis motor DC geared yang digunakan di dalam ujikaji pembinaan prototaip mesin pemotong rumput robotik dan perbezaan kelajuan pergerakan bagi setiap jenis motor. Berdasarkan kepada ujikaji yang dijalankan mendapati setiap jenis motor yang digunakan mempunyai daya tujah dan kelajuan pergerakan yang berbeza. Motor pertama mempunyai kelajuan yang sangat rendah, tetapi daya tujahan yang tinggi. Ianya sesuai untuk mesin yang memerlukan ketepatan dan tork yang tinggi, tetapi tidak sesuai untuk pergerakan yang pantas. Motor kedua dapat bergerak dengan kelajuan yang tinggi tetapi mempunyai daya tujahan yang rendah. Ianya boleh menyebabkan mesin sukar untuk bergerak dengan beban yang lebih berat. Manakala motor ketiga mempunyai keseimbangan antara kelajuan dan daya tujahan dan membolehkannya bergerak dengan baik. Motor DC geared 75RPM dipilih kerana mesin dapat bergerak dengan lebih baik jika dibandingkan dengan motor DC yang lain.

Jadual 2 : Jenis motor DC geared dan pergerakan motor

Bil	Jenis motor DC Geared	Daya tujah	Kelajuan m/s	Pergerakan motor
1.	16 RPM	14kgf.cm	0.027m/s	Pergerakan terlalu perlahan
2.	225 RPM	1.3kgf.cm	0.389m/s	Daya tujahan rendah, mesin sukar bergerak
3.	75 RPM	3kgf.cm	0.13m/s	Mesin dapat bergerak dengan baik

Daripada pengujian menunjukkan prototaip mesin pemotong rumput robotik ini mengambil masa lebih kurang satu jam untuk kerja memotong rumput dengan keluasan 10 kaki x 20 kaki. Bateri mampu bertahan selama 2 jam manakala mengambil masa selama 6 jam untuk dicaj penuh. Ketinggian pisau pemotong adalah tetap iaitu 25mm. Mesin dapat dikawal dengan menggunakan PS2 controller pada frekuensi 25Hz dengan jarak 10 meter.

5. Kesimpulan

Berdasarkan ringkasan dapatan dan objektif projek, dapatlah disimpulkan bahawa pembangunan prototaip mesin pemotong rumput ini dapat mengatasi masalah yang melibatkan kesihatan pengendali kerana ianya bersaiz kecil, dan boleh dikawal secara jarak jauh dengan menggunakan PS controller. Jika dibandingkan dengan mesin yang sedia ada saiznya besar dan lebih berat serta perlu di kawal secara manual. Mesin sedia ada menggunakan bahan bakar dan memerlukan kos dalam pengendaliaannya. Jika menggunakan prototaip ini , penggunaan kos bahan bakar dapat dijimatkan kerana prototaip ini menggunakan tenaga yang boleh dicas semula. Prototaip ini juga mesra pengguna di mana ianya boleh dikendalikan oleh semua peringkat umur kerana ianya mudah untuk digunakan dan dikawal serta ringan.

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Modelling and Control of Chaotic Behaviour in a Nonlinear System

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Abstract

The dynamic behaviour of an inverted flexible pendulum system that is excited at its base—a nonlinear mechanical system—is examined in this paper. This system exemplifies a nonlinear mechanical system exhibiting chaotic behaviours within a particular parameter range. This example establishes and illustrates a novel method for simulating the dynamics of nonlinear systems. A related novel kind of control is established based on this dynamical state-based modelling. A time-frequency energy analysis simulates how the chaotic systems' equilibria change over time. Impulses are utilised to control the states expressed in frequency-related energy variables. The impulses are shaped in a way that applies frequency-related energy pulses as feedback to the system at times. Control is used to maintain the system's position within the current equilibrium region to prevent transition between different equilibriums. The experimental data are thoroughly presented and discussed, emphasising the injection of designed impulses that impact the system's transition between states of equilibria. An appropriate shaping of impulses was achieved based on frequency-related energy state modelling, enabling impulse-based control to gain control over chaotic dynamics. The experimental findings show how the new control approach works in controlling the chaotic behaviour of the inverted flexible pendulum system.

Keywords: - nonlinear system, inverted flexible pendulum, chaotic behaviour, chaos control.

1. Introduction

Control of nonlinear systems, particularly in the context of chaotic vibrations, has garnered significant attention in recent research. Nonlinear systems are characterized by their complex dynamics which can lead to phenomena such as bifurcations and chaos. Effective control strategies are essential for managing these behaviours, especially in engineering applications where stability and performance are critical. In robotics, the most well-known and typical example of a nonlinear system is the flexible beam (flexible pendulum). The problem here is that because of the flexible beam's infinite degrees of freedom, there are more variables in this system to regulate than there are control inputs. The system is discretised in practice, requiring that a suitable n umber of degrees of freedom be considered.

2. Literature Review

The chaotic behaviour of nonlinear and flexible systems is investigated and discussed in the literature using various methods. Nonplanar, chaotic, bending-torsion oscillations without considering the beam's tip mass or the presence of numerous equilibria have been demonstrated in Sheheitli & Rand (2012) using elastic beams as an example. While out-of-plane vibrations and chaotic behaviour were deduced from vibration under harmonic excitation in the aforementioned publication, multiple equilibria were experimentally seen in a flexible pendulum system with a constant length, substantial deformations, and tip mass (Patil & Gandhi, 2014). In this study, the balance between the bending potential energy of the beam and the gravitational potential energy of the tip mass results in the existence of numerous dynamic equilibriums. As a result, it is known that the system has a variety of equilibria depending on the mass value about the beam's flexural rigidity. As an extension of elastic theory, a static modelling of multiple equilibria was derived (Patil & Gandhi, 2014). Gandhi & Meena (2014) investigated the emergence of chaotic vibrations in flexible link networks through experimentation. They experimentally explored how chaotic vibrations occur with the very flexible link system (deformation 300 times larger than thickness). The flexible link with tip mass was excited harmonically at varying frequencies and amplitudes at a fixed base. Poincare maps are used to display the results. Chaotic behaviour is seen in the area surrounding the equilibria, which is characterised by several clusters, as shown by a butterfly diagram.

A novel mechanical method for simulating an inverted flexible pendulum system on a cart with a large tip

mass and several dynamic equilibria was presented by Gorade et al. (2015). Euler-Lagrange analysis is used to create the mathematical model. Donaire et al. (2016) implement a new approach for a mechanical system that eliminates the requirement to solve partial differential equations (PDEs) and allows for the energy-shaping control of an under-actuated mechanical system. The control law is composed of a proportional integral controller that comes after the first stage of partial feedback linearisation. The method has been used to stabilise an ultra-flexible pendulum on a cart that was in an unstable upward position. Gandhi et al. (2016) have examined the application of energy shaping control on an inverted flexible pendulum fixed to a cart. The authors of thi s work suggest a novel nonlinear energy-shaping controller for an incredibly flexible inverted pendulum mounted on a cart. The model used in the design was previously validated through experimental means. It was obtained using the restricted Lagrange formulation. The study's goal was to maintain the pendulum's upward orientation when the cart came to a stop at the intended spot. In recent years, there has been an increased interest in controlling chaos in dynamic systems. Experimental conditions and parameters are tested first to generate chaotic behaviours and second to establish initial vibration control (Kahar et al., 2018). It is also has been shown that impulsive control may reduce chaos in many complicated dynamical systems. Impulses in specific frequency-related energy are designed and injected into the system to control the system equilibrium states. In other publications of the authors (Kahar & Söffker, 2019), the first results for state machine modelling and initial control approaches are published. Here, the modelling and experimental characterisation of the system was within the focus. New findings are investigated and examined experimentally. These papers discussed how ‘jumping’ or equilibrium transitions behaved when the inverted flexible pendulum system underwent chaotic vibration while being excited harmonically. Different states of chaotic jumping are observed. Signal analysis techniques are employed to analyse the experimental data for the experiments. A suitable state-based model was developed based on the findings to describe and simulate the behaviour of jumping between three distinct equilibria. For the first time, impulses with frequency-specific energy content are used to describe the states and equilibrium transitions of the systems.

In a related context, the concept of "chaotification" in nonlinear vibration isolation systems was also explored by Chai et al. (2020). Their work emphasizes the role of initial conditions and system parameters in determining the quality of chaos, which can be harnessed to improve vibration control. By employing an open-plus-nonlinear- closed-loop method, they analyze the bifurcation characteristics of their system, providing insights into how chaos can be utilized rather than merely suppressed.

In this paper the chaos control approach and the results are revised to demonstrate the potential for closed - loop control, and the effectiveness of the novel approach more clearly. While in previous publications, only the first open-loop results are shown, in this contribution the approach is realised as a closed-loop approach, working online, continuously analysing the actual status of the chaotic system, and continuously feeding back impulses to the actual state of the system (if the conditions are fulfilled). The results demonstrate the idea and the potential of this novel approach for controlling chaotic behaviours using a state model established from frequency analysis, avoiding rigorous modelling of the system.

3. Methodology

3.1 Experimental setup

The experimental setup of an inverted flexible pendulum system is depicted in Figure 1. A thin, flexible beam with dimensions of 0.2 mm thickness, 20 mm width and 250 mm length make up the system. The beam exhibits an initial deformation under the influence of the tip mass’s weight as depicted in the picture, with a stable equilibrium position on one side (left equilibrium). On the opposite side, there is a comparable other equilibrium (right equilibrium). A motor powers the cart, enabling a controlled motion. Here, it is discovered that applying a sinusoidal signal to the cart stimulates the chaotic behaviour of the flexible beam. To measure the displacement of flexible beam during the chaotic vibration, a laser sensor is installed parallel to the flexible beam on the system frame. To measure the strain, a strain gauge is fixed to one side of the beam and coupled in a full bridge configuration. A PID (Proportional-Integral-Derivative)controller is used to precisely control the cart's position so that it follows the intended trajectory when a sinusoidal input is employed. Phase portrait which depicts the chaotic transitions between the system's equilibria, are produced by the beam’s deflection x and its derivative ẋ. The investigation on jumping (equilibrium transitions) and its energy content in frequency bands are analyses from the strain gauge data.

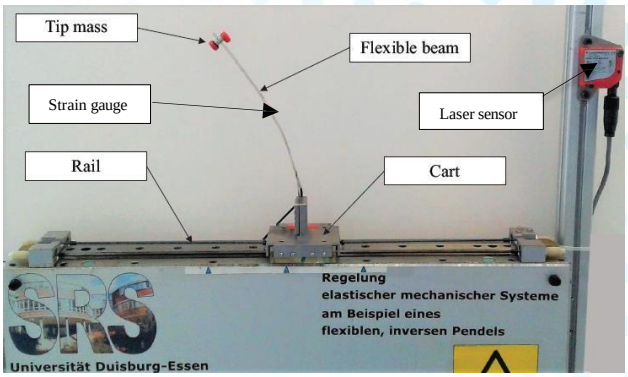


Figure 1: Inverted flexible pendulum system

In Figure 2, the system displacement displays chaotic behaviour and jumping between equilibria.

While in the phase portrait, the unstable equilibrium region in the centre (C) is distinguished from the stable equilibria region left (L) and right (R). The diagram depicts that the jumping behaviour between equilibria are contained inside region L (left equilibrium), C (centre equilibrium) and R (right equilibrium). It is possible to see the phenomena of 1-equilibrium (vibration only on one side of the stable equilibrium), 2 -equilibria (jumping between region L and R) and also to the region of the unstable equilibrium C.

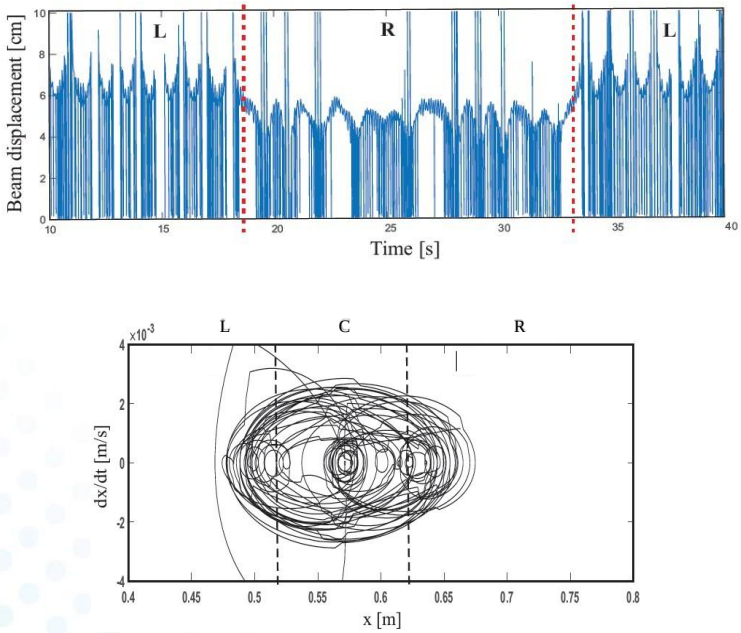


Figure 2: System displacement and phase portrait diagram indicating three equilibrium points

3.2 Experimental modelling (State machine model)

This section discusses a modelling process and additive impulse control of the chaotic behaviour. The analysis of frequency spectrum and energy content from the equilibrium transition are the subject of the experimental results.

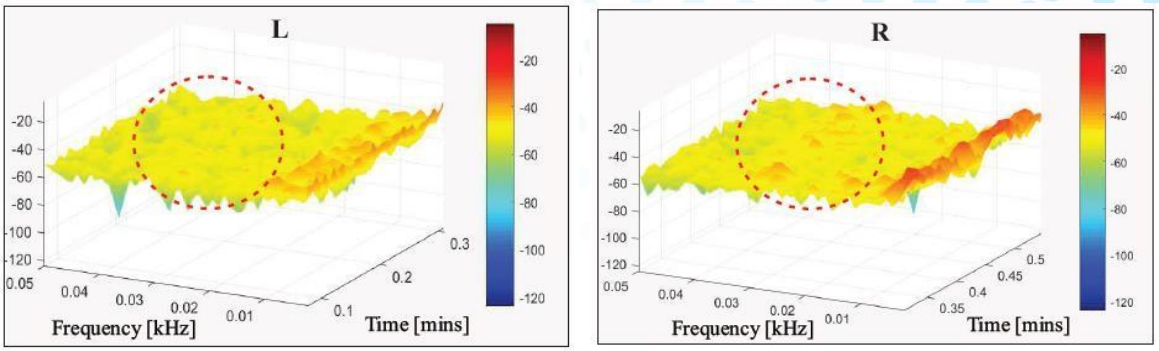


Figure 3: Distribution of energy between jumping states from left to right equilibrium ([2 7.5] Hz)

A Time-Frequency Energy analysis (TFE) during jumping event (equilibrium transition) between regions is carried out (Figure 3). The pattern of energy distribution in the specific frequency range between equilibria is examined. For example, Figure 3 shows the spectrogram of frequency-energy distribution for a jumping event between two equilibria (left to right). When the system jumps from left to right equilibrium at the low -frequency band (2 to 7.5 Hz), the energy content rises. This analysis was performed on different range of frequency band and equilibria. For phenomenological modelling, all behavioural changes are gathered based on relevant observations. To summarise the measured observation, state machine modelling is applied. State machine modelling is a qualitative approach describing the dynamical changes between different states (here: states represented by equilibrium L, R, and C) and transition conditions (energy content and frequency band).

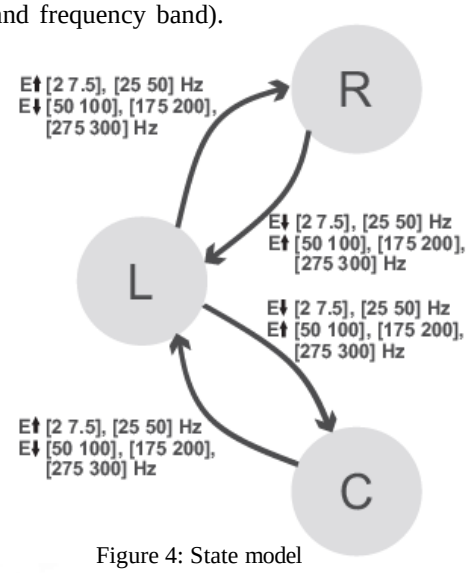


Figure 4: State model

Based on the behavioural changes of the flexible pendulum and the frequency-based energy analysis, the transition conditions for the jumping between equilibria are determined. A state machine model of the system (Figure 4) is established. In this case, the states represent the multiple equilibria the system exhibits. For instance, the state model demonstrates that for a state transition from left (L) to right (R) equilibrium, energy content (E) in the system increases in the lower frequency bands ([2 7.5] Hz and [25 50] Hz) and decreases in the higher frequency bands ([50 100] Hz, [175 200] Hz and [275 300] Hz). However, for state transition from right (R) to left (L) equilibrium, the energy changes oppositely described in frequency bands function. The time -frequency energy for transition from left (L) to centre (C) equilibrium is also depicted in Figure 4.

3.3 Impulse control system

Considering that the system's behavioural changes are mainly stimulated by the frequency-based energy changes in the state model (Figure 4), the hypothesis is that specific energy impulses externally added will also generate control effects for the chaotic behaviour within the equilibria, whether to cause jumping between

equilibrium or to remain in its equilibrium. This motivates the idea of the novel impulse control system.

A control method for chaotic behaviour in a nonlinear system using additive impulse is presented by the experimentally established state model in Figure 4. To generate the state transitions which based on the state model, impulses in specific frequency bands and energies are designed. Impulse signals with frequencies lower than a chosen cutoff frequency are thought to pass through a low-pass filter (LPF), whereas impulses with frequencies higher than the cutoff frequency are attenuated. This blocks the impulses that are injected into a specific frequency range. An impulse signal represents the first data input; the second control input is represented by the flexible pendulum's displacement as measured by a sensor, and the third input is the sinusoidal signal . Depending on the value of the second input, a switch block passes through either the first or the third input signal.

The inverted flexible pendulum system with a PID controller, pulse generator, low-pass filter and switch block for impulse injection is constructed using a Simulink model. At regular intervals, square wave impulses are produced by the pulse generator block. The energy-frequency composition of each impulse and the output waveform's shape are determined by the block parameters, which include amplitude, pulse width, period, and phase delay. In this sense, closed-loop control means that model-specific impulses are generated and applied additionally to the cart's reference motion control system, acting as an actuation mechanism.

4. Finding and Analysis

In contrast to other publications (Kahar et al.,2018; Kahar & Söffker, 2019), in this contribution the impulses are continuously injected when the related control conditions (state and reference state) based on the system modelling parameter (Figure 4) are fulfilled. Control actions are applied to induce or avoid equilibrium transition as actuation mechanism-shaped impulses are injected. Details about design and frequency filtering (frequencies, low pass and band pass filters) are given in Kahar et al., 2018.

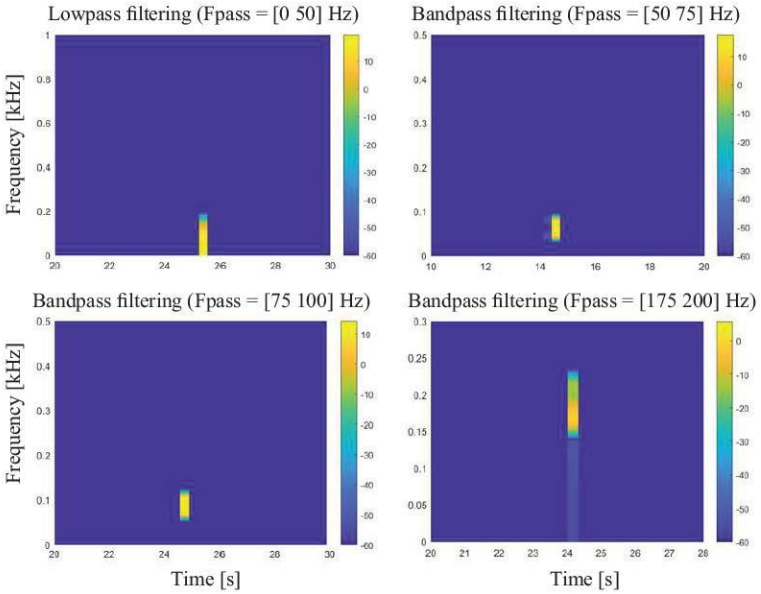
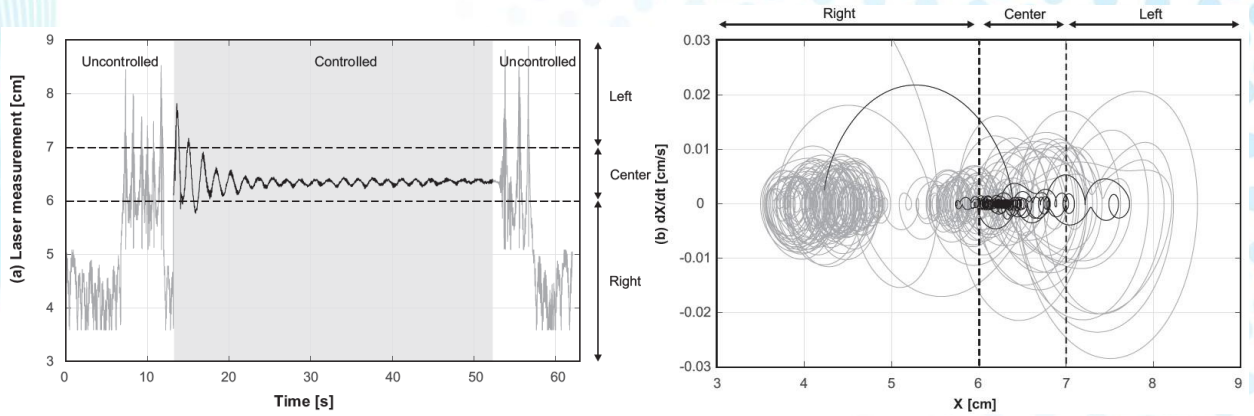


Figure 5: Spectrogram of an impulse signal filtered into a specific frequency

Spectrograms of specifically designed impulse signals are displayed in Figure 5. The energy contents in specific frequency bands of [0 50], [50 75], [75 100] and [175 200] Hz are injected into the system as additive impulses to perform control through actuation. The impulses influence the energy distribution between the "modes" or frequency bands that the system vibrates with, which ultimately results in the behavior of the chaotic vibration (jumping or remaining in the desired equilibrium).

The results in Figure 6 demonstrate that the chaotic behaviour of the system may be controlled by both the design and the frequency filtering of injected additive impulses, which caused equilibrium shifts. The left, right and centre equilibrium of the jumping behaviour are represented by L, R, and C in these diagrams, respectively.



(a) (b)

Figure 6(a) System's displacement during controlled and uncontrolled state (grey time interval represents controlled state). Figure 6(b) Phase portrait of the system's behavior during controlled and uncontrolled state (black represents controlled state).

Figure 6(a) and 6(b) depicts the time response and phase portrait of the system's chaotic behaviour under impulse control. In Figure 6(a), in uncontrolled state (white time interval), the system (flexible beam) shifts back and forth between right and centre equilibrium. However, in controlled state (grey time interval), the system shifts and stays at the targeted centre equilibrium from t = 13s to t = 52s. After t=52 the system shifts back to the uncontrolled state and behaviour. The same effect can be displayed by the phase portrait in Figure 6(b). It demonstrates how the system oscillates between right and centre equilibrium in uncontrolled state and stays in centre equilibrium in controlled state (black lines). The effects of control system by injecting a dditive impulses can be clearly stated as:

i. The control system guides the system's motion to the desired C-equilibrium in the moment of control.

ii. The control actions significantly reduce the chaotic vibration of the nonlinear system.

iii. Switching off the control system leads the system back to uncontrolled and chaotic vibration.

5. Conclusion

In this paper, a novel control method for chaotic behaviour in a nonlinear system is introduced. Based on the idea that the system to be controlled is described by the (measurable) frequency-specific energy contents related to the different states (equilibria) the system shows, the conditions for the state transition are defined in terms of frequency-specific energy changes. Based on this new modelling approach, a suitable control using a shaped impulse generator, which is required for transitions is generated. A nonlinear inverted flexible beam is used as an example, showing three equilibria: two stable and one unstable equilibrium.

In the contribution, the strategy for control and the experimental control results clearly show that the new method can be applied to predict the results. Here the control of chaotic systems concerning achieving the desired equilibrium transition can be obtained. The results also show that the chaotic behaviour of nonlinear systems can be modelled using a state-machine-based approach, allowing the design of control actuation realised by designed impulses in specific transition conditions (energy content and frequency band).

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Utilizing Full Factorial Design (FFD) for Vehicle Chassis Optimization

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Abstract

When designing a vehicle chassis, it's critical to confirm that the structure will be strong enough to connect the four corners of the vehicle while causing the least stress and displacement. The work aims to optimise go-kart chassis design to choose the optimal set of parameters that affect it. The impact of different design parameters on the stress and deformation of the chassis under static loading is investigated for this purpose. A statistical model that predicts and optimises the performance of the chassis design is built to make the study and in-depth analysis easier. It is assumed that the chassis would be strong enough to handle various loading scenarios if it demonstrated that it could withstand static loads. The thickness of the frame walls, the material, and the static load are the factors that affect the performance of the chassis design. The three design parameters are changed in a series of finite element analyses on the chassis to look into how they affect the stress and deflection of the structure. Using the two fundamental concepts of experimental design—randomisation and replication—a comprehensive 23-factorial experiment approach has been used to investigate the interactions between the factors. The results are shown graphically, and empirical data define the go-kart chassis design's performance attributes.

Keywords: full-factorial design, design-of-experiments, go-kart chassis, optimisation.

1. Introduction

A go-kart is a little car with four wheels. Various go-kart racing competitions are held among technical higher educational institutions for students to participate in. Currently, the design and development of go-karts only focus on the safety of the driver and fabrication cost rather than on other engineering aspects, such as stress concentration and frame deformation, which significantly affect the driver's safety and costs. This is due to the need to continuously participate in racing competitions as a technical higher educational institute.

The need to produce a go-kart with optimum design parameters to withstand static loading is crucial for the above reasons. The development method of each of the go-karts was simply by selecting a basic design structure from internet research and suiting the technical and dimensional properties according to competition specifications, also considering the aesthetic value. During the development of these go-karts, strength, safety, and performance analysis has been carried out on the track through physical testing activities. The design process should identify and consider significant design parameters in go-kart chassis. Therefore, the need for optimisation was felt for the design parameters of the go-kart chassis.

Therefore, vehicle chassis optimisation is critical in automotive engineering, where factors like structural integrity, weight reduction, and cost must be balanced. Full Factorial Design (FFD), a method under Design of Experiments (DOE), has gained significant attention due to its ability to analyse the interaction between multiple variables systematically. Using a go-cart chassis as a model, this paper focuses on FFD in vehicle chassis optimisation, illustrating how this approach enhances chassis performance, manufacturing efficiency, and other design aspects.

2. Literature Review

Studies about the design and analysis of a go-kart chassis frame and the analyzation processes such as the static analysis and modal analysis was conducted in Kotari & Gopinath (2012) and Reddy & Kumar (2013). These paper deals with the analysis of chassis frame for improving its payload with suitable reinforcement, adjusting the wall thickness, addition of stiffeners and adding c channel at maximum stress region of chassis frame. The Finite

Element Analysis (FEA) has been carried out with various alternatives.

Full Factorial Design (FFD) in vehicle chassis optimisation is an essential field of study that applies statistical techniques to increase safety, lower weight, and improve performance in automotive engineering. FFD makes the systematic examination of various components and their interactions possible, which is especially beneficial because it is crucial in the intricate design space of vehicle chassis. Vehicle chassis optimisation is frequently a multi-objective problem requiring designers to compromise several performance metrics, including cost, strength, and weight. Here FFD is a lightweight multi-objective optimisation design system that incorporates sophisticated modelling approaches, highlighting the significance of taking dependability and mass into account at the design stage (Minqing, 2024). This is consistent with FFD's guiding principles, which may adequately examine the trade- offs between conflicting design parameters and objectives.

Several studies have proven the use FFD in obtaining ideal parameter settings in engineering applications by comparing its efficacy with alternative design approaches (Rafidah et al., 2014). Similarly, material optimisation of composite using a two-level complete factorial design, emphasising the method's ability to examine interactions between several parameters was demonstrated in Tholibon et al., 2017. This method works well for designing chassis since material qualities have a big impact on total performance. Moreover, FFD's significance goes beyond conventional materials and structural optimisation. Although it does not particularly address the use of factorial designs to chassis dynamics and performance, the work by Majecki et al. (2015) focuses on predictive control in automotive systems.

The integration of Finite Element Analysis (FEA) with Full-Factorial Design (FFD) is critical in the context of automobile chassis, describing the process of designing a prototype car chassis using factorial design techniques to optimise design parameters and Finite Element Analysis (FEA) to verify the structural integrity (Odi-Owei et al., 2022). This combination enables a thorough assessment of the effects of various design decisions on the performance of the chassis under varied loading scenarios. The results, which show that full-factorial experiments can provide essential insights into parameter interactions and improve the design process, further validate the usefulness of the Full-Factorial Design approach in parametric optimisation and modelling in automotive applications (suspension systems) (Avesh & Srivastava, 2020). This is important because, in chassis optimisation, knowing how different design variables interact can help make better decisions and get better results.

To sum up, applying Full Factorial Design to vehicle chassis optimisation offers a thorough method for tackling the complex problems in automotive engineering. Researchers can make significant gains in chassis performance, safety, and efficiency by combining statistical procedures with sophisticated modelling tools.

3. Methodology

This paper uses all possible combinations of the experimental factor levels to measure responses in a full factorial experiment. The settings at which responses will be measured are represented by the combinations of factor levels. A ‘run’ is an experimental condition, and an ‘observation’ is the response measurement. The whole set of runs is called the ‘design’.

3.1 Selection of Factors

The design matrix and findings of 2^3 factorial designs were enhanced by one centre point with two responses (normal stress and chassis displacement) and three independent variables (factors). Those factors are the round tube wall thickness, chassis material properties and static loading. A lower bound is used to determine a plausible lower value for the mean response, while to predict a likely higher value for the mean response, an upper confidence bound is used, based on Reddy & Kumar (2013) and Kotari & Gopinath (2012). The upper and lower bound for each factor are given in Table 1.

Table 1: Lower and higher bound for independent variables (factors)

Factor	Wall thickness (mm)	Material, E (GPa)	Load (N)
Lower bound	2	180	450
Higher bound	4	220	600

3.2 2^3 Full Factorial Design Approach

The experiment design, known as a 2^3 complete factorial design because there are three factors to consider, asked for eight test runs, each with combinations of the three factors at two levels of each, as Table 2 illustrates. The results in Table 2 were analysed using statistical analysis, which was then used to assess each parameter's statistical significance at a 95% significance level and the combinations of parameters. The results from the Finite Element Analysis (FEA) for normal stress and displacement are displayed in Figure 1 and Figure 2.

Table 2: Design matrix of 2^3 factorial design and experimental results

Standard order	Run order	Factor			Response	
		A	B	C	Stress (Mpa)	Displacement (mm)
		Wall thickness (mm)	Material, E (GPa)	Load (N)		
1	1	2	180	450	121.74	3.089
5	2	2	180	600	158.489	3.951
7	3	2	220	600	157.055	3.565
4	4	4	220	450	112.790	2.397
8	5	4	220	600	146.199	3.045
3	6	2	220	450	120.560	2.781
2	7	4	180	450	113.283	2.746
6	8	4	180	600	146.750	3.483

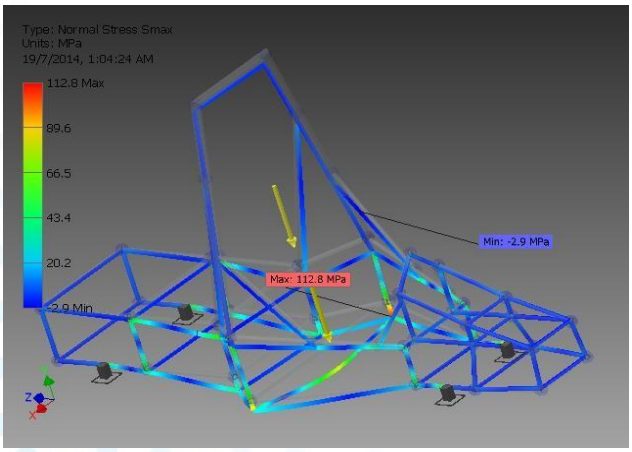

Figure 1: FEA normal stress results

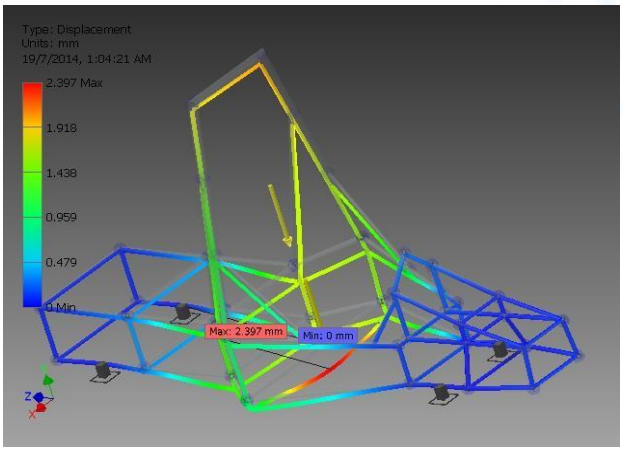

Figure 2: FEA displacement results

4. Findings and Analysis

This paper investigates the effects of factors on responses using a statistical tool for data analysis. Results are obtained and presented in variety of graphical method, including the Cube plot, Interaction plot, and Main Effects plot. To compare the significance of each effect, the standardised effects are plotted as a Pareto or Normal plot. ANOVA tables are created to identify the major factors influencing the response in the output.

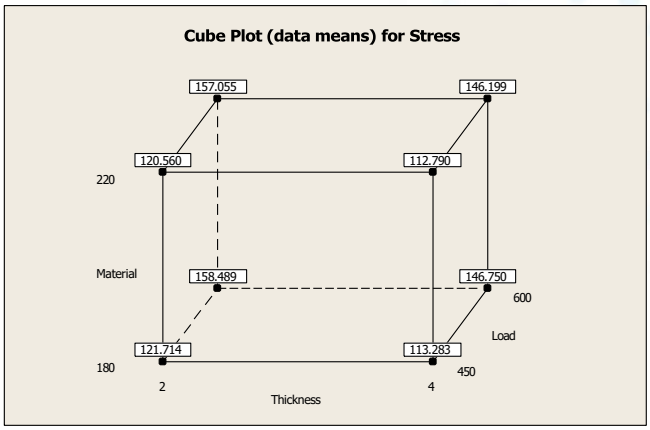

Figure 3(a): Cube Plot (data means) for stress

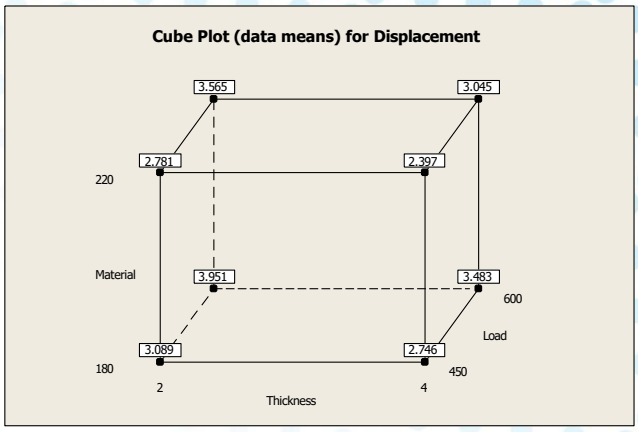

Figure 3(b): Cube Plot (data means) for displacement

4.1 Effect of Factors on Responses

Cube plots in Figure 3(a) and Figure 3(b) show the relationship between factors (material, wall thickness and static loading) and a response (stress and displacement). Data means are the average of the raw data for each combination of factor levels. For the stress data in Figure 3(a), the cube displays all combinations of factor settings for the three factors and the data mean for each combination.

The combination of Load450 and Thickness4 is associated with the lowest data mean of stress value (112.790) with the Material220 as the least significant factor. For the displacement data in Figure 3(b), the cube displays that the combination of Load450, Thickness4 and Material220 is associated with the lowest data mean of displacement value (2.379).

4.2 Significance of Factors

A Normal Probability Plot and Pareto Chart help assess the significance and size of an effect.

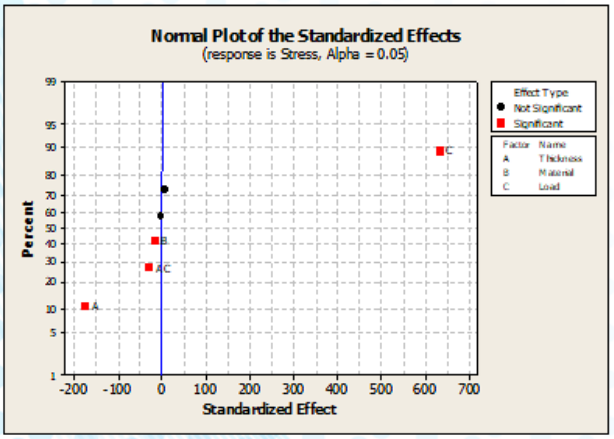

Figure 4(a): Normal probability plot for stress

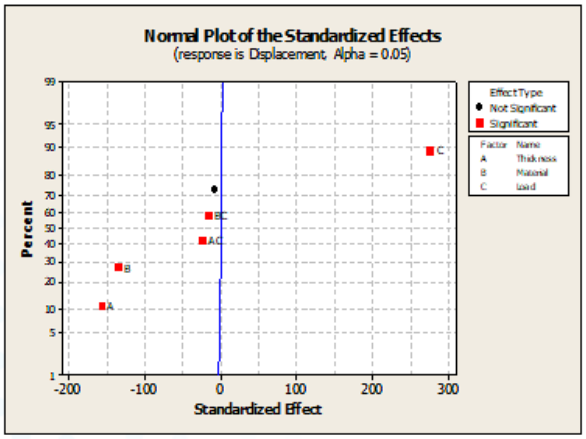

Figure 4(b): Normal probability plot for displacement

In Normal Probability Plot, points that do not lie close to the line in the effects' normal probability plot typically indicate significant effects. Compared to minor effects, important effects are bigger and farther from the fitted line. Less significant effects are often smaller and concentrated around zero. By default, the normal probability plot employs $\alpha = 0.05$.

Figure 4(a) shows that the primary factors influencing the development of stress on the chassis are static load (C), followed by wall thickness (A) and the interaction between wall thickness vs. load (AC), while material (B) is the least significant. Therefore, this plot demonstrates that factors C, A, and AC are the most significant in orderly manner. Meanwhile, Figure 4(b) shows that the primary factors influencing the displacement of the chassis are static load (C), followed by wall thickness (A) and material (B), as well as the interaction between wall

thickness vs. load (AC) and material vs. load (BC). Thus, factors C, A and B are the most significant in orderly manner.

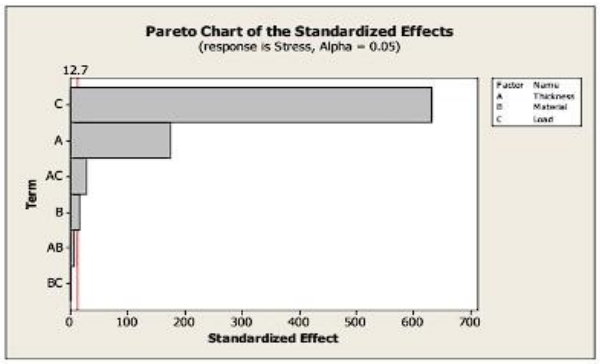

Figure 5(a): Pareto chart of the standardized effects for stress

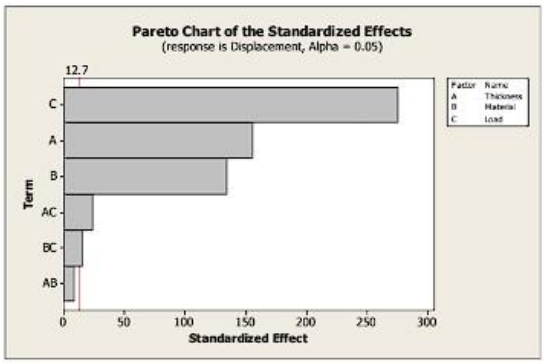

Figure 5(b): Pareto chart of the standardized effects for displacement

Pareto charts are shown in Figure 5(a) for chassis stress and Figure 5(b) for chassis displacement, are another tool used in this research to show the absolute values of the standardized effects from the largest effect to the smallest effect. Pareto charts also plots a reference line to indicate which effects are statistically sign ificant assess the major impact of parameters. The reference line for statistical significance depends on the significance level (denoted by α or alpha). On the Pareto charts, bars that cross the reference line are statistically significant.

In Figure 5(a), the bars that represent factors C, A, AC and B cross the reference line that is at 12.7. These factors are statistically significant at the 0.05 level with the current model terms. These chart shows that load, followed by wall thickness and then the interaction between wall thickness and load, as the significant factors in the development of stress on the chassis. Material is the least significant factor in this case. The interaction between wall thickness and material and also between material and load are insignificant.

While in Figure 5(b) shows the development of displacement of the chassis. The chart visualized that the load is the major factor, followed by wall thickness, material, the interaction between wall thickness and load, and the interaction between material and load. The interaction between wall thickness and material is insignificant.

4.3 ANOVA Result

The p-value is a probability that measures the evidence against the null hypothesis. Lower probabilities provide stronger evidence against the null hypothesis. The analysis of variance (ANOVA) in Table 3 summarises the primary effects and interactions. Here, P-values are used to assess the presence of significant effects.

P-value ≤ α shows that the factors are statistically significant. A, B, C, and AC are statistically significant factors for stress, while A, B, C, AC, and BC are significant factors for the displacement, with $P < 0.05$.

P-value > α: shows that the factors are not statistically significant. For example; P value for the interaction between AB and BC for stress, also AB for displacement is greater than the significance level 0.05.

Table 3: Analysis of variance (ANOVA) results for stress and displacement of chassis

Term	DF	Seq (SS)	F	P
Stress				
Main effect	3	2644.9	143110.83	0.002
Thickness, A	1	188.14	30539.92	0.04
Material, B	1	1.65	267.66	0.039
Load, C	1	2455.11	398524.9	0.001
2-way interaction	3	5.42	293.41	0.043
Thickness*Material,AB	1	0.3	48.37	0.091
Thickness*Load,AC	1	5.11	829.54	0.022
Material*Load,BC	1	0.01	2.32	0.37
Residual error	1	0.01		
Displacement				
Main effect	3	1.79019	39453.3	0.004
Thickness, A	1	0.36765	24307.64	0.004
Material, B	1	0.27417	18126.95	0.005
Load, C	1	1.14837	75925.3	0.002
2-way interaction	3	0.01308	288.32	0.043
Thickness*Material,AB	1	0.00108	71.48	0.075
Thickness*Load,AC	1	0.00852	562	0.027
Material*Load,BC	1	0.00349	98	0.042
Residual error	1	0.00002	230.49	

DF = degree of freedom; Seq SS = sequential sum of squares; F = F values from Fisher's statistical test; P = Probability

4.4 Response Optimisation Plot

Response optimization helps identify the combination of variable settings that jointly optimize a single response or a set of responses. According to Figure 6, the individual desire for displacement is 0.60438, while the individual desirability of stress is 0.90607. For these two variables together, the composite desirability is 0.74001.

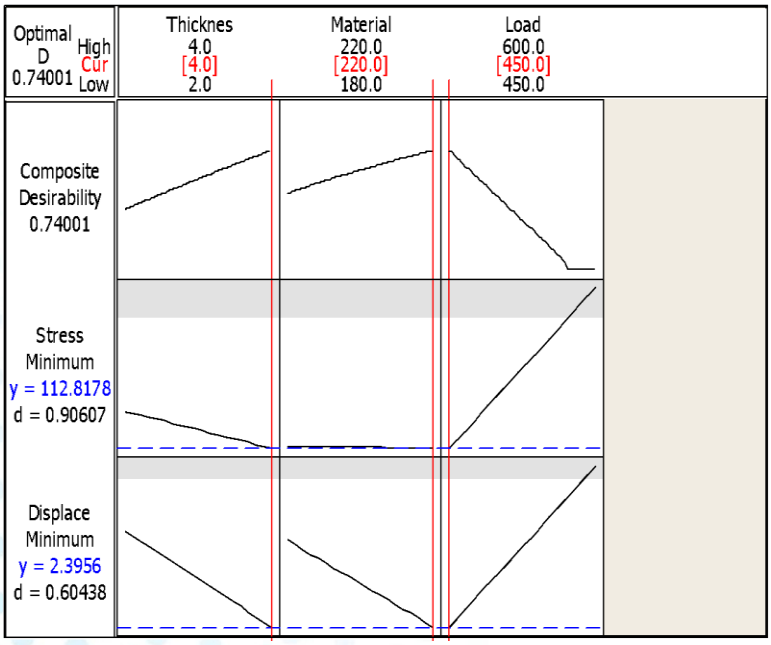

Figure 6: Response optimization plot

To achieve this goal, we should set the factor levels to the values indicated under Global Solution in the session window. In other words, wall thickness would be 4, material would be 220, and the load would be 450. The effect of each factor (columns: thickness, materials, load) on the responses or composite desirability (rows: stress, displacement) is displayed in the optimisation plot.

The graph's vertical red lines indicate the factor settings as of right now. The numbers (in red) at the top of each column indicate the current factor level settings. The results for the current factor level are shown as numbers and horizontal blue lines. Statistical analysis determines that stress and displacement are reduced and acceptable when all parameters are optimal (thickness = 4, material = 220, and load = 450).

5. Conclusion

An analysis of go-kart chassis design optimisation in this research involves modelling, the Finite Element package (FEA) and statistical optimisation software (FFD). The design of experiment was applied to create a design suitable for this analysis, namely a factorial design, that was later run in statistical software. Three input variables have been selected (round tube's wall thickness, chassis material property (Young Modulus) and static loading, to monitor and optimise responses (stress and displacement of the chassis). Design of a go-kart chassis can be improved by optimising design parameters such as geometrical dimension, square tube wall thickness, and chassis material and by setting a maximum static loading subjected to the chassis frame. Static loa ding subjected to the go-kart and geometrical dimension of the chassis is the most influential factor in determining the strength of the chassis during static loading. Thus, it can be concluded that by observing the above results and analysis, the stresses and stiffness of chassis frame structure greatly depends on the parameters selection of that particular frame. The stresses obtained in the analysis is crucial to be determined in order to manufacture a chassis space frame with the stresses are very much lower as compared to that of the yield point of the material.

Acknowledgement

The authors would like to express our gratitude to the academic management of Politeknik Banting Selangor for their support and assistance in completing this research—special thanks to Dr. Rizauddin Ramli of Universiti Kebangsaan Malaysia for his valuable feedback and guidance. We also appreciate the resources and facilities provided by Politeknik Sultan Salahuddin Abdul Aziz Shah, which made this work possible. Finally, we thank

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POLITEKNIK KOTA KINABALU

Accelerating Electric Vehicle Adoption: Key Factors and Barriers in Kota Kinabalu's Transition to Sustainable Transportation

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Abstract

The global transition to electric vehicles (EVs) is a crucial step in mitigating the environmental impact of traditional internal combustion engine vehicles, particularly in urban areas. This study investigates the primary factors influencing EV adoption and the significant barriers impeding its uptake in Kota Kinabalu, Malaysia. A survey of 384 residents aged between 20 and 69 years was conducted to analyze the key drivers and challenges associated with EV adoption in this urban region. The results show that government incentives such as tax rebates and subsidies, accessibility to charging infrastructure, and increased environmental awareness are the most influential factors that encourage adoption. However, several barriers were identified, with the high initial cost of EVs, insufficient charging infrastructure, and concerns over a limited driving range ("range anxiety") being the most critical. The study employed the Relative Importance Index (RII) to quantify these challenges, with high purchase costs (RII = 0.87) and lack of charging infrastructure (RII = 0.84) emerging as the top obstacles. Additionally, range anxiety (RII = 0.81) was identified as a significant concern that further inhibited adoption. These findings indicate that infrastructure and financial hurdles remain substantial barriers to widespread EV use in Kota Kinabalu. This study provides critical insights for policymakers, urban planners, and industry stakeholders. This emphasizes the need for comprehensive strategies that include enhanced financial incentives, significant expansion of charging networks, and targeted public education to increase awareness of EV benefits. Addressing both the enablers and the challenges is vital to accelerating EV adoption in rapidly urbanizing regions like Kota Kinabalu, which are striving to reduce carbon emissions and advance sustainable mobility solutions

Keywords: Electric vehicle, sustainable transportation, environmental concerns, government incentives, charging infrastructure

1. Introduction

The transition from internal combustion engines (ICEs) to electric vehicles (EVs) is an imperative global trend aimed at reducing greenhouse-gas emissions and mitigating transportation-related pollution. This shift is driven by the need to address climate change, as ICE vehicles are significant contributors to carbon dioxide emissions due to the combustion of fossil fuels. The purpose of this study is to forecast the future adoption of electric vehicles in Kota Kinabalu, Sabah, an emerging urban center in Malaysia. This study is crucial for several reasons.

First, it provides valuable insights into how demographic factors, such as age, gender, education level, and income, influence EV adoption in the region. Understanding these factors will help policymakers and urban planners design targeted strategies to encourage EV uptake. Research on electric vehicle (EV) adoption has identified several important factors. Government incentives, the availability of charging stations, and environmental concerns are seen as key drivers encouraging people to adopt EVs (Wu et al., 2023). However, there are differing opinions on the economic practicality and social acceptance of EVs, especially in areas with less developed infrastructure and low public awareness (Yang, 2023).

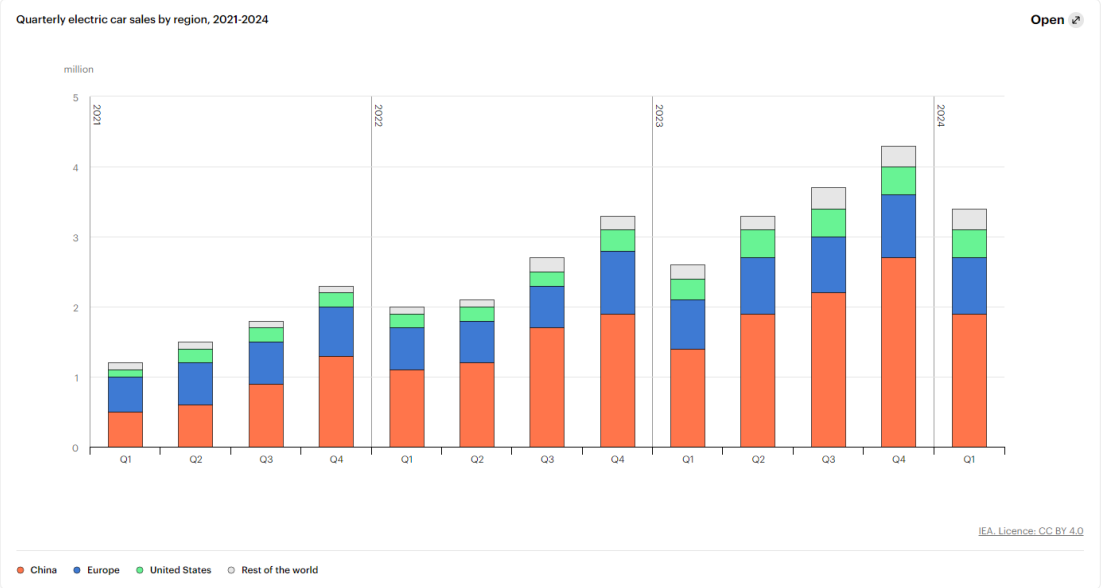

Figure 1: This is current global EV sales from 2021 to 2024

The chart illustrates quarterly electric vehicle (EV) sales by region from 2021 to the first quarter of 2024, showing a clear upward trend driven by increasing consumer demand and manufacturing initiatives (Dwyer et al., 2021). China consistently leads EV sales, followed by Europe and the United States, with all regions experiencing steady growth, particularly in 2023. The rest of the world also shows gradual progress, reaching a peak of 0.3 million sales in Q4 2023, the highest compared to previous years. Overall, the chart highlights the rapid global expansion of the EV market, aligning with efforts to promote electric mobility and reduce carbon emissions (Energy Agency, 2024).

On the other hand, in Malaysia, the number of EV users remains relatively low compared with other countries. During the annual review virtual press conference, Malaysia Automotive Association (MAA) president, Datuk Aishah Ahmad, revealed that the number of new EVs sold in 2021 was 274 units, showing a positive increase to 2,631 units in 2022 (Mick Chan, 2023). The Malaysian government aims to have 125,000 EVs on the road by 2030, supported by initiatives such as the Battery Electric Vehicle Global Leaders Incentive (BEV GLI) and the installation of 10,000 charging stations by 2025 under the Low Carbon Mobility Blueprint (*Malaysia Electric Vehicles*, 2023).

Despite these efforts, the adoption of EVs in Malaysia continues to face significant challenges. A survey that had been conducted had reveals that while consumers have positive environmental attitudes, high pricing and maintenance costs of electric vehicles (EVs) act as significant barriers, discouraging their widespread adoption in Malaysia (Chenayah et al., 2024). The PlugShare application, a public platform to track the number of charging stations, indicates that Pahang, Terengganu, and Kelantan have 36, six, and five charging stations, respectively. While the coverage of charging stations between Kuala Lumpur and Penang has improved, the East Coast of Peninsular Malaysia remains an 'EV desert' due to the sparse and distant placement of charging stations.

The significance of this study lies in its potential to guide strategic planning for the development of the EV charging infrastructure in Kota Kinabalu, ensuring that it aligns with the expected growth in EV adoption. Additionally, it can identify specific factors that motivate residents to opt for EVs over ICE vehicles as well as the challenges they face in making this transition. This research is not only pivotal for the local context but also contributes to broader goals such as the National Energy Policy (NEP) 2040 and the Long-Term Low Emission Development Strategy (LT-LEDS) 2050 by forecasting Sabah's readiness for these initiatives (Songkin & Hj Jaafar, 2023).

2. Literature Review

2.1 Key Factors

2.1.1 Government incentives

Government incentives play a crucial role in the adoption of electric vehicles (EVs). Policies like tax breaks, subsidies, and reduced fees encourage consumers to shift from internal combustion engine (ICE) vehicles to EVs. For instance, in Norway, policies favor EVs over ICE vehicles, contributing to significant EV adoption (Mersky et al., 2016). Similarly, China's subsidies were one of the earliest and most effective measures to promote EV uptake (Li et al., 2019). Road tax exemptions, subsidy to charging facilities, and tax incentives for manufacturers are some of the initiatives by the government to promote EV adoption in Malaysia (Muhammad Yusry, 2024). Research from Brazil underscores the importance of incentive policies tailored to different consumer profiles ("The Economic Attractiveness of Electric Vehicles in Brazil: The Importance of Incentive Policies," 2021). In conclusion, government incentives, coupled with technological advancements and external factors like fuel prices, are vital to EV adoption strategies (Helveston et al., 2015).

2.1.2 Charging stations

The availability and compatibility of charging stations are key factors influencing EV adoption. Studies show that an extensive and reliable charging infrastructure reduces range anxiety, which is a significant barrier to EV ownership (Khazaei & Tareq, 2021). Narassimhan & Johnson, 2018, highlight that in the U.S., charging infrastructure and demand-side incentives drive EV adoption. The importance of infrastructure is further supported in countries like China and Malaysia, where insufficient charging networks hinder EV market growth (Candra, 2022). A robust charging network thus facilitates EV adoption and addresses consumer concerns.

2.1.3 Model availability

The availability of various EV models significantly impacts consumer adoption by providing options that cater to different needs and preferences. Studies show that a diverse range of models helps address concerns over pricing and perceived risks, which are barriers to adoption (Liao et al., 2017). Research in France has identified model availability as one of 21 factors affecting adoption rates, showing that a broader selection of EV models enhances market appeal (Haidar & Aguilar Rojas, 2022). As the variety of EV models increases, adoption is expected to rise, contributing to the overall growth of the EV market.

2.1.4 Infrastructure

Dedicated lanes and charging lanes are infrastructure developments designed to incentivize EV usage. In Norway, EV users benefit from dedicated lanes, reducing travel time and encouraging adoption (Steve Hanley, 2022). Similarly, the introduction of charging lanes in Sweden and future projects in the U.S. provide continuous charging, eliminating the need for frequent stops (Steve Scauzillo, 2018). These infrastructural advancements are aimed at making EVs more practical and appealing to potential users.

2.1.5 Environmental concerns

Environmental concerns are significant motivators for EV adoption. Consumers increasingly prioritize vehicles that reduce carbon emissions and other environmental issues (Ali & Naushad, 2022). Studies in China and Macau affirm that individuals concerned about environmental issues are more likely to adopt EVs (Zhang et al., 2022). Based on research conducted by Sang and Ali, the findings show that the intention to use electric vehicles in Malaysia is strongly influenced by factors such as environmental concern, consumer knowledge, psychological benefits, and demographics. (Sang & Ali Bekhet, 2015). As environmental consciousness grows globally, this factor will continue to drive EV adoption.

2.1.6 Social reinforcement

Social reinforcement, including social pressure and social approval, also plays an essential role in EV adoption. Research indicates that social norms and social learning can significantly influence consumer decisions regarding EVs (Jayasingh et al., 2021). The impact of social reinforcement is especially prominent in communities where EVs are seen as a status symbol, further contributing to their acceptance and popularity.

2.2 Challenges

2.2.1 High cost of EVs

One of the significant barriers to EV adoption is the high initial cost compared to traditional Internal Combustion Engine (ICE) vehicles. This is largely due to expensive battery technology, which impacts both driving range and mass production capabilities (Wang et al., 2019). In countries like Malaysia, the high purchase price, alongside insufficient infrastructure and government support, hampers adoption. However, (Propfe et al., 2012)suggest that for high-mileage users, hybrid vehicles may offer long-term savings due to lower operational costs. Additionally, emerging technologies like electric roads could present cost-effective solutions (Coban et al., 2022). Despite high prices, EVs still offer potential benefits in terms of efficiency and sustainability.

2.2.2 Limited driving range

Another concern is the limited driving range of EVs, which can deter potential buyers. EV range is influenced by battery capacity, driving behaviour, weather, and vehicle weight. (Needell et al., 2016) identified "range anxiety" as a key reason for slow EV adoption. Limited range, long charging times, and insufficient infrastructure are cited as major barriers, particularly in countries like Indonesia (Setiawan et al., 2022). However, research suggests that improvements in driving range would significantly increase consumer interest in EVs (Zou et al., 2020).

2.2.3 Lack of EV infrastructure

A lack of adequate charging infrastructure remains a critical issue for EV adoption. Public charging stations are essential in addressing range anxiety and encouraging EV ownership (Sehar et al., 2017).Studies across different markets have identified inadequate infrastructure as a primary obstacle (Singh et al., 2022). The role of slow and fast charging options is critical, with both complementing each other to alleviate concerns about charging availability (Zou et al., 2020). Furthermore, strategic placement of charging stations and state support are crucial to consumer buy- in.

2.2.4 Insufficient Government Incentives

The lack of robust government incentives, such as subsidies or tax credits, makes EVs less competitive against ICE vehicles. Effective policy measures have been shown to boost EV adoption, as seen in China and the U.S., where financial incentives have been pivotal(Zheng et al., 2018). However, insufficient incentives, such as in Malaysia and Indonesia, create barriers to market penetration (Setiawan et al., 2022). Comprehensive incentive packages have been proposed to overcome these obstacles and stimulate greater adoption.

2.2.5 Lack of government intervention

Beyond financial incentives, effective government intervention is critical for promoting EV adoption. In countries like India, more robust policy measures, including increased renewable energy use, are necessary to support EV growth (Vidhi & Shrivastava, 2018). Despite some government support, barriers like lack of consumer awareness and ineffective policy implementation hinder adoption (Yang & Tan, 2019). A comprehensive evaluation model for policy effectiveness could help address these barriers and facilitate wider EV adoption.

3. Methodology

The materials and methods section are designed to provide sufficient details to allow replication and build upon the published results. Below is a detailed description of the materials and methods used in the study. The study was conducted in Kota Kinabalu, Sabah, Malaysia. This location was chosen due to its dynamic urban environment, which presents unique demographic, economic, and infrastructural characteristics that can significantly influence the adoption of electric vehicles (EVs). A comprehensive literature review was performed, systematically analyzing journals from relevant sources such as Google Scholar, Scopus, IEEE Explorer, and Science Direct. The search focused on keywords related to electric vehicles and predictive modeling. The literature review informed the development of survey questions designed to identify influential factors affecting EV adoption in Kota Kinabalu. The research employed a combination of quantitative and qualitative research methods, distributed to 384 residents of Kota Kinabalu via WhatsApp and Telegram. The physical data collection conducted at three locations (Centre Point Sabah, Karamunsing Shopping Complex, and Suria Sabah) to gather real-time information on the availability and usage of charging infrastructure, as well as public interaction with EVs.

The questionnaire consisted of three sections: demographic information, factors influencing EV adoption, and challenges in EV ownership. The data is been analyzed using statistical method, Relative Important Index (RII). RII ranked the significance of different factors and challenges in EV adoption. The higher number of RII indicates the highest voted variables by the respondents. The data is been analyzed using statistical method, Relative Important Index (RII). RII ranked the significance of different factors and challenges in EV adoption. The higher number of RII indicates the highest voted variables by the respondents. This process aids in pinpointing the factors that are both significant and strongly favoured by the respondents. RII value can be calculated based on Equation (1).

RII Formula (Rajgor et al., 2016):

$$RII = \frac{\Sigma W}{A*N} \qquad (1)$$

Where;

W = weighting for each criterion
A = highest weighting
N = total number of respondents

Sections of the Questionnaire

1. **Section A: Demographic Information** - Collected data on age, income, academic level, and gender of the respondents.
2. **Section B: Factors Influencing EV Adoption** - Assessed various factors that could influence the adoption of EVs.
3. **Section C: Challenges in EV Ownership** - Identified potential challenges faced by EV owners.

4. Finding and Analysis

4.1 Key Factors

Table 1: Mean Value of Key Factors in Influencing EV Adoption from SPSS

	N	Mean	Std. Deviation	Variance
There are a lot of charging stations around Kota Kinabalu.	376	2.09	1.123	1.262
I am aware of the location of the charging stations.	376	2.16	1.233	1.519
I am using the government incentives provided to buy EV.	376	2.55	1.348	1.816
I feel like I am a rich person when using EV.	376	3.05	1.245	1.550
I am aware there are different models of EV.	376	3.19	1.371	1.880

I am aware of the existence of the government incentives for EV owners.	376	3.36	1.248	1.559
Driving an EV can improve my image in society.	376	3.49	1.200	1.440
I feel proud using EV.	376	3.53	1.230	1.514
I think the government incentives has positive influence in EV adoption.	376	3.59	1.179	1.389
I will prefer to use EV if there is dedicated lane for EV users.	376	3.64	1.208	1.459
I will prefer use EV if there are charging lane provided for EV users.	376	3.94	.963	.928
I will use EV since EV can reduce carbon dioxide content which can reduce global warming.	376	3.98	1.095	1.200
I know that the usage of EV can reduce air pollution.	376	4.22	1.145	1.311
Valid N (listwise)	376			

Table 1 presents the mean values for factors influencing Electric Vehicle (EV) adoption in Kota Kinabalu, with scores ranging from 2.09 to 4.22. These scores, based on a Likert scale, reflect varying levels of agreement or awareness among respondents. A higher mean score indicates stronger agreement or higher awareness. The lowest mean score (2.09) for the statement "There are a lot of charging stations around Kota Kinabalu" suggests that the limited availability of charging infrastructure is a key barrier to EV adoption. This finding supports previous research by (Songkin & Hj Jaafar, 2023),which highlights the scarcity of charging stations in Sabah as a major obstacle to widespread EV usage. Conversely, the highest mean score (4.22) for environmental factors, such as the potential for EVs to reduce air pollution and carbon dioxide emissions, indicates that environmental benefits are strong motivators for EV adoption. This is consistent with studies suggesting that reducing pollution and combatting global warming are significant drivers of EV interest (Ling et al., 2021); Kim & Heo, 2019).

Table 2: Ranking of Key Factors using RII

Key Factors	**Level of Agreement using the Mean Likert Scale**					**Mean**	**RII**
	1	2	3	4	5		
There are a lot of charging stations around Kota Kinabalu.	143	121	65	31	16	2.09	0.42
I am aware of the location of the charging stations.	156	91	61	50	18	2.16	0.43
I am using the government incentives provided to buy EV.	122	65	83	73	33	2.55	0.51
I feel like I am a rich person when using EV.	57	48	154	54	63	3.05	0.61
I am aware there are different models of EV.	56	66	96	68	90	3.19	0.64
I am aware of the existence of the government incentives for EV owners.	42	38	124	87	85	3.36	0.67
Driving an EV can improve my image in society.	33	20	157	62	104	3.49	0.70
I feel proud using EV.	37	23	122	91	103	3.53	0.71
I think the government incentives has positive influence in EV adoption.	21	50	93	110	102	3.59	0.72
I will prefer to use EV if there is dedicated lane for EV users.	28	30	109	93	116	3.64	0.73

I will prefer use EV if there are charging lane provided for EV users.	6	19	92	132	127	3.94	0.79
I will use EV since EV can reduce carbon dioxide content which can reduce global warming.	16	25	58	129	148	3.98	0.80
I know that the usage of EV can reduce air pollution.	24	11	37	92	212	4.22	0.84

Table 2 evaluates thirteen factors related to EV adoption using the Relative Importance Index (RII), ranking them according to respondents' perceived importance. The highest RII (0.84) for "EVs reduce air pollution" and (0.80) for "EVs reduce carbon dioxide content" highlights the strong environmental awareness among respondents. Government incentives are also influential, with RII values of 0.72 and 0.67 for positive influence and awareness of these incentives, respectively. However, lower RII scores for the availability (0.42) and location (0.43) of charging stations underscore the need for better infrastructure. Social factors, such as the impact on personal image (RII = 0.70) and pride (RII = 0.71), also play a role in the decision to adopt EVs. Furthermore, practical factors, like the preference for using EVs with dedicated lanes (RII = 0.73) and charging lanes (RII = 0.79), emphasize the importance of targeted infrastructure investments.

In conclusion, a multi-faceted approach is recommended to promote EV adoption in Kota Kinabalu. Public awareness campaigns focused on the environmental benefits of EVs, along with highlighting available government incentives, are key. Additionally, expanding charging infrastructure and dedicated lanes for EVs will address critical adoption barriers. Marketing strategies that emphasize the social status and pride associated with EV use can also enhance its appeal.

4.2 Challenges

Table 3: Mean Value of Challenges in EV Adoption from SPSS

	N	**Mean**	**Std. Deviation**	**Variance**
High cost in charging the EV.	376	3.55	.943	.888
High Maintenance Cost.	376	3.63	1.250	1.562
Lack of Government Incentives.	376	3.64	1.160	1.345
Government lack in promoting the usage of EV.	376	3.79	1.081	1.168
EV has limited driving range.	376	3.89	1.067	1.139
Lack of Dedicated Lane for EV users.	376	3.96	1.135	1.289
Lack of Charging Station.	376	4.09	1.119	1.253
High Initial Cost.	376	4.11	.989	.977
Valid N (listwise)	376			

Table 3 presents the mean values for various challenges affecting Electric Vehicle (EV) adoption in Kota Kinabalu, based on responses from 376 participants. The highest mean score (4.11) is for "High Initial Cost," indicating that the high purchase price of EVs is perceived as the most significant barrier. The low standard deviation suggests a strong consensus among respondents, highlighting the widespread agreement that the initial cost is a major challenge. Another critical issue is the lack of charging stations, with a mean score of 4.09, showing similar consensus on the insufficient charging infrastructure in Kota Kinabalu. These findings align with research by (Songkin & Hj Jaafar, 2023), which also identifies high costs and inadequate charging infrastructure as key obstacles to EV adoption in Sabah.

Table 4: Ranking of Challenges on Adoption of EV using RII

Challenges	**Level of Agreement using the Mean Likert Scale**					**Mean**	**RII**
	1	2	3	4	5		
High cost in charging the EV.	2	35	173	87	79	3.55	0.71
High Maintenance Cost.	34	28	100	95	119	3.63	0.73
Lack of Government Incentives.	26	25	112	107	106	3.64	0.73

Government lack in promoting the usage of EV.	12	22	128	84	130	3.79	0.76
EV has limited driving range.	10	19	120	81	146	3.89	0.78
Lack of Dedicated Lane for EV users.	18	16	93	84	165	3.96	0.79
Lack of Charging Station.	20	15	54	108	179	4.09	0.82
High Initial Cost.	10	7	84	106	169	4.11	0.82

Table 4 further emphasizes the most significant barriers to EV adoption, with the high initial cost and lack of charging stations both having the highest Relative Importance Index (RII) of 0.82. Additional challenges include the absence of dedicated EV lanes, limited driving range, and high maintenance costs. These findings point to the need for financial incentives, expanded infrastructure, and technological improvements to make EVs more accessible and practical for consumers. Addressing these barriers requires a multi-faceted approach. Financial incentives and subsidies can help reduce the initial purchase cost, while investments in charging infrastructure and the creation of dedicated EV lanes can enhance the convenience and appeal of EVs. Furthermore, government promotion and support are crucial in raising awareness and encouraging adoption, while ongoing advancements in battery technology can mitigate concerns about driving range and maintenance costs. By tackling these challenges, policymakers and stakeholders can create a more conducive environment for the widespread adoption of electric vehicles in Kota Kinabalu.

5. Conclusion

In conclusion, this research highlights the critical factors and challenges influencing the adoption of electric vehicles (EVs) in Kota Kinabalu. Key drivers, such as government incentives, environmental benefits, and public awareness, have been identified as significant enablers of EV adoption. However, the study also reveals considerable barriers, including high initial costs, limited charging infrastructure, and concerns over driving range. The use of the Relative Importance Index (RII) has quantitatively ranked these factors, with high purchase cost and insufficient charging infrastructure emerging as the most prominent obstacles. To accelerate EV adoption in Kota Kinabalu, a multi-faceted approach is necessary, including increased financial incentives, expansion of charging networks, and targeted public education. By addressing both the enablers and barriers, policymakers and stakeholders can create a supportive environment for sustainable transportation solutions.

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Liquefaction Mitigation using Bored Pile Foundation

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Abstract

Liquefaction is where the ground temporarily loses strength during an earthquake, poses a serious risk to buildings and structures. This paper explores the use of bored pile foundations to reduce this risk. Bored piles are deep, strong columns that are drilled into the ground to support structures. Our study combines computer simulations and field tests to see how well these piles work in preventing liquefaction. The soil at the study site has liquefaction potential when it subjected to earthquake magnitude more than 5 Mw. Study results suggest that bored pile foundations bearing capacity is reduced by 93% and 79% when the soil is liquefied

Keywords: liquefaction, bearing capacity, pile foundation

1. Introduction

Liquefaction is a geotechnical phenomenon that occurs when saturated, loose, and cohesionless soils lose their strength and stiffness due to the buildup of pore water pressure during seismic shaking (SEED HB & IDRISS IM, 1971). This loss of soil strength can lead to severe ground deformations, such as settlement, lateral spreading, and even total ground failure, which can have devastating consequences for infrastructure and buildings. Liquefaction typically occurs in areas with loose, granular soils, especially in regions that experience frequent seismic activity. Several major earthquakes, such as the 1964 Niigata Earthquake in Japan (Ishihara & Koga, 1981) and the 1989 Loma Prieta Earthquake in the U.S (Bardet & Kapuskar, 1993)., have highlighted the destructive potential of liquefaction, but few events have been as catastrophic as the 2018 liquefaction disaster in Palu, Indonesia (Mason et al., 2019).

The 2018 Sulawesi earthquake and tsunami, which struck Central Sulawesi, Indonesia, on September 28, triggered widespread liquefaction in the city of Palu and its surrounding areas (Tampubolon et al., 2022). With a magnitude of 7.5, this earthquake caused not only a destructive tsunami but also massive liquefaction in several districts of Palu, leading to the displacement of entire neighborhoods. In particular, the areas of Balaroa, Petobo, and Jono Oge were severely affected, where thousands of homes were buried or swept away as the ground turned into a fluid-like state, flowing downhill like a mudslide (Mason et al., 2019). This event resulted in the loss of thousands of lives and the destruction of significant infrastructure, leaving many regions uninhabitable.

In response to these risks, engineers have explored various methods for reducing the impact of liquefaction, particularly through foundation design. Among these, the use of bored pile foundations has emerged as a potential solution for mitigating the effects of liquefaction on structures. Bored piles, also referred to as drilled shafts, are deep foundation elements installed by drilling into the ground and filling the hole with concrete and reinforcement . These piles are known for their ability to transfer loads to deeper, more stable soil layers or bedrock, making them a robust option in regions prone to liquefaction. Unlike shallow foundations, which are highly vulnerable to the loss of soil strength (Das, 2017), bored piles are capable of bypassing liquefiable soil layers and provide a stable foundation even during seismic events.

This paper aims to explore the effectiveness of bored pile foundations as a mitigation strategy against liquefaction in seismic regions. Through a combination of site investigation, numerical modeling, and case study analysis, this study will examine how bored piles interact with liquefied soil and reduce ground deformations during seismic activity. By analyzing key design parameters, such as pile dimensions, reinforcement detailing, and layout configuration, this research seeks to provide a deeper understa nding of how bored piles can improve the resilience of structures in liquefaction-prone areas. In addition, this paper will review relevant case studies where bored piles have been successfully implemented to mitigate liquefaction effects, providing practical insights and design guidelines for engineers and geotechnical practitioners.

2. Methodology

The method used in this research is a qualitative descriptive method, where the research involves data collection and analysis. The data used includes field testing of the Standard Penetration Test (SPT) and Cone Penetration Test (CPT), soil sampling, earthquake data collection, and pile foundation modeling. The primary data in this research is soil data obtained through field testing, while the secondary data consists of historical earthquake data from the Bali Province.

The safety calculation of soil layers against liquefaction can be performed using the field data collected . The field data used in this research includes SPT and CPT data (Youd et al., 2001). The result of the liquefaction potential analysis is presented as a Safety Factor (SF) by comparing the Cyclic Resistance Ratio (CRR) with the Cyclic Stress Ratio (CSR) (Bolton Seed et al., 1985).The calculation of single pile bearing capacity can be done using field data. The data used in this research include SPT and CPT results. The comparison of pile bearing capacity is analyzed both before and during liquefaction.

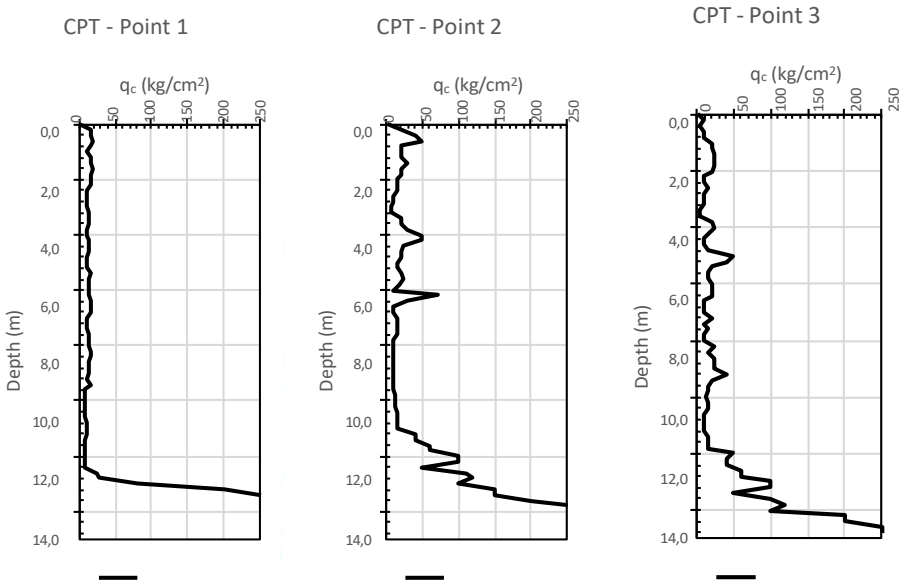
The research will be conducted in the Sanur area, Denpasar City, Bali Province, taking into account the conditions of the area where soil samples will be taken. The research location meets several conditions, including a high groundwater table/saturated soil and predominantly sandy soil.

3. Result and Discussion

3.1 Soil Test Result

Field soil testing was conducted through a series of Standard Penetration Tests (SPT) and Cone Penetration Tests (CPT). The research involved SPT and CPT tests at three locations to obtain an overview of soil conditions and stratigraphy. The SPT was conducted down to an average depth of 6 meters, while the CPT was carried out to a depth of around 13 meters. The soil condition at the site consists of loose sand with low average SPT and CPT values. Hard soil was only found at a depth of around 13 meters.

SPT values at depths of 2 to 6 meters at the research site ranged from 2 to 4. Gradation tests were performed at each test point to determine soil types. The dominant soil type at the testing site is sand with a clay content of 4% to 5%. The unit weight of the soil ranged between 16.17 – 18.37 kN/m³. For the purposes of this research, the unit weight of sand was assumed to be 17.5 kN/m³, and the saturated unit weight was assumed to be 18.5 kN/m³. The saturated unit weight of the hard soil was assumed to be 19 kN/m³. The groundwater table was found at a depth of 1.5 meters. The following is a graph of the soil test results at the research location.



CPT Fig **1.** CPT Test Result on Study Area CPT

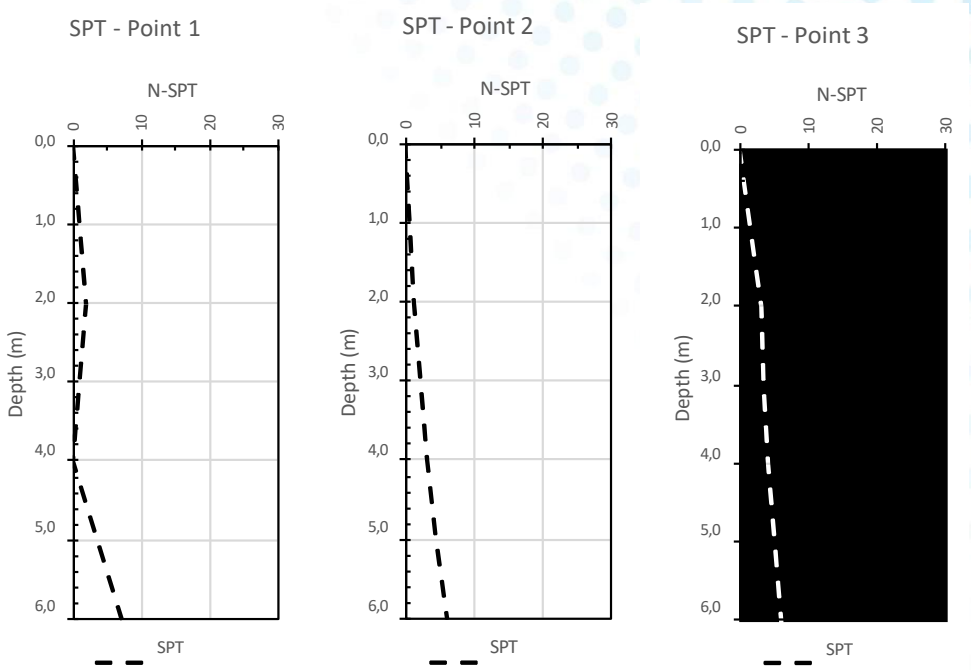


Fig 2. SPT Test Result on Study Area

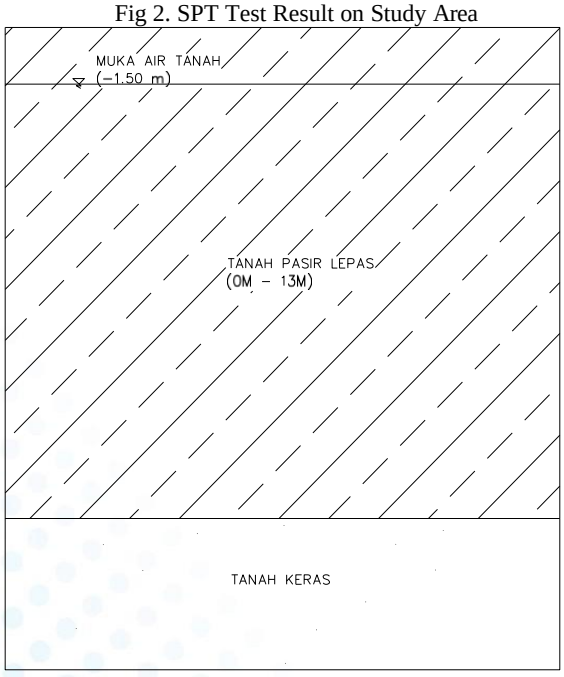


Fig 3. Soil Stratigraphy from Soil Test Result

Based on the field tests conducted, the average Standard Penetration Test (SPT) value is 3. According to the correlation by(Carter & Bentley, 2016), this corresponds to an internal friction angle (φ) of approximately 25° to 30° for the soil at the study site, which consists of loose sand. For the purposes of data input in calculations, an internal friction angle of 27° is assumed. For hard soil layers with a cone penetration resistance (qc) greater than 250 kg/m², an internal friction angle of 38° is used.

3.2 Soil Liquefaction Susceptibility Analysis

The analysis of soil layer safety against liquefaction was conducted using the planned earthquake data with magnitudes (Mw): 4, 5, and 6. The calculation results indicate that the soil layers will not undergo liquefaction when subjected to an earthquake with a magnitude of Mw = 4. However, the soil layers will start to liquefy when subjected to an earthquake load of Mw > 5.

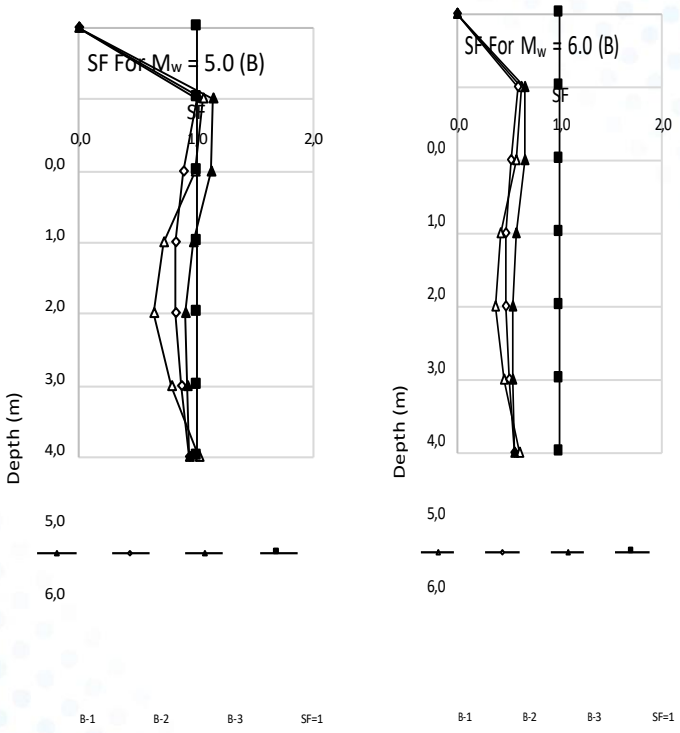


Fig **4.** Soil Liquefaction Susceptibility Result

Graphic above is described, the soil is likely to liquefied when the magnitude of the earthquake is greater than Mw =5, and depth of liquefied soil is 1 – 13 m.

3.3 Pile Foundation Bearing Capacity

For the calculation of single pile foundations, two types of pile foundations will be modelled: the first type is a pile foundation where the bottom tip rests on hard soil, and the second type is a pile foundation where the bottom does not rest on hard soil. Also, all the foundation will be calculate its bearing capacity before and during liquefaction occurs.

Table 1 Specification of the pile foundation

	Type 1	Type 2
Foundation Type	Bored Pile	Bored Pile
Concrete	Fc'- 35 Mpa	Fc'- 35 Mpa
Rebar	BJTS-420B	BJTS-420B
Diameter	300 mm	300 mm
Effective Lenght	8000 mm	1500 mm

Based on bearing capacity calculation by (Grigorian, 2022) , is obtained the bearing capacity result as tabulated at table below;

Table 2. Bearing Capacity Calculation Result Tabulation

Bearing Capacity	Type 1	Type 2
Before Liquefaction	198.9 KN	1875 KN
During Liqufaction	13.25 KN	390 KN
Decrease	185.65 KN (93%)	1485 KN (79%)

From the calculation of the bearing capacity of the foundation, it was found that pile foundation type 1 experienced a 93% reduction in bearing capacity, while pile foundation type 2 experienced a 79% reduction in bearing capacity. Pile foundation type 1 experienced a significant reduction because the pile tip does not rest on hard soil and remains within the liquefaction zone. The skin friction for type 1 piles comes only from the upper soil layer, which does not experience liquefaction because it is above the groundwater table (GWT). Pile foundation type 2 also experienced a considerable reduction, but it was less than that of type 1 because the pile tip rests on hard soil that does not liquefy, providing end-bearing resistance. However, due to the reduction in effective vertical pressure, a significant reduction in capacity still occurred. Therefore, when designing pile foundations in soils with liquefaction potential, it is better to place the pile tips deeper in hard soil layers to ensure sufficient bearing capacity during liquefaction events.

Future study that can be assess in the future are the bearing capacity reduction of the pile group at the liquefiable soil, the settlement of the pile foundation due to liquefaction, the horizontal pressure that can occur when liquefaction.

4. Conclusion

The conclusions of this study are as follows:

1. The soil layer at the test location will experience liquefaction during earthquakes with a magnitude starting from Mw > 5 at depths ranging from -1.5 m to -13 m.
2. The bearing capacity of the single pile foundation type 1 and type 2 before liquefaction occurred is 198.9 kN/m² and 1875 kN/m², respectively.
3. The bearing capacity of the single pile foundation type 1 and type 2 during liquefaction is 13.25 kN/m² and 390 kN/m², respectively.
4. The reduction in the bearing capacity of the single pile foundation type 1 and type 2 during liquefaction is 93% and 79%, respectively.

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A Review of 100% Census Techniques in Oil Palm Plantations: Methods and Applications

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Abstract

Oil palm plantations significantly impact Malaysia's economy, environment, and social structure. As the second largest palm oil producer globally, Malaysia's oil palm industry greatly contributes to the national Gross Domestic Product and agricultural sector. In order to maintain productivity and sustainability of the industry, a 100% census in oil palm plantations is crucial. This review explores the systematic 100% census techniques used by the Malaysian Palm Oil Board (MPOB) in oil palm plantations. This technique is essential to obtain precise data on the number of trees, their health, and yield potential, which are vital for effective plantation management and optimization. MPOB employs a detailed, ground-based approach to ensure every tree is accounted in, leading to accurate yield estimates and robust health monitoring. The review details MPOB's methodologies, including standardized data collection forms, comprehensive training for field personnel, and periodic audits to maintain data quality. However, it also acknowledges challenges such as the labour-intensive nature of the method and the need for ongoing training and quality control. Therefore, MPOB has increasingly incorporated modern technologies into its census methods, such as Geographic Information Systems (GIS) and remote sensing. This comprehensive review underscores the importance of 100% census techniques as a fundamental aspect of effective plantation management in Malaysia's oil palm industry, highlighting their crucial role in ensuring sustainable and profitable operations.

Keywords: 100% census, oil palm plantation, sustainable plantation management, Malaysian Palm Oil Board, yield potential

1.0 Introduction

The oil palm industry's significant role in Malaysia's economy is evident through its deep-rooted presence and the substantial contributions it makes to various economic sectors (Parveez et al., 2021). The industry not only generates significant revenue through exports but also provides employment to millions of Malaysians, particularly in rural areas, where oil palm plantations are predominantly located (Aziz et al., 2021). This employment has led to improved living standards and economic development in these regions, reducing poverty levels and contributing to social stability (Tkemaladze, 2017). The economic interdependencies created by the oil palm industry have made it a cornerstone of Malaysia's economic policy, ensuring that it remains a priority for the government and private sector alike (Nambiappan et al., 2018). Furthermore, Malaysia's position as the second-largest producer of palm oil globally has solidified its influence in international markets, allowing the country to play a pivotal role in shaping global trade policies related to palm oil (Robert & Menon, 2007). This influence has enabled Malaysia to advocate for the interests of palm oil-producing countries and counteract negative perceptions and trade barriers imposed by some Western countries (Parveez et al., 2021). However, maintaining this position requires continuous innovation and adaptation to changing market dynamics, including shifts in consumer preferences toward more sustainably produced goods (Aziz et al., 2021). By embracing sustainable practices and leveraging its economic strength, Malaysia can continue to lead the global palm oil market while contributing to global sustainability goals (Robert & Menon, 2007).

As international demand for sustainably sourced palm oil grows, Malaysia's commitment to sustainability has been demonstrated through the implementation of various environmental standards, such as the Malaysian Sustainable Palm Oil (MSPO) certification (Senawi et al., 2019). Central to these sustainability efforts is the adoption of 100% census techniques in oil palm plantations, which ensure that all trees are regularly monitored for diseases, growth rates, and productivity, contributing to efficient resource management and minimal environmental impact. In this paper, we aim to explore the relevance of 100% census techniques in the context of both economic and environmental sustainability, and we have reviewed 42 relevant studies, organized by

publication year and sourced through electronic databases, to compile a comprehensive comparison table that highlights the development of these techniques alongside modern technological advancements.

2. The 100% Census in Oil Palm Plantations

A 100% census in oil palm plantations is not only about counting trees; it is a comprehensive approach that ensures every aspect of the plantation is thoroughly assessed (Li, 2015). This level of scrutiny is essential for maintaining high standards of plantation management and ensuring the long-term sustainability of the industry (Parnando, 2017). By systematically collecting detailed data on each palm, managers can develop a deep understanding of the plantation's health and productivity, which is critical for making informed decisions (Saidy et al., 2023). This includes identifying areas of the plantation that may require additional attention, such as those affected by disease or poor soil conditions (Azahar et al., 2014). Moreover, the data collected thro ugh a 100% census can be used to track changes over time, providing valuable insights into the effectiveness of different management practices (Smith, 2024). This ongoing monitoring is vital for adapting to changing environmental conditions and ensuring that the plantation remains productive and profitable (Sacks et al., 2008). Data collected during the 100% census can be stored as a record for future use and references.

In addition, the 100% census also serves the plantation management for meeting regulatory requirements and certification standards (Lewis et al., 2020). Many international buyers and certification bodies, such as the Roundtable on Sustainable Palm Oil (RSPO), require detailed documentation of plantation practices, including the health and productivity of the trees (Ogahara et al., 2022). Conducting a 100% census provides the necessary data to demonstrate compliance with these standards, which can enhance the plantation's marketability and access to premium markets (Lee et al., 2019). Furthermore, the census data can be used to support sustainability initiatives, such as reforestation projects or the implementation of environmentally friendly farming practic es (Hanafiah et al., 2022). The oil palm plantation’s record history ensures site specific future improvements and for research purposes.

3. MPOB Oil Palm Census

The Malaysian Palm Oil Board (MPOB) has long been at the forefront of developing and implementing effective census techniques in oil palm plantations, ensuring that the industry remains competitive and sustainable (Lee et al., 2019). One of the key strengths of MPOB's approach is its commitment to continuous improvement and adaptation, reflecting the evolving needs of the industry (Parveez et al., 2024). In addition to ground -based inspections, MPOB has increasingly incorporated modern technologies into its census methods, such as Geographic Information Systems (GIS) and remote sensing (Ogahara et al., 2022). These tools allow for more efficient data collection and analysis, providing a comprehensive view of the plantation that goes beyond what can be observed from the ground alone (Robert & Menon, 2007). By integrating these technologies with traditional methods, MPOB ensures that the data collected is both accurate and actionable, supporting more effective plantation management and decision-making (Nordiana et al., 2008). By combining the innovations with established practices, MPOB not only ensures the reliability of the data but also promotes more informed decision making, leading to a better management of plantations.

MPOB's commitment to quality and accuracy is further demonstrated by its rigorous training programs for field personnel (Hanafiah et al., 2022). These programs are designed to equip personnel with the skills and knowledge necessary to conduct thorough and accurate censuses, ensuring that they can identify and document even the most subtle signs of stress or disease in the trees (Sutherland, 2006). MPOB also came out with rating of disease severity (Fig. 1), the system used to evaluate and classify the extent of disease infection, particularly in oil palm plantations. This rating system is critical for managing and mitigating diseases like *Ganoderma boninense*, which poses significant threats to the productivity of oil palm. This level of detail and precision is essential for maintaining the reliability of the data, which in turn supports more effective management practices and better outcomes for the plantation (Robert & Menon, 2007). By continually refining its techniques and investing in the development of its workforce, MPOB plays a critical role in ensuring the sustainability and success of Malaysia's oil palm industry (Ogahara et al., 2022). Moreover, MPOB’s focus on quality is evident through its intensive training programs, which ensure that field workers can accurately detect early signs of stress or disease in oil palm trees. The commitment to standardize data collection not only minimizes errors but also enhances the reliability of information, leading to better management and long-term sustainability of plantations.

Rating of disease severity	Label	Characteristics
1	Healthy	No fruiting body + No foliar symptoms
2	Mild	Presence of fruiting body + No foliar symptoms
3	Medium	Presence of fruiting body + Foliar symptoms (≤ 4 dry fronds OR < 50%) + with or without unopened spear
4	Severe	Presence of fruiting body + Foliar symptoms (> 4 dry fronds OR ≥ 50%) + with unopened spear
5	Dead	Dead due to BSR
6	Dead	Dead not due to BSR or Vacant Point

Fig. 1 Rating of disease severity by MPOB
Source:(Malaysian Palm Oil Board, 2023)

4. Challenges of 100% Census

The implementation of a 100% census presents several significant challenges, particularly in large -scale oil palm plantations (Tang & Al Qahtani, 2020). One of the most pressing issues is the sheer scale of the task, which requires a substantial investment of time and resources (Sheil et al., 2009). Large plantations, which can span thousands of hectares, necessitate the deployment of a large workforce to manually inspect and record data for each tree, a process that can be both time-consuming and labour-intensive (Colchester & Chao, 2011). This requirement for a large labour force can lead to increased operational costs, making it a financially demanding process, especially for smaller operators who may not have the same level of resources as larger compan ies (Rianto, 2010). Furthermore, the physical demands of conducting a 100% census in challenging environmental conditions, such as in remote or difficult-to-access areas, can exacerbate these challenges, leading to potential delays and increased risks of errors (Cohen et al., 2019). Even if the 100% census method is essential for thorough data collection, it poses considerable challenges, especially in large-scale plantations where covering thousands of hectares is time-consuming and labour-intensive. The high operational costs and physical demands, particularly in remote or hard-to-reach areas, make this process even more difficult for smaller operators, potentially impacting efficiency and accuracy.

Human error remains a critical challenge in the traditional 100% census approach (Rival & Levang, 2014). Despite comprehensive training, the potential for mistakes in data collection, whether due to fatigue, oversight, or misinterpretation, is a constant concern (Parveez et al., 2024). These errors can significantly impact the accuracy of the census data, leading to incorrect assessments of tree health and productivity, which can, in turn, affect the overall management and profitability of the plantation (Murphy et al., 2021). To mitigate these issues, some plantations have begun to explore the use of technology to supplement traditional methods, but the transition comes with its own set of challenges, including the need for substantial investment in equipment and training, as well as concerns about data security and privacy (Tang & Al Qahtani, 2020). Nevertheless, addressing these challenges is essential for the continued success and sustainability of the oil palm industry, particularly as it seeks to remain competitive in a rapidly changing global market (Rival & Levang, 2014). Human error is an ongoing issue in the traditional 100% census approach, as factors like fatigue or misinterpretation can easily lead to inaccurate data collection. While technology offers a promising solution to improve accuracy, its adoption requires significant investment in both equipment and training, presenting additional challenges for plantations.

5. Technological Innovations in Oil Palm Census

As the oil palm industry continues to evolve, the adoption of technological innovations in census techniques offers a promising path forward, addressing many of the challenges associated with traditional methods (Parvand & Rasiah, 2022). Drones, equipped with high-resolution cameras and multispectral sensors, have emerged as a powerful tool for conducting aerial surveys of oil palm plantations (Khuzaimah et al., 2022). These devices can quickly cover vast areas, capturing detailed images and data that provide insights into tree health, height, and yield potential (Avtar et al., 2020; Korom et al., 2016). By using drones, plantations can significantly reduce the time and labour required for census activities, making the process more efficient and cost-effective (Tan, 2023). Furthermore, the ability to capture data from multiple angles and altitudes allows for a more comprehensive analysis of the plantation, identifying issues such as pest infestations or nutrient deficiencies that may not be visible from the ground (Hafeez et al., 2023). The integration of technological advancements, such as drones, into
census techniques marks a significant improvement in the efficiency and accuracy of data collection for oil palm

plantations. These drones, with their ability to survey large areas quickly and provide detailed insights into tree health and productivity, not only reduce labour and time but also offer a more comprehensive view of plantation conditions than traditional methods.

In addition to drones, artificial intelligence (AI) and big data analytics are playing an increasingly important role in the modernization of oil palm census techniques (Akhtar et al., 2023). AI algorithms can process large volumes of data from various sources, including aerial imagery, satellite data, and ground-based sensors, to provide detailed analyses of plantation conditions (Javaid et al., 2022). These technologies enable the identification of patterns and trends that might be missed by human inspectors, improving the accuracy of yield predictions and health assessments (Salazar et al., 2019). This integration of AI and big data represents a significant advancement in the field, offering the potential for more precise and actionable insights into pla ntation management (Himeur et al., 2023). The incorporation of AI and big data analytics into oil palm census techniques is revolutionizing the assessment of plantation conditions, as these technologies can analyse vast amounts of information far beyond human capacity. By automating tasks and identifying subtle trends, AI not only enhances the accuracy of yield predictions and health assessments but also reduces human error, making plantation management more efficient and data-driven. The shift over time from traditional methods to modern technologies (Table 1) in 100% census techniques for oil palm plantations is clearly evident.

Table 1. Timeline of 100% Census Techniques in Oil Palm Plantations: From Traditional to Modern Technologies Source: (Li, 2015; Salazar et al., 2019; Tan, 2023)

Time Period	Technology Level	Tools and Methods	Key Features
1960s-1990s	Low	Manual tallying, paper records	Labour-intensive, prone to error
2000s	Moderate	Basic GIS, early remote sensing, manual computer data entry	Improved accuracy and speed
2010s-Present	High	Drones, satellite imagery, AI, IoT sensors	High precision, fast, integrated analysis

6. Traditional versus Technological Methods

Traditional method, such as ground-based inspections have been the backbone of plantation management for decades, providing detailed, hands-on assessments of each tree (Schoneveld et al., 2019). This traditional method offers the advantage of direct observation, allowing field personnel to make immediate and nuanced judgments about tree health and productivity (Fix et al., 2022). However, the labour-intensive nature of the traditional method makes them time-consuming and costly, especially in large plantations (Murphy et al., 2021). Moreover, the reliance on manual data collection increases the potential for human error, which can compromise the accuracy and reliability of the data (Li, 2015). As plantations expand in size and complexity, these limitations have become increasingly apparent, highlighting the need for more efficient and scalable solutions (Fix et al., 2022). Although traditional groundbased inspections provide valuable hands-on insights, their labour-intensive nature and susceptibility to human error highlight the need for more efficient, technology-driven solutions as plantations expand in size and complexity.

On the other hand, technological methods, such as the use of drones, AI, and IoT devices, offer significant improvements in efficiency, accuracy, and scalability (Salazar et al., 2019). Additionally, the ability to integrate data from multiple sources, such as aerial imagery and ground-based sensors, provides a more comprehensive view of the plantation, allowing for more informed decision-making (Hafeez et al., 2023). However, the adoption of these technologies also comes with challenges, including high initial costs, the need for technical expertise, and concerns about data security (Javaid et al., 2022). Ultimately, a balanced approach that combines the strengths of both traditional and technological methods may offer the best solution, providing the detailed insights of traditional methods with the efficiency and scalability of modern technologies (Zamiri & Esmaeili, 2024). Technological methods like drones, AI, and IoT devices enhance efficiency, accuracy, and scalability in plantation management, offering a more comprehensive view and reducing labour costs, but it also brings challenges such as high initial costs and data security concerns. Thus, combining these innovations with traditional methods can provide the most effective solution.

Table 2. Comparison of Traditional and Technological Methods in Oil Palm Census Techniques Source: (Javaid et al., 2022; Schoneveld et al., 2019; Tan, 2023)

Aspect	Traditional Methods (Past)	Technological Methods (Present)
Data Collection	Manual inspections, paper records, physical measurement	Drones, satellite imagery, IoT sensors, AI analytics
Labour Intensity	High, requiring large workforce and significant time	Reduced, automation of data collection and analysis
Accuracy	Prone to human error, variability in data	High precision with reduced human error
Cost	High due to labour and logistics	Initial high cost but lower long-term operational costs
Speed	Slow, dependent on manpower and physical constraints	Fast, capable of covering large areas quickly
Data Integration	Limited, data collected manually and analysed individually	Comprehensive, integration of multiple data sources
Flexibility	Less flexible, harder to adapt to changes	Highly adaptable, real-time updates and analysis
Sustainability	May require more resources and generate more waste	Potential for lower environmental impact with optimized resource use

7. Future Directions

Looking to the future, the ongoing development of technologies such as drones, AI, and IoT devices offers promising avenues for enhancing the effectiveness of 100% census techniques in oil palm plantations (Coombs et al., 2020). Continued research and innovation are needed to refine these technologies and tailor them to the specific needs of the oil palm industry. Additionally, efforts to reduce the cost of these technologies could make them more accessible to small and medium-sized plantation operators, helping to level the playing field and promote broader adoption across the industry. Another promising area of research is the integration of remote sensing technologies, such as satellite imagery, with ground-based data collection methods, providing a more comprehensive and detailed overview of plantation conditions. The advancement of technologies like drones, AI, and IoT holds great potential for improving 100% census techniques in oil palm plantations by enhancing precision and efficiency.

Policy initiatives play an important role in shaping the future of 100% census techniques in oil palm plantations (Murphy et al., 2021). Together, governments and industry bodies can support the adoption of new technologies by providing incentives, subsidies, and training programs that help offset the initial costs and reduce the learning curve associated with these tools. Additionally, policies that emphasize sustainability and environmental responsibility could drive the development and use of technologies that minimize environmental impact while maximizing productivity (Cheng et al., 2023). By pursuing these future directions, the oil palm industry in Malaysia continue to thrive while ensuring long-term sustainability and profitability (Coombs et al., 2020). In the adoption of new technologies, policy initiatives provide the necessary support for advancing 100% census techniques through incentives, subsidies, and training.

8. Conclusion

The 100% census remains a cornerstone of effective plantation management in Malaysia's oil palm industry, providing the detailed data necessary for informed decisionmaking and optimized operations. While traditional methods of census-taking have proven effective, the challenges such as labour intensity, high costs, and susceptibility to human error, highlight the need for innovation and the adoption of new technologies. The integration of drones, AI, and IoT devices offers promising solutions that can enhance the efficiency and accuracy of the census process, ensuring that Malaysia's oil palm industry remains competitive and sustainable in the global market. Moving forward, a balanced approach that combines the best of traditional and modern methods will be key to achieving long-term success in the industry. This hybrid approach can harness the strengths of each method, providing comprehensive data while addressing the limitations of individual techniques. By doing so, the industry can better manage resources, respond to challenges, and ultimately drive sustainable growth.

Furthermore, the future of the oil palm industry will likely be shaped by ongoing research and technological advancements, as well as supportive policies that encourage innovation and sustainability. By embracing these changes, the industry can continue to grow and thrive while minimizing its environmental impact and contributing

to the global demand for sustainable agricultural products. The successful implementation of 100% census techniques, combined with technological innovations and sustainable practices, will ensure that Malaysia's oil palm industry remains a leader in the global market, delivering economic benefits while safeguarding the environment for future generations. As the industry evolves, it will be important to continue refining and adapting these techniques to meet the changing needs of the market and the environment, ensuring long-term success and sustainability.

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Application of IoT for Smart Plant Monitoring and Employed Rainwater Harvesting

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Abstract

The emergence of the Internet of Things (IoT) represents a transformative shift from conventional lifestyles to tech-savvy ones, giving rise to innovations like smart cities, homes, agriculture, energy efficiency, transportation, and industries. This project focuses on creating an intelligent plant monitoring system, leveraging both automation and IoT technologies. Various sensors, including pH, LM35, and water level sensors, play integral roles in this system. The pH sensor assesses acidity and alkalinity levels, prompting the Arduino board to activate the water pump when the pH level dips below a predefined threshold. Another critical component is the water level sensor, which detects tank levels and relays this data to the Arduino board, subsequently transmitting it to the cloud. Notably, rainwater is employed as the primary water source in this prototype to reduce environmental impact and lower treatment costs. The comprehensive plant monitoring data is then relayed to Thingspeak and accessed through our website application for display and analysis.

Keywords: Internet of Things; Sensors; Arduino; Rainwater; Thingspeak

1. Introduction

In modern agriculture, efficient monitoring and maintenance of plant health are essential for maximizing crop yields and ensuring food security. Traditional agricultural practices rely heavily on manual observations and interventions, which are not only time-consuming but also prone to human error and inconsistencies. These traditional methods often fail to provide the real-time data needed to respond promptly to the dynamic environmental conditions that affect plant growth (Petrellis, 2017; Guo et al., 2020; Suhag et al., 2021). The volatility of environmental factors such as soil moisture, temperature, humidity, and pH levels can lead to significant challenges in agriculture. Without timely and accurate monitoring, crops are susceptible to diseases, inadequate water supply, and nutrient deficiencies, which can ultimately result in harvest failures. According to recent studies, precision agriculture and smart farming technologies can mitigate these issues by offering continuous and automated monitoring solutions (Athawale et al., 2020; Kohli et al., 2020; Serdaroglu, Onel, & Baydere, 2020). To address these challenges, this paper describes the development of an automated plant monitoring and irrigation system using Internet of Things (IoT) technologies. IoT in agriculture involves the integration of various sensors and devices that collect and transmit data on critical plant parameters to a central system for analysis and action. This approach not only enhances the accuracy of monitoring but also enables farmers to make data-driven decisions, thereby improving crop health and yield.

Recent advancements in sensor technologies and wireless communication have made it feasible to deploy IoT-based solutions in agriculture. For instance, IoT-enabled smart agriculture systems can monitor soil moisture levels, temperature, light intensity, and other environmental parameters in real-time. These systems can automatically adjust irrigation schedules, apply fertilizers, and even predict plant diseases by analyzing the collected data (Rehman, Asif, & Ahmad, 2021).

The development of the smart plant monitoring system described in this paper leverages these IoT technologies to provide a comprehensive solution for modern agriculture. The system includes a web application that displays real-time data from various sensors installed in the field. Farmers can monitor their crops remotely, receive notifications about critical conditions, and access predictive analytics to prevent potential issues before they arise.

2. Related Works

Zhang, Wang, and Li (2023) present a system that combines AI and IoT technologies to detect plant diseases. The system uses IoT sensors to collect environmental data and AI algorithms to analyze images of plants for disease symptoms. This approach aims to improve the precision and efficiency of plant disease management in agriculture. Banerjee and Mukherjee (2022) introduce an intelligent irrigation system that leverages IoT technologies to enhance water use efficiency in agriculture. The system monitors soil moisture and weather conditions, automatically adjusting irrigation schedules. The study highlights the potential of IoT in reducing water waste and improving crop yields. Ahmed, De, and Hussain (2022) describe an IoT-based smart agriculture monitoring system designed to optimize farming operations. The system monitors various environmental parameters and provides real-time data to farmers. The study discusses the benefits of using IoT in agriculture, including improved efficiency and productivity.

Li and Zhang (2022) present an agricultural monitoring system that integrates IoT and big data technologies. The system collects data from various sensors and uses big data analytics to provide insights into crop health and environmental conditions. This approach aims to improve decision-making and enhance agricultural productivity. Kumar and Patel (2022) develop a smart irrigation system that utilizes IoT technologies to monitor and manage water usage in agriculture. The system employs sensors to measure soil moisture and weather conditions, automatically adjusting irrigation schedules to optimize water use. The study highlights the potential of IoT in promoting sustainable agriculture practices. Sharma and Singh (2021) discuss a real-time monitoring system that integrates IoT and cloud computing for precision agriculture. The system collects data from various sensors deployed in the field and analyzes it in the cloud. The study demonstrates how this integration can enhance decision-making and improve agricultural productivity.

Mishra and Mohanty (2021) explore the application of convolutional neural networks (CNNs) in detecting plant diseases using IoT devices. The system captures images of plants and analyzes them using CNNs to identify disease symptoms. This approach aims to provide early detection and management of plant diseases, improving overall crop health. Lakshmi and Nair (2022) explores how IoT devices, coupled with predictive analytics, can enhance agricultural monitoring. The system predicts crop yields and potential issues by analyzing environmental data, aiming to support decision-making processes in farming. Rajesh et al. (2022) discuss the implementation of a smart farming system that uses IoT devices and machine learning algorithms to monitor soil conditions and optimize crop management. The study highlights how machine learning models can predict crop diseases and suggest preventive measures. This research by Singh and Singh (2021) focuses on how IoT technologies can improve resource utilization in agriculture. The system uses sensors to monitor soil moisture, nutrient levels, and weather conditions, providing data-driven insights to optimize resource use. Rana et al. (2021) discuss recent advancements in IoT-based systems for crop monitoring and disease prediction. The system integrates various sensors and machine learning algorithms to provide real-time insights into crop health and predict potential disease outbreaks. Agarwal et al. (2022) explore AI-driven IoT solutions designed to enhance crop monitoring and management. The study highlights the integration of AI algorithms with IoT sensors to provide predictive analytics for crop health and yield optimization.

3. System Design and Development

This section describes the development of a smart plant monitoring system integrated with an automated rainwater harvesting setup. The system employs various sensors including pH, ultrasonic, and temperature sensors, along with an Arduino Uno microcontroller, a WiFi shield, a breadboard, a 12V light bulb, and a water container. The objective is to create an efficient, cost-effective solution for monitoring plant health and optimizing water usage through rainwater harvesting. Efficient monitoring of plant health and sustainable water management are critical in modern agriculture. Traditional methods are often labor-intensive and prone to error, necessitating innovative solutions. This project presents the design and implementation of a smart plant monitoring system that integrates rainwater harvesting to provide a sustainable and automated approach to agriculture. The sketch of the prototype is shown in Figure 1.

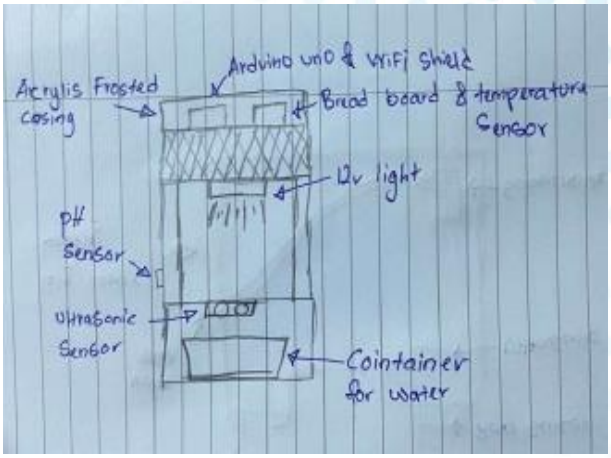


Figure 1: Sketch of Smart Plant IoT Monitoring System

Figure 2 illustrates the initial design of the smart plant prototype. At this stage, the focus is on the conceptual layout, showcasing how the different components will be integrated into the overall system. The diagram highlights the placement of sensors, controllers, and connectivity modules. The prototype includes a basic setup of soil moisture sensors, light sensors, and possibly temperature and humidity sensors. This visual representation helps to clarify the relationship between the different components and provides a blueprint for further development. Figure 3 advances the previous conceptual design to a more concrete phase, where actual hardware is integrated into the prototype. It shows the physical assembly of the components, including the microcon troller, sensors, and power supply. The image may also display how the sensors are embedded within the soil or attached to the plant environment, illustrating the real-world application of the prototype. This stage is crucial as it demonstrates the transition from a theoretical design to a functional system, highlighting any challenges or adjustments made during the physical construction. Figure 4 represents the fully operational prototype within its intended environment. It includes the plant being monitored, with all sensors actively collecting data and transmitting it to the IoT platform. The figure also depicts the user interface or dashboard where real -time data is visualized, such as soil moisture levels, temperature, and light intensity. This final stage emphasizes the successful integration of IoT technology with the smart plant system, showcasing the system's capability to provide automated monitoring and potentially even control actions based on the data collected.

Figure 2: Smart Plant Prototype

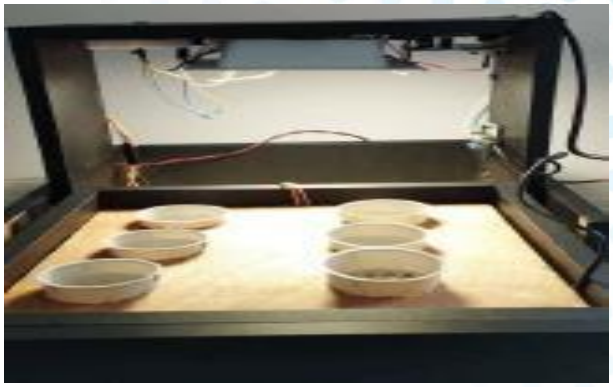


Figure 3: Smart Plant Prototype with Hardware

Figure 4: Smart Plant IoT Monitoring with Plant

3.1 System Components

- pH Sensor: Measures the acidity or alkalinity of the soil, providing essential data for maintaining optimal growing conditions.
- Ultrasonic Sensor: Monitors the water level in the rainwater harvesting container, ensuring adequate water supply for irrigation.
- Temperature Sensor (LM35): Measures the ambient temperature around the plants, which is crucial for maintaining the right environment for plant growth.
- Arduino Uno: The central microcontroller that processes data from various sensors and controls other components.
- WiFi Shield: Enables the Arduino to connect to the internet and transmit data to a cloud-based platform for remote monitoring and control.
- Breadboard: Used for prototyping and connecting various electronic components without soldering.
- 12V Light Bulb: Provides artificial lighting to the plants, simulating sunlight for indoor or low-light conditions.
- Water Container: Stores harvested rainwater for irrigation purposes.

3.2 Data Collection and Processing

The sensors continuously monitor the environmental parameters and send the data to the Arduino Uno. The Arduino processes this data and uses the WiFi shield to upload it to an online cloud platform, such as Thing Speak or a custom web application, for real-time monitoring.

3.3 Automated Irrigation

The ultrasonic sensor in the water container ensures that there is always sufficient water for irrigation. When the water level drops below a certain threshold, the system triggers a water pump to draw water from the container to irrigate the plants. The pH sensor data ensures that the soil remains within the optimal pH range, and the temperature sensor data helps maintain suitable ambient conditions.

3.4 Rainwater Harvesting Design

The rainwater harvesting system is designed to efficiently collect, store, and utilize rainwater for irrigation purposes. Below is a detailed description of each component and its role in the system and the prototype is shown in Figure 5 and Figure 6:

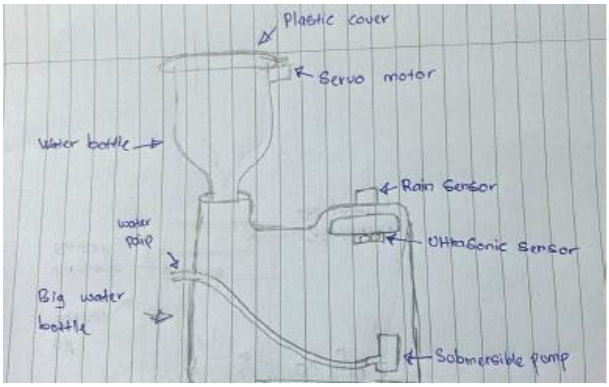


Figure 5: Sketch of Rainwater Harvesting

Figure 6: Rainwater Harvesting Prototype

3.5 Plastic Cover

The plastic cover is positioned at an angle to collect rainwater and direct it into the system. Its surface area is designed to maximize the amount of rainwater captured.

3.6 Servo Motor

The servo motor is attached to the plastic cover and connected to the Arduino Uno microcontroller. It controls the opening and closing mechanism of the water flow. When the rain sensor detects rain, the Arduino activates the servo motor to open the plastic cover, allowing rainwater to flow into the small water bottle.

3.7 Small Water Bottle

The small water bottle acts as the initial collection point for rainwater funneled from the plastic cover. It is positioned below the plastic cover to ensure efficient water transfer.

3.8 Water Pipe

The water pipe connects the small water bottle to the big water bottle, channeling the collected rainwater into

the main storage container. It ensures a smooth and controlled flow of water.

3.9 Big Water Bottle

The big water bottle serves as the main storage container for the harvested rainwater. It is designed to hold a significant volume of water, ensuring a steady supply for the irrigation system.

3.10 Submersible Pump

The submersible pump is placed inside the big water bottle and is responsible for pumping the stored rainwater to the irrigation system. The pump is controlled by the Arduino, which activates it based on the water level monitored by the ultrasonic sensor.

3.11 Ultrasonic Sensor

The ultrasonic sensor is mounted at the top of the big water bottle to monitor the water level. It sends real-time data to the Arduino, which then decides whether to activate the submersible pump. If the water level drops below a predefined threshold, the Arduino will trigger the pump to ensure continuous irrigation.

3.12 Rain Sensor

The rain sensor is placed outside to detect the presence of rain. When it detects rain, it sends a signal to the Arduino, which then activates the servo motor to open the plastic cover and start the water collection process. When the rain stops, the servo motor closes the cover to prevent debris from entering the system.

3.13 System Monitoring and User Interface

The smart plant monitoring system includes a user-friendly web interface with several key pages: the login page as shown in Figure 7, pH monitoring page, temperature monitoring page, and water level monitoring page as shown in Figure 8. The login page serves as the entry point to the system, requiring users to authenticate themselves by entering a username and password. This ensures that only authorized users can access the monitoring and control functionalities of the system. Upon successful login, users are directed to the pH monitoring page, which displays real-time data on soil acidity and alkalinity levels. This page is equipped with graphs and alerts that notify users when pH levels fall outside the optimal range for plant health. The temperature monitoring page provides continuous updates on the ambient temperature around the plants. It features visual indicators and historical data charts to help users track temperature fluctuations and make informed decisions about environmental control. Finally, the water level monitoring page shows the current water level in the rainwater harvesting container, as detected by the ultrasonic sensor. This page includes real-time visualizations and alerts that inform users when the water level is too low or too high, ensuring that the irrigation system has a sufficient water supply at all times. Together, these pages offer a comprehensive and interactive platform for managing plant health and optimizing irrigation through the smart monitoring system.

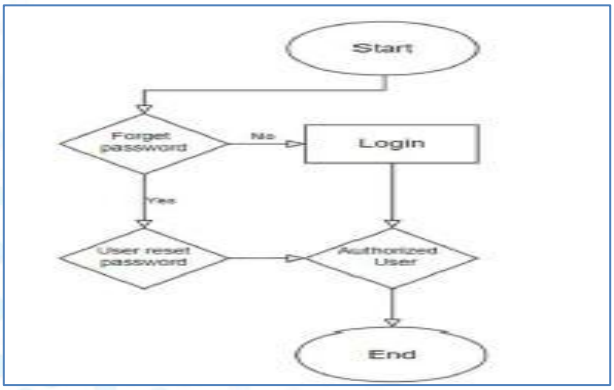


Figure 7: Login flowchart

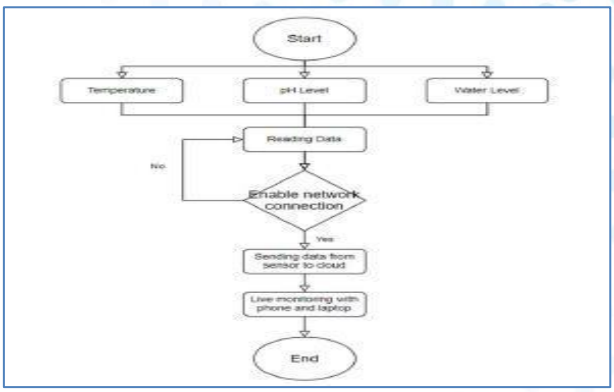
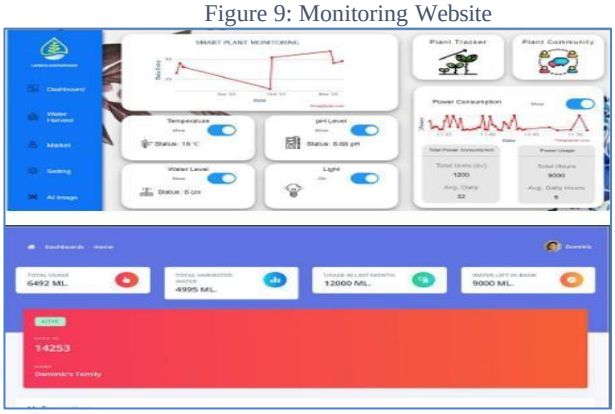


Figure 8: Monitoring page for Smart IoT

4. Result and Discussion

The dashboard interface shown in Figure 9 serves as a consolidated platform for monitoring important production metrics in the water chamber, such as temperature, pH levels, and water levels. The system retrieves data from a cloud architecture known as ThingSpeak and then presents this information on the website. Using real-time data obtained from the intelligent plant prototype, the website offers information on the water level in the main storage container and other relevant parameters. The intelligent plant system automatically triggers the rainwater harvesting system's water pump upon exhaustion of the water chamber, and it continues to function until it reaches the predetermined threshold, as specified in the system's code. Furthermore, the dashboard al lows users to manage critical functions such as light activation and deactivation, as well as monitor power usage to avoid circuit overheating. The next section provides an in-depth explanation of its five main characteristics.

Figure 9: Monitoring Website



4.1 Monitoring Plant Parameters

Monitoring plant characteristics is an essential aspect of providing ideal growing conditions for plants. This technology facilitates user access to real-time data on crucial environmental parameters, such as temperature, pH levels, humidity, and water levels, all of which impact plant health. Furthermore, it enables the remote management of components linked to the intelligent plant system, such as lighting controls, water pumps, and fans. For instance, users have the ability to modify the lighting specifications in order to guarantee that plants get sufficient illumination, even in their absence. Equipped with internet access, this device enables customers to remotely monitor and manage their plants via a smartphone application or online interface. By auto mating real- time modifications based on current circumstances, this capacity not only improves the ease of plant care, particularly for those managing numerous settings or hectic schedules, but it also optimizes resource use.

4.1.1 pH Level monitoring

We propose an Internet of Things (IoT) system that regulates water pH levels to provide optimal growth conditions for plants. Since pH plays a crucial role in how plants absorb nutrients, keeping it stable is essential for healthy growth. When pH levels fluctuate too much, it can lead to nutrient imbalances, either depriving plants

of what they need or giving them too much, which can harm productivity. Our system uses a pH sensor to constantly track the water's acidity or alkalinity. If the pH drifts outside the optimal range, the system automatically takes corrective action, reducing the need for manual intervention. This ensures that the pH stays stable over time, giving plants the right environment to thrive. By measuring how much the pH deviates, we can confirm that the system effectively controls the pH with minimal fluctuations by measuring how much it deviates. The goal is to keep the pH in the ideal range to support the best possible plant health. The equation is as follows:

$$\text{pH Deviation} = \text{Target pH} - \text{Actual pH Reading}$$

Table 1 presents the data obtained from a pH level monitoring system used to assess plant health over a period of time. The system's sensors record continuous measurements, monitoring variations and recording remedial measures. The pH deviation column measures the discrepancy between the optimal and detected pH values, thereby evaluating the system's precision in regulating water pH within the intended range. Once the divergence exceeds the permissible level, the system initiates a remedial reaction. The data show patterns in how the system worked over a few days. For example, a neutralizing solution was used to fix a pH that wasn't where it should be, and the irrigation schedule was changed to keep the pH stable. The presented data provides evidence of the system's efficacy in preserving consistent pH levels and highlights the advantages of automated monitoring. These practices contribute to the enhancement of plant health, mitigation of nutritional deficits, and optimization of production in precision agriculture.

Table 2: pH data

Day	Target pH	Average pH Reading	pH Deviation	Corrective Action Triggered?
1	6.2	6.4	0.2	No
2	6.2	6.7	0.5	Yes (Applied neutralizer)
3	6.2	6.3	0.1	No
4	6.2	5.9	0.3	Yes (Adjusted irrigation)
5	6.2	6.2	0.0	No

The system regulates plant health by stabilizing a pH level of 0.2 units or less and initiating remedial measures when it exceeds 0.3 units. Proper access to vital nutrients minimizes the possibility of nutrient lockout, thereby fostering improved development and increased crop productivity.

4.1.2 Temperature Monitoring

Effective temperature control is essential, as variations in temperature may impact vital activities, including photosynthesis and nutrient uptake. The IoT system uses temperature sensors to continuously monitor ambient conditions, prompting automated reactions such as fan or heater activation in the event of anomalies. The system guarantees consistent growth conditions by maintaining the temperature within the optimal range, thereby enhancing plant health and increasing overall output. The formula is as follows:

$$\text{Temperature Variance} = \frac{\Sigma(\text{Measured Temperature} - \text{Optimal Temperature})^2}{\textit{Number of Measurements}}$$

The system should keep temperature variance below 2°C. Table 2 shows the data collected from the temperature sensor during the monitoring period.

Table 3: Temperature data

Day	Optimal Temp (°C)	Avg Temp Measured (°C)	Temp Variance
1	25	26.5	1.5
5	25	24.7	0.3
10	25	25.2	0.2
15	25	24.8	0.2

The system has robust temperature control capabilities, as shown by data indicating very slight deviations from the ideal temperature range. The few variations observed are well within acceptable thresholds, suggesting that the IoT system effectively sustains the optimized circumstances for plant development. The small deviation indicates that the automated controls, such as the activation of fans or heaters, are functioning as designed,

ensuring a consistent and favorable environment for plant health. This uniformity in temperature control not only reduces plant stress but also encourages consistent development, resulting in enhanced total crop productivity and resistance to external weather conditions.

4.2 Plant Tracker Progress

Within the smart plant prototype system, the plant tracker serves as a digital record, therefore streamlining the administration of all plants. The application allows users to monitor the development phases of specific plants and schedule their care routines. Featuring an intuitive interface, the tracker facilitates the seamless inclusion of new plants, including the capability to upload images for visual record-keeping. In due course, users will be able to construct a gallery that displays the progression of each plant, facilitating the detection of problems such as growth irregularities or possible illnesses. Furthermore, the system allows for the entry of critical information such as fertilization plans, watering routines, and harvest dates, resulting in a holistic management solution. Furthermore, it enables users to produce reports and provide updates on the development of their plants, making it an indispensable tool for both novice gardeners and expert cultivators.

4.3 Plant Community

In order to facilitate the exchange of information and experiences among plant enthusiasts, the plant community platform functions as an interactive hub. This functionality enables users to establish connections with one another in order to provide guidance, deliberate on plant maintenance, and even engage in reciprocal plant trading. The website cultivates a feeling of community, facilitating discussions on optimal methods in gardening. While the app already does not use automated photo-identifying technology for plant species, it is anticipated that future upgrades will include this capability, therefore streamlining the identification process and offering tailored care instructions. Furthermore, the website facilitates the recording of care procedures and encourages the sharing of seeds and plants, thereby updating the longstanding practice of plant propagation in a digital manner. Through these interactions, users are able to not only effectively oversee their plant collections but also acquire knowledge from the collective experiences of other community members.

4.4 Rainwater Harvesting

Rainwater harvesting, when combined with the smart plant system, is a highly effective and ecological technique for gathering and storing rainwater for future use. The current technique effectively collects rainfall, subjects it to filtration, and then retains it inside a reservoir, thereby facilitating its subsequent circulation to plants as required. Utilizing rainwater enables consumers to decrease their reliance on external water sources, therefore reducing water expenses and promoting more environmentally friendly agricultural methods. Traditionally, rainwater harvesting has been a dependable means of collecting water, and its incorporation with contemporary IoT infrastructure guarantees that plants get sufficient hydration, even in times of drought. Th e implementation of this automated procedure guarantees a reliable water supply with little human involvement, making it a pragmatic option for both small gardens and large agricultural enterprises.

4.5 Plant Disease Detection

The plant disease detection function utilizes artificial intelligence (AI) to systematically discover possible health problems in plants. The method utilizes a trained machine learning model to analyze visual data obtained from taking a picture of a plant's leaves in order to identify indicators of illness. An artificial intelligence system can detect patterns, such as changes in leaf texture, color, and form, to precisely determine the plant's health or infection status. Following the diagnosis of an illness, the system furnishes comprehensive information about the condition, including the disease's name, symptoms, and therapy suggestions. The capacity to recognize problems early enables users to rapidly resolve them, therefore reducing the likelihood of disease transmission and fostering improved plant development. As the AI system becomes more adept at assimilating new data, its diagnostic precision increases, making it an indispensable instrument for efficient plant surveillance and disease control.

5. Conclusion

In conclusion, the development of a smart plant monitoring system integrated with automated rainwater harvesting exemplifies the potential of IoT technologies in revolutionizing modern agriculture. By leveraging a variety of sensors, such as pH, temperature, and ultrasonic sensors, along with the Arduino microcontroller, the system effectively automates the monitoring and maintenance of plant health. Rainwater harvesting not only

supports sustainable water management, but also reduces the environmental impact and costs associated with traditional irrigation methods. The prototype successfully demonstrates how IoT can enhance precision agriculture by providing real-time data and automated responses to maintain optimal growing conditions. This innovation paves the way for more efficient, sustainable, and scalable agricultural practices, addressing critical challenges such as water scarcity and the need for consistent crop health monitoring. As IoT technologies continue to evolve, the integration of such systems in agriculture could significantly contribute to global food security and resource conservation efforts.

Future work could explore further enhancements, such as incorporating advanced machine learning algorithms for predictive analytics and extending the system's capabilities to larger-scale farming operations. This project lays a strong foundation for the continued application of IoT in agriculture, highlighting its transformative potential in creating smarter and more sustainable farming practices.

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Phytochemical Screening of Farmed Edible Bird Nests fortified with Propolis: Boosting Economic Viability through Scientific Research

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Abstract:

Edible Bird Nest (EBN) is a delicacy valued for its potential health benefits, and the EBN industry is a profitable business in Malaysia. The propolis market in Malaysia is still in the early stages, but the global propolis market is valued at more than USD 600 million. Consumers are increasingly concerned about their health and are seeking sustainable and natural products. This study aimed to compare the phytochemical profiles between hydrolysed farmed edible bird nests (FEBNH) and FEBNH fortified with Stingless Bee Propolis (SBP) of *Genotrigona thoracica* species from Miri, Sarawak. Subsequently, this study also probed into the potential of phytochemical profiling to enhance the economic volatility of local products. The FEBNH powder was prepared using enzymatic hydrolysis, and SBP extract was obtained using aqueous extraction. FEBNH was fortified with 1% and 20% SBP. The results revealed that FEBNH fortified with 20% SBP exhibited the highest intensity of targeted secondary metabolites. Therefore, phytochemical evaluation provides insights into the phytochemical profile of FEBNH and demonstrates the potential of SBP fortification to enhance its bioactive properties, leading the way for the development of novel functional food products. Utilising farmed EBN provides a sustainable raw material and fortifying it with propolis is an innovation to enhance health value and create new products to feed market demand. This indicates a strong and growing global demand for natural organic products, potentially leading to higher demand and prices for local EBN and propolis. However, more research is required to quantify the specific economic impacts.

Keywords: Phytochemical Screening; Hydrolysed Edible Bird Nest; Stingless Bee Propolis; Fortification; Nutraceutical

1. Introduction

Edible Bird Nest (EBN) and propolis are two natural products that have been used in in Traditional Chinese Medicine (TCM) and included in their diet. EBN, is the nest that is made of solidified saliva of swiftlets. EBN is prized for its health benefits, including improving immunity, improving skin complexion, and promoting wound healing (Chua & Zukefli, 2016; Unal et al., 2022; Wong, 2013). EBN's distinctive composition of glycoproteins, sialic acid, and other bioactive compounds has attracted significant research interest (Chong et al., 2022). Currently, there are two main origins of EBN, which are farmed and natural EBN. EBN harvested naturally from the limestone cave in known as natural EBN, nests farmed and harvested from a man-made house or building is known as farmed EBN. The development of farmed EBN is due to the increasing market demand for EBN (Unal et al., 2022)

Currently, one of the scientific approaches to enhance the bioactivity of EBN is through enzymatic hydrolysis. Enzymatic hydrolysis has been reported to improve EBN's solubility and release important bioactive proteins. (Amiza et al., 2019; Hui Yan et al., 2022; Nurfatin et al., 2016). Mutually, propolis, is a natural product with increasing reputation because of it's with a wide range of health benefits, including anti-inflammatory, antimicrobial, and antioxidant activities. (Lim et al., 2023). Consequently, we are recommending the combination of hydrolysed EBN and propolis to synergistically enhance their bioactive potentials.

This study aimed to conduct a phytochemical screening of farmed hydrolyzed edible bird nest (FEBNH) produced through alcalase hydrolysis fortified with propolis from the stingless bee of *Genotrigona thoracica* species. The presence of important secondary metabolites, including phenolics, flavonoids, alkaloids, tannins, triterpenoids, and coumarins, was investigated using standard qualitative tests. The findings provide insights into

the bioactive compounds of the investigated samples, which can be further explored for their potential health benefits and economic values. Additionally, this study seeks to demonstrate how phytochemical screening and standardisation of bioactive compounds can create new markets, mitigate economic volatility, and enhance the economic value of propolis and edible bird nests.

1.1 Edible Bird Nests and Propolis

EBN has been a part of traditional Chinese diet and medicine for centuries, with records dating back to the Tang Dynasty (Quek et al., 2018a). It is mainly harvested from the nests of swiftlets, small cave-dwelling birds found in Southeast Asia. The swiftlets build their nest using their saliva, which solidifies into a gelatinous, translucent material.

Traditionally, EBN is harvested directly from limestone caves across the Southeast Asia region. However, due to massive commercial requests, it has resulted in EBN being harvested from a man-made building also known as Swiftlets House (Chantakun et al., 2021). The EBN harvested from a man-made building is identified as farmed EBN (FEBN).

There are numerous studies comparing natural and farmed EBN. Before, older generation consumers favoured natural EBN, believing that natural is always better (Hamzah et al., 2013; Tan et al., 2020). However, as consumer awareness grows and more scientific studies were conducted on the biochemical and nutritional content of natural and farmed EBN, farmed EBN gained confidence. (Dai et al., 2021)

While propolis is a resinous substance collected by stingless bees to seal and protect their hives from external threats such as pathogens and predators. (Bobiş, 2022). Propolis has been used in traditional medicine for its various health benefit properties, including anti-inflammatory, antimicrobial, and antioxidant activities. (Lim et al., 2023).

Though the long-standing tradition of using EBN in Chinese medicine, the scientific evidence supporting many of their curative claims is still limited. Evaluating the biological activities and health benefits of important bioactive compounds, such as antioxidant, anti-inflammatory, or antimicrobial properties, can further corroborate the value proposition for consumers. (Babji et al., 2018). Nevertheless, the cultural significance and apparent health benefits of EBN have contributed to its persistent popularity as a traditional delicacy and health remedy in many parts of the world. As research continues to explore the bioactive properties of this unique natural product, the potential for developing new health applications remains an area of active investigation. Developing saleable products that highlights their scientifically validated bioactive constituents and health benefits allows producers to promote their product and earned higher prices in the market.

1.2 Enzymatic Hydrolysis and Fortification of Edible Bird Nest (EBNH) with Stingless Bee Propolis (SBP)

Enzymatic hydrolysis utilises enzymes to break down complex proteins into smaller, more readily absorbable protein to enhance the bioactivity and functional properties of EBN (Noor et al., 2018; Tang et al., 2021). This process can improve digestibility, solubility, antioxidant capacity, and release bioactive amino acids with pharmacologic potential. (Amiza et al., 2019). Previous studies have reported that the enzymatic hydrolysis of EBN improve its functional and bioactive properties, making it a promising approach for developing new products with enhanced health benefit potentials. Therefore, this study only utilised hydrolysed EBN for product development.

The combination of EBNH and propolis holds great potential for synergistic effects. Individually, EBNH and SBP has eminent bioactive properties that showed health benefit bioactivities. Therefore, researchers can explore innovative ways to develop enhanced natural remedies that combined both to provide broader spectrum of bioactivity, targeting various aspects of health and wellness. The synergistic effects could potentially lead to improved health benefit outcomes, making the hydrolysed EBN and propolis combination a promising natural product for further investigation and development.

To better understand the potential therapeutic applications of hydrolysed EBN and propolis, it is essential to investigate their phytochemical composition. Phytochemical screening involves the identification and characterization of various classes of secondary metabolites present in plant-derived materials.

1.3 Phytochemical Constituents and Their Therapeutic and Pharmacological Potentials

Phytochemical screening involves screening and identifying numerous classes of secondary metabolites

present in plant-derived materials, such as phenolics, flavonoids, alkaloids, tannins, triterpenoids, and coumarins. (Twaij & Hasan, 2022). Secondary metabolites are known to have important roles in the bioactivity of natural products. For example, phenolics and flavonoids are potent antioxidants that protect cells from oxidative damage. (Rozman et al., 2022). Alkaloids have been associated with various pharmacological activities, including analgesic, anti-inflammatory, and antimicrobial properties. (Zullkiflee et al., 2022). Tannins have been shown to possess astringent, anti-inflammatory, and antimicrobial activities. (Lim et al., 2023). Triterpenoids exhibit a wide range of biological activities, such as anti-inflammatory, antimicrobial, and anticancer properties. (Zulhendri et al., 2022) Coumarins have been studied for their potential in treating various diseases, including cancer, neurodegenerative disorders, and cardiovascular disease. (Lim et al., 2023)

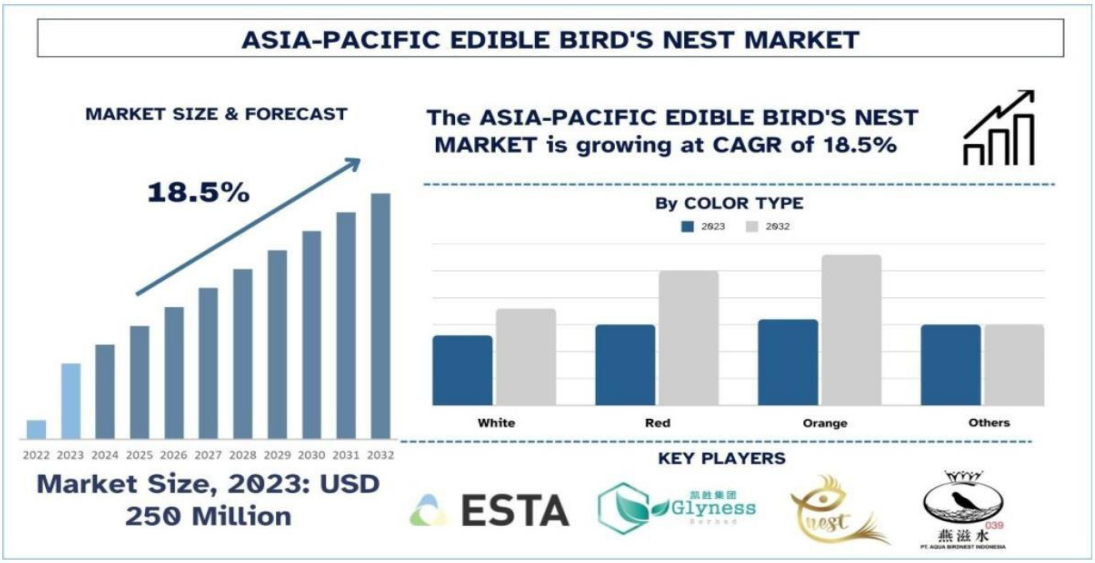
In Traditional Chinese Medicine (TCM), EBN is often used as a health tonic amongst the Chinese, and it is believed that EBN has a multipurpose general health rejuvenation. and nutritional food against reducing cough, treating flu, and respiratory symptoms. It has also been used as remedy for consumption illness, relieved asthma, clear sputum, reducing cough (Ghassem et al., 2017; Yeo et al., 2021) improving libido, haemoptysis, asthenia, improving voice, relieving difficulty in breathing, useful in easing general weakness of bronchial ailment, and relieving gastric trouble. (Ghassem et al., 2017)

Stingless bee, or better known as kelulut in Malay, Malaysia; klanceng in Java, Indonesia; immu in Sulawesi, Indonesia; lukut in Tagalog, Philippines; and damar in Hindi, India, is previously also known as pot honey. (Ngalimat et al., 2020). Previous studies have reported that stingless bee honey is composed of carbohydrates, amino acids, phenolic compounds, organic acids, vitamins, minerals, lipids, and enzymes. (Salleh et al., 2021). The chemical constituents of propolis is effected by the geographical location and botanical sources from which the bees collect the resin. Propolis has been reported to contain bioactive compounds of flavonoids, phenolic acids, and terpenes (Lim et al., 2023). These bioactive compounds is known to be effective in improving va rious conditions, such as oral infections, skin diseases, and even certain types of cancer.(Zullkiflee et al., 2022) The bioactive compounds of flavonoids, phenolic acids, aldehydes, ketones, and terpenes present in propolis have been shown to exhibit strong antibacterial, antiviral, and antifungal properties. (Ibrahim et al., 2016; Lim et al., 2023; Zullkiflee et al., 2022). The bioactive compounds in propolis can help reduce inflammation by inhibiting the production of inflammatory mediators, promoting the healing of damaged tissues, and preventing the development of various diseases, such as cancer and cardiovascular disorders. (Lim et al., 2023)

EBN, EBNH, and propolis are individually recognized for their health benefits and pharmacological potential, contributing to their popularity and market demand. However, the combination of these valuable natural products through fortification remains largely unexplored. The fortification of these substances represents an innovative approach in developing new product varieties and may enhanced synergistic effects. Conducting a phytochemical screening of EBNH and propolis will provide valuable insights into their chemical composition and potential helath benefit applications. This information will guide further research and development, leading to the innovation of novel natural products.

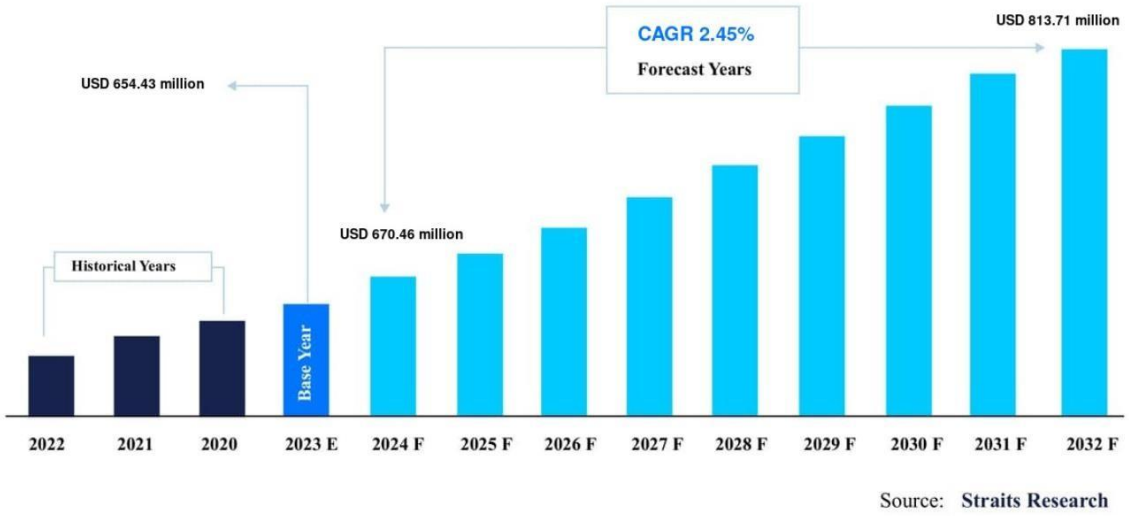
1.4 Economic Importance and Market Potential

Apart from its exceptional taste, increased urbanisation, rising awareness of its health benefits, and higher acceptance for its cultural significance have led to the continuously growing demand for EBN. In the Asia Pacific market alone, its compounded annual growth rate (CAGR) is anticipated to rise at around 18.5% during the forecast period of 2024 to 2032, with a market size estimated at approximately around USD 250 million (UnivDatos Market Insights Report, 2023). While the demand is high, almost 70% of the world demand for EBN is still unfulfilled. (Ya'acob et al., 2021).



(Sources: UnivDatos Market Insights Report, 2023)

Propolis is another precious resource that is gaining much attention due to its medicinal properties and natural origin. The global propolis market size was estimated to grow at a steady rate of 2.45% over the forecast period from 2024 to 2032, with an estimated value of over USD 654.43 million in 2023 (International Research Reports, 2024).



Source: **Straits Research**

The growing interest and awareness for both EBN and propolis has indeed created new market opportunities for business owners. However, these industries are still fragmented and need suitable policies to ensure the industry's sustainability (Nazmi & Rabu, 2015). Several challenges were identified over the decades, including the authenticity of EBN, the quality assurance, and the depletion of the swiftlet population. (Qi Hao & Abdul Rahman, 2016). Furthermore, the propolis market also faces significant challenges, such as inconsistency in raw materials. related to geographic origin (Pant et al., 2024) difficulties in the extraction process to ensure quality (Kasote Vassya Bankova Alvaro Viljoen et al., 2022), which eventually leads to difficulties in developing standardized formulations for commercial use. (Pant et al., 2024).

The high demand for EBN, particularly in TCM, drives its market value, with prices ranging from USD 2000 to 3000 per kilograms, depending on quality and grade. (Ltd, 2022). EBN are primarily concentrated in Southeast Asian countries, namely Thailand, Indonesia, Malaysia, and Vietnam (Quek et al., 2018b) and the Palawan Island in the Philippines (Daud et al., 2019). These regions provide suitable conditions for swiftlets, with humidity

around 90% and temperatures ranging from 28 to 30ºC, along with abundant food sources (Quek et al., 2018a) like insects.

Malaysia, located at the center of the swiftlets' natural habitat, is recognized as a major producer in the EBN industry. (Daud et al., 2019) In Malaysia, EBN is harvested from various regions, including Johor, Kuala Lumpur, Penang, Terengganu, Sarawak, Sabah, and Selangor. (Dai et al., 2021; Quek et al., 2018a).

The emergence farmed EBN has helped to resolve the problem of EBN supply chain. Consequently, the outcomes from the phytochemical profiling may assist in the identification and standardisation of local EBN products. The scientific validation can serve as the foundation for developing premium branding and certification strategies, ultimately driving increased consumer demand, and enabling farmers to earn better prices. By bridging the gap between scientific innovation and economic development.

2. Methodology

In this study, farmed edible bird nests (EBN) were used as compared to natural bird nests. The farmed bird nest (FEBN) was also hydrolyzed with the alcalase enzyme; the stingless bee propolis (SBP) was used from the genus *Genotrigona thoracica*. EBN and SBP samples were obtained from Miri, Sarawak. Additionally, three distinct samples used in this study which are FEBNH, FEBNH + SBP (1%) and FEBNH + SBP (20%). This is because experimenting with various value makes it easier to comprehend how the quantity of SBP influences the bioactive characteristics of the finished products, implying that greater value may improve FEBNH potential health benefits and lower value could be included to assess if minimal fortification still offers some enhanced properties. Furthermore, varying the amount of SBP added helps in figuring out the optimum SBP fortification level to maximize the health advantages while avoiding superfluous raw material use. The balance between cost - effectiveness and bioactive enhancement which is essential for commercial scalability and product development in a growing market, can be evaluated by the researchers by evaluating various levels.

2.1 Sample Preparation

2.1.1 Farmed Edible Bird Nest Hydrolysate (FEBNH) Powder Preparation

The FEBNH powder was prepared using a modified method from Tang et al. (2021). Dried FEBN coarse granules were first macerated in water with 1:1 ratio, at room temperature for 15 minutes before being diluted with boiling water to achieve a 1:50 EBN-to-water ratio. The mixture was simmered for 45 minutes to soften the EBN.

After cooling to 65°C, the pH of the FEBN suspension was adjusted to 6.5 using distilled vinegar. The substrate was then treated with 2% alcalase enzymes to initiate the enzymatic hydrolysis of the EBN, which was allowed to proceed for 2 hours. To terminate the enzyme reaction, the solution was heated to 75°C for 5 minutes. The solution was then filtered using polypropylene membranes with pore sizes of 5µm and 1µm. The resulting FEBN hydrolysates were frozen at -20°C for 48 hours and then freeze-dried. The dried farmed Edible Bird Nest Hydrolysate (FEBNH) powder was crushed and stored in an airtight container for further analysis.

2.1.2 Stingless Bee Propolis (SBP) Extraction Preparation

The propolis extraction is according to the procedure described by Salleh et al. (2021). Initially, 20 grammes of raw propolis samples were pulverized into a powder and mixed with 200 mL of distilled water. The mixture was heated to 70 °C for 5 minutes and then incubated in the dark at room temperature for 24 hours. After incubation, the mixture was filtered using Whatmann No. 1 filter paper and centrifuged at 25,000 rpm for 10 minutes. The resulting propolis extract was stored in a refrigerator at 2°C until further analysis.

2.1.3 Fortification of EBNH Powder and SBP Extract Preparation

To prepare the EBNH-SBP combination, varying volumes of propolis extract (1, and 20 mL) will be incorporated into 20 mL of EBNH solution, resulting in mixtures with SBP of 1% and 20%.

2.2 Phytochemical Screening

Qualitative tests based on visual observation of changes in colour and the observation of the formation of precipitation after the addition of the standard test reagents. The aqueous extract was subjected to different chemical compound screening tests according to standard procedures.

There are six phytochemical tests which were carried out to evaluate the bioactive potential of SBP after added to the FEBNH, namely phenolic, flavonoid, alkaloids, tannin, triterpenoid and coumarin. These compounds are known for their antioxidant, anti-inflammatory, anti-microbial, and other health-promoting qualities. As such, alkaloids, triterpenoids, coumarins, and flavonoids are powerful antioxidants that have additional anti - inflammatory and medicinal properties. After fortification, they offer a thorough profile of bioactive substances that may contribute to the potential development of a unique food product that improves health.

2.2.1 Detection of phenol (ferric chloride test):

1ml of samples was added with 5 drops of 5% ferric chloride solution. The presence of a dark green or bluish black colour indicates the presence of phenolic compounds. (Shaikh & Patil, 2020).

2.2.2 Detection of flavonoid (ferric chloride test):

1ml of sample was added with 5 drops of 10% ferric chloride solution. The presence of green precipitate marked the presence of flavonoid. (Audu et al., 2007; Shaikh & Patil, 2020)

2.2.3 Detection of alkaloids (Dragendroff's test):

A 1 1ml of samples was added with 1 mL of Dragendorff's reagent. The presence of reddish-brown precipitate indicates the presence of alkaloids.(Oshadie et al., 2017; Shaikh & Patil, 2020)

2.2.4 Detection of tannin (alkaline reagent test):

0.4 1ml of samples was added with 4 mL NaOH solution (10%). The mixture was shaken well and observed for any changes. The presence of emulsion indicates the presence of hydrolysable tannin. (Oshadie et al., 2017; Shaikh & Patil, 2020)

2.2.5 Detection of triterpenoid (Salkowski's test):

5 drops of concentrated sulphuric acid was added to the sample and shaken well, then allowed to stand. The appearance of a golden yellow layer at the bottom layer indicates the presence of triterpenoid. (Oshadie et al., 2017; Shaikh & Patil, 2020)

2.2.6 Detection of coumarin (alkaline reagent test):

1m1 of samples was added with 1ml NaOH solution, and the colour changes were observed. The presence of a yellow colour indicates the presence of coumarin (Shaikh & Patil, 2020).

3. Result and Discussion

3.1 Phytochemical Constituents

Table 1: Phytochemical Constituents of Hydrolysed EBN (EBNH) and Hydrolysed EBN fortified with 1% SBP and 20% Stingless Bee Propolis (SBP)

Phytochemical Constituents	**Hydrolysate**		
	FEBNH	**FEBNH + SBP (1%)**	**FEBNH + SBP (20%)**
Phenol	Dark green +++	Dark brown ++++	Dark brown +++
Flavonoid	Dark brown +++	Dark brown ++	Dark brown +++
Alkaloid	Dark green (with precipitate) +	Dark green (with precipitate) +++	Dark green (with precipitate) +++
Tannin	Not present	Not present	Not present
Triterpenoid	Golden yellow layer +++	Golden yellow layer ++	Golden yellow layer +++
Coumarin	Yellow +	Yellow ++	Yellow +++

Note: Intensity: + (Pale); ++ (Light); +++ (Medium); ++++ (Dark)

Table 2: Phytochemical Constituents and Bioactivity Potentials.

Phytochemical Constituents	Detection	Bioactivities	Reference
Phenol	Detected	Anti-apoptosis, anti-ageing, anti-inflammatory, antimicrobial, cardioprotective, anticancer	(Noor et al., 2018; Rocha et al., 2023)
Flavonoid	Detected	Antibacterial, antimicrobial, antidiarrheal, antioxidant, cardioprotective, anticancer	(Dai et al., 2021; Noor et al., 2018)
Alkaloid	Detected	Antimicrobial and antifungal, neuroprotective effects, antioxidant, analgesic and anti-inflammatory, antidiarrheal, antihelminthic, antibacterial	(Dai et al., 2021; Rozman et al., 2022)
Triterpenoid	Detected	antitumor, anti-inflammatory, antifungal, antibacterial, antiviral, antiparasitic, neuroprotection, cardiovascular protection, hepatoprotective activity	(Rozman et al., 2022; Zulhendri et al., 2022)
Coumarin	Detected	anti-inflammatory, anticoagulant, antihypertensive, anticonvulsant, antioxidant, antimicrobial, neuroprotective, antioxidant, anticancer	(Rozman et al., 2022)

The aqueous extract of FEBHN was yellowish and subsequently added with standard chemical reagent to detect the presence of targeted bioactive compounds. Also, the FEBNH was fortified with two different percentage of stingless bee propolis (SBP). The initial colour remains yellowish before the addition of the chemical reagents. Generally, the results showed that there is distinctive observation between the three samples. This can be shown the presence and intensity of the colour observed.

Referring to Table 1, the phytochemical test colour variations show different levels of bioactive chemical in the samples. With the highest intensity at 1% SBP, phenols changes from dark green in FEBNH to dark brown in SBP fortified samples. The colour of flavonoids is consistently showing a dark brown colour and it gets stronger at an increased addition of SBP samples. The dark green colour and precipitate development indicate that alkaloids are present in all samples, albeit to a greater extent in the SBP fortified samples. When the amount of SBP added increased, the coumarins exhibit a more vivid yellow layer which indicate a larger coumarin content, while the golden layer in the triterpenoid test stays constant. These colour shifts imply that SBP fortifi cation improves FEBNH bioactive profile, particularly for coumarins and alkaloids.

Moreover, results in Table 1 showed that FEBNH fortified with 20% SBP exhibited higher intensity of phenols and flavonoids compared to FEBNH fortified with 1% SBP and FEBNH. The increased intensity of phenolics and flavonoids in the FEBNH-SBP (20%) samples suggests that the addition of SBP significantly enhanced the content of these bioactive compounds. This finding is consistent with previous studies that have reported the high phenolic and flavonoid content of stingless bee propolis. (Rozman et al., 2022).

All the samples, including FEBNH and FEBNH fortified with 1% SBP and FEBNH fortified with 20% SBP, showed positive for presence of alkaloids. The FEBNH-SBP (20%) sample exhibited the highest content of alkaloids, followed by FEBNH-SBP (1%) and FEBNH. This shows that SBP may contain high concentrations of alkaloids, which improves the overall bioactive profile of the FEBNH-SBP combination. Conversely, the tannin test found no significant presence of tannins in any of the samples, implying that neither FEBNH nor FEBNH- SBP combinations contain significant levels of tannins.

As for the bioactive compounds of triterpenoids and coumarins, FEBNH and FEBNH-SBP (20%) demonstrated the highest intensity. The FEBNH-SBP (1%) sample showed the lowest intensity of these phytochemicals compared to the other samples.

The enhanced phytochemical profile of FEBNH-SBP (20%) acknowledged the synergistic effect of the bioactive compounds present in both FEBNH and SBP. The fortification with SBP, known for its high content of phenolics, flavonoids, and other phytochemicals, has significantly increased the overall bioactive potentials of the

combined product.

It is evident that hydrolysation and fortification of FEBN and SBP are viable with considerable phytochemical enhancement. The phytochemical screening identifies potential bioactivities, which can help anticipate the pharmacological potentials, as summarize in Table 2. Alkaloids, triterpenoids, phenols, flavonoids, and coumarins are found in food and may have a variety of health benefits such as anti-inflammatory, antibacterial, cardioprotective, and anticancer effects as summarize in Table 2. Each compound contributes to a different therapeutic effect. Hence, these findings underscore the potential of FEBNH fortified with SBP to work as functional food product with diverse health-promoting properties, aligning with current growing market demand for natural, bioactive-rich products.

Furthermore, utilising farmed EBN promotes environmental and economic sustainability. It is also evident that different samples of EBN have different phytochemical profiles. Therefore, this can be used as one of the standards to identify its origin and health benefit properties. Farming EBN typically occurs in controlled environments, such as swiftlet houses designed to replicate natural nesting sites. (Seow et al., 2016). This approach minimises the impact on wild swiftlet populations and their habitats, protecting them from overharvesting (Seow et al., 2016) and ensuring a sustainable supply. By providing swiftlets with optimal nesting conditions, farming also leads to more consistent and sustainable yields, allowing for better monitoring of bird health and nest quality (Tan et al., 2020), which in turn leads to standardised production. The scalability of EBN farming supports stable, continuous production, meeting the growing market demand and promoting economic sustainability by providing a reliable income source for farmers while reducing pressure on natural populations.

4. Conclusion

The results reveal that FEBNH fortified with 20% SBP exhibited the highest concentration of targeted secondary metabolites. The phytochemical evaluation not only highlights the enhanced bioactive properties of FEBNH fortified with SBP but also suggests the potential for developing innovative functional food products with known qualities. The use of farmed EBN offers sustainable, standardised raw materials, while fortification with propolis represents a novel approach to enhance health benefits and meeting natural product market demand. The growing global interest in natural organic products further supports the enhanced marketability of local EBNH and propolis, potentially increasing demand and prices. However, more research is needed to quantify the specif ic economic impacts of these innovations.

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PBM APP: A Comprehensive Solution for Efficient Workshop and Laboratory Management in Civil and Electrical Engineering Departments

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Abstract

Managing workshops and laboratories in educational institutions is a challenging process that requires adherence to current regulations. To address these challenges, developers created the Laboratory Workshop Management, also known as the Pengurusan Bengkel Makmal (PBM) Apps, to facilitate access to information, share management status, and provide real-time updates for users. PBM is accessible through Google Sites and Kodular applications and serves as a reference center for laboratory and workshop management in Civil and Electrical Engineering Departments. The goal is to enhance efficiency, optimize resource utilization, and improve facility accessibility by offering guidance, real-time updates, and user-friendly interfaces. The PBM apps for laboratory management enables equipment and material inventory tracking, as well as scheduling of lab facility maintenance, to streamline data organization. Survey questions has been distributed to PBM apps user in which is a laboratory and workshop supervisor from civil and electrical engineering departments. A sample size of 9 for a population of 9 taken from civil engineering department, and a sample size of 17 for a population of 17 from electrical engineering department, taken to understand the effectiveness of PBM's usage and the impact of PBM's on work performance. Finding shows that Pengurusan Bengkel Makmal (PBM) apps has successfully achieved the objective in increasing efficiency in data management, improved transparency in data management and provide data-driven optimization. As for the impact, finding shows that PBM's has given positive impact on user work performance. This shows that by centralizing information, automating processes, and reducing manual tasks, the apps increase efficiency in managing educational facilities. This innovation has demonstrated the practicality and advantages of using the PBM apps in academic facility management by functioning as a comprehensive reference, guide, and information updated platform.

Keywords :Pengurusan Bengkel Makmal (PBM); Facilities Management; real-time update; Laboratory Workshop Management

1. Introduction

In today's fast-paced research environment, efficient management of laboratory and workshop is crucial. Traditional workshop & laboratory management systems often struggle with inefficiency, lack of transparency, and limited data-driven insights, leading to wasted resources, delays in providing reports, and suboptimal utilization of equipment and facilities. Managing laboratory and workshop facilities in academic institutions involves several scheduling, resource allocation, and operational efficiency difficulties. The absence of a systematic approach to data management can lead to a multitude of problems, hindering an organization's ability to leverage data effectively and achieve its goals.

To address these challenges, 'Pengurusan Bengkel makmal (PBM) apps, a comprehensive solution designed to streamline and optimize laboratory and workshop operations than introduced. 'Pengurusan Bengkel Makmal (PBM) apps is a powerful tool designed to revolutionize laboratory and workshop management. This innovation provides a novel approach for managing academic facilities that makes use of 'Pengurusan Bengkel Makmal (PBM) apps. PBM Apps goal is to improve efficiency, optimize resource use, and increase fac ility accessibility by combining guide, stop center, real-time data update, and user-friendly interfaces. PBM apps aims to streamline laboratory and workshop management, data access and improve overall user satisfaction. This innovation intends to illustrate the feasibility and benefits of using PBM apps in academic facility management by conducting a complete stop center as reference, guide dan update information.

1.1 Problem statement

Effective data management is essential in laboratory and workshop environments to ensure precise documentation, timely data updates, and timely report delivery. At Politeknik Kota Kinabalu, the process usually begins with a request for documentation from the Head of Department (HOD), which outlines the precise demands and specifications. After receiving the directive from the HOD, the departmental asset coordinator prepared the supervisor with an information. Following that, the supervisor of the laboratory and workshop prepares the paperwork upon request. The time frame that is often provided is 3 to 5 working days. Nevertheless, the timeline for compiling asset information for civil engineering department with 6 laboratory and 3 workshops, and 17 laboratories in electrical engineering can easily stretch beyond the initial 3 to 5 days estimate.

Gathering accurate and complete information on each asset can be time consuming due to the process that involves physically checking manually on each item, recording details (serial numbers, purchase dates, condition), and possibly reviewing purchase record. Furthermore, in terms of coordination, involving multiple lab and workshop supervisors for data collection, adds complexity. Ensuring consistent data entry and format across different individual is crucial. Another issue related to data-driven optimization is existing asset records might be scattered, outdated, or incomplete. Thus, consolidating and verifying this information adds to workload.

To address this issue, departmental asset coordinator developed a structured plan for data collection to increase efficiency in data management, improved transparency in data management and provide data-driven optimization, called 'Pengurusan Bengkel Makmal (PBM)' apps. This user-friendly platform offers a range of features that simplify equipment tracking, streamline maintenance schedules, and provide real-time insight into inventory levels. This innovation practicality functioning as a comprehensive reference, guide, and information updated platform by centralizing information, automating processes, and reducing manual tasks.

1.2 Objective

The objective of this study is:

i. To developed 'Pengurusan Bengkel Makmal (PBM)' apps that can be access through Google Sites.

ii. To determine the effectiveness of PBM usage

iii. To determine the impact of PBM on work performance

1.3 Research question

The research question of this study is:

i. How well does PBM usage work?

ii. How does PBM affect performance at work?

1.4 Scope of study

This research aims to evaluate the effectiveness of PBM usage and the impact of PBM on work performance. Target population of respondents are supervisors in civil and electrical engineering departments. This study will not include other staff members and students. This study conducted within one week time and can be access through Google Sites. Independent variable for this study is the use of PBM apps by laboratory and workshop supervisors, and a dependent variable are effectiveness and impact of PBM in user work performance. As for data control and security, only authorized person will be able to upload and update data in PBM's. Another user will only allow to view document uploaded in PBM's.

For effectiveness, it is measured by assessing PBM function on facilitating workshop and laboratory management, duration required to obtain information, accuracy and up-to-date documentation, data-driven optimization for easy decisions related to laboratory management, regularly updated information, overall effectiveness and completeness of the information provided in PBM.

Furthermore, for impact on user work performance, it is measure by assessing the PBM apps on helping to improve user productivity at work, help to reduce errors in laboratory management, assist in monitoring and reporting laboratory assets, help to assess and improve laboratory management practices and lastly, to determine if PBM do support on user professional needs in workshop and laboratory management

2. Literature Review

2.1 Data Management system

Data management is the process of acquiring, evaluating, and using data safely and effectively to enhance outcomes. To address issues with data organization, these challenges have increased the need of an organization's having an effective data management plan. Because there are large amounts of high-quality data that need to be properly handled, an organization needs a flexible, modern data management system that connects with its current technology (Jim, 2024). Data management across many datasets may be done effectively with the help of modern data management tools. Multiple components are usually included in a robust data management plan to facilitate strategy and operations across the entire organization. To improve the effectiveness of data access, a s ystematic approach to data management spanning multiple categories is necessary. Furthermore, it is imperative that data access be granted in a timely and efficient manner.

In this research, Polytechnics require organized and well-managed data management due to multiple laboratories and workshops. Every lab and workshop in the department has equipment that needs to be tracked down, serviced, or organized. Thus, to ensure that data access is efficient, records must be managed appropriately.

2.2 Google site

Google sites is a free website creation tool offered by Google that allows users to build simple websites without needing any coding knowledge. It is part of the Google Workspace suite and integrates with other Google services like Google Calendar, Google Maps, and Google Docs. Google site is designed to be user-friendly, even for those with no coding experience. It is completely free to use, making it an accessible option for individuals. It also integrates seamlessly with other Google services, making it easy to share information. It allows multiple users to collaborate on site, facilitating teamwork and shared projects. A few steps in the data processing process would be to create a workflow for curation and reusability, retain data that can be processed, assign ownership and allowed uses, and make the data citable (Rusbridge, 2007).

Google Sites works by creating a site by selecting a premade template or choosing a blank site. The interface is drag and drop, making it easy to add content like text, images and video. Next is adding content. Google Sites offers a variety of content blocks to add pages, text, image, video, map, calendar and more. Besides, creator may embed content from other Google services such as Google Docs, Google Sheets, and YouTube. There are numerous theme and style options for the website. Once satisfied, creator may publish its and the site will be accessible to anyone with the link.

2.3 Kodular applications

Utilizing the Kodular platform, no coding experience may create Android apps. With its visual block -based programming language and drag-and-drop interface, it opens app development to a larger developer community. The app's layout can be altered by the user by dragging and dropping elements like buttons, text fields, and pictures. To specify an app's functioning, images on its layout are connected to blocks. Because it eliminates the need to write sophisticated code, this visual method makes app development simpler. Kodular offers a range of features that make it powerful tool for app development. Kodular's visual interface makes app building intuitive and accessible to beginners. User can easily arrange components and connect them with blocks to create the desired functionality. Furthermore, Kodular's block-based programming language allows users to create app logic without writing code. Kodular's apps built with Material Design, a modern language developed by Google. Kodular offers a variety of extensions and modules that extend the platform's capabilities. These modules provide access as social media integration, database connectivity and more. In term of community and document ation circle, Kodular has a vibrant community of users and developers who share knowledge, resources, and support. The platform also provides comprehensive documentation that guide user through the app development process.

Since, laboratory and workshop management required effective data management and data storage, implementing best practice using appropriate tools may ensure the reliability and value of the data. According to Edwin (2023), to manage a variety of data sources, guarantee real-time processing, and promote stakeholder engagement, modern data quality procedures make use of cutting-edge technology, automation, and machine learning. To guarantee accurate, dependable, and useful data for well-informed decision-making and commercial success, they place a high priority on data governance, ongoing monitoring, and proactive management. In this innovation project, PBM is accessible through Google Sites and Kodular applications and serves as a reference centre for laboratory and workshop management in Civil and Electrical Engineering Departments.

2.4 Understanding Google Drive

Google Drive is a cloud storage solution that it makes available to anyone who wants to use cloud technology for data backup and easy online file storage. Because the files are uploaded to the cloud, you can use a Google account to access them from any other device with an Internet connection (Olga Weis, 2021). Google Workspace provides flexible storage options, so you will always have enough space for your files. With centralised administration, data loss prevention and Vault for Drive, you can easily manage users and file sharing to help meet data compliance needs. Drive uses Google AI to predict and surface what's important for you in real -time. Drive recognizes important content, collaborators and events, using features like Quick Access and ML -based search enhancements to connect each user with files that may require attention. Use shared drives to store your team's work in secure, easy-to-manage shared spaces. Any files added to shared drives are owned collectively by the team, so everyone stays up to date. Drive for desktop gives you access to files directly from your computer, without impacting all your disk space. Spend less time waiting for files to sync and more time being productive.

Google Drive offers numerous advantages for organizations seeking a robust document management system, making it a viable option for all users. Google drive provides a central repository for all organization's documents, eliminating the need for multiple physical or local storage locations. This centralized storage ensures all team member can easily access the latest versions of files from any device with an internet connection. This accessibility fosters collaboration, reduces confusion, and streamlines communications.

In term of collaboration and shared workspace, Google Drive's real-time collaboration features are a game-changer for organizations. Multiple users can work simultaneously on the same document, making it ideal for team project, brainstorming sessions, and collaborative writing. Google Drive automatically tracks every change made to a document, providing a comprehensive history of edits. This feature eliminates the risk of losing crucial information or accidental overwrites, ensuring data integrity and accountability. In Politeknik, there are various laboratory and workshop in each department. Hence, using google storage data will be an advantage for multiple users to work simultaneously on the same document at the same time. Users can see each other's changes in real-time, fostering a more dynamic and efficient workflow.

2.5 Conceptual design

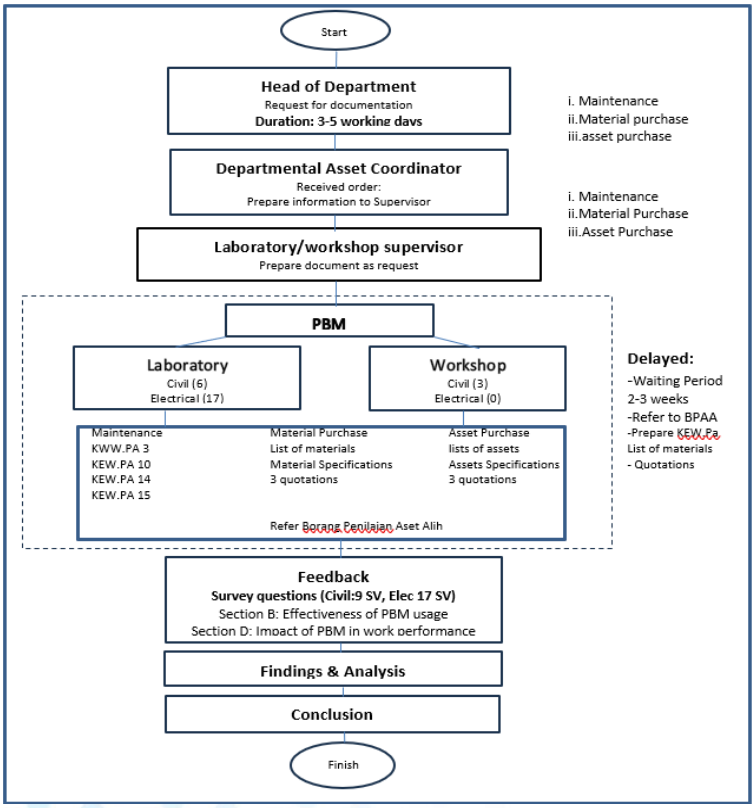

Figure 2.1: Conceptual design

3. Methodology

Methodology on this research consist of two sections. First section is about the development of Pengurusan Bengkel makmal (PBM) apps dan the second sections is a survey questions on determining the effectiveness of PBM usage and the impact of PBM apps on user work performance.

3.1 Development of 'Pengurusan Bengkel Makmal (PBM) apps

PBM interface is divided into two categories. One category is for Jabatan Kejuruteraan Awam and another category is for Jabatan Kejuruteraan Elektrik. By clicking one of the icons, the apss will direct user to the next interface. The next interface consists of 8 sub menus. The sub menus are i. Mengenai PBM, ii. HIRAC, iii. Pengurusan Aset Alih, iv. Borang Rekod Penggunaan, v. Borang KEWPA, vi. Taklimat, vii. Rekod Penyelenggaraan and, viii. Pengurusan Aset Alih. User may click on any of this sub menus to view document. As for Jabatan Kejuruteraan Awam, there are 6 laboratory and 3 workshop. User may click on any laboratory or workshop to view document. To upload document or to update any document, supervisor just need to go to any particular menu or icon to upload document. While, for viewing purposes, supervisor or user may view any document by clicking icons or menus on the interface. To return to main menu, user just need to click on Kembali button. By clicking PBM button at user upper lefthand side, user will be direct to the main page. Figure 3.1, figure 3.2, figure 3.3 show interface and menu's in PBM apps.

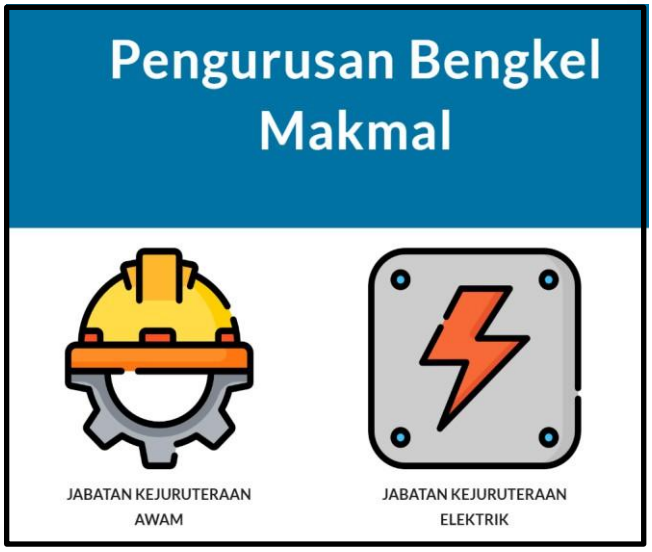

Figure 3.1:PBM Interface

Figure 3.2: 8 Main menus in PBM apps

Figure 3.2:8 Sub menu in PBM apps

3.2 Survey questions

Survey question was distributed to laboratory and workshop supervisor to understand the effectiveness of PBM usage and the impact of PBM apps on user work performance. A sample size of 9 for a population of 9 respondent was from civil engineering department, and a sample size of 17 for a population of 17 respondent was from electrical engineering department. The method to determine a sample size is refer to Krejcie & Morgan (1970) table. Fortunately, researcher manage to get feedback from all the supervisor from civil and electrical engineering department. Each respondent has given 1 week of time to fill in the survey question which is send via link to all respected respondents. Figure 3.1 show sample size table by Krejcie and Morgan (1970).

Appendix D: Sample size table by Krejcie and Morgan (1970)

N	*S*	*N*	*S*	*N*	*S*
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

For PBM apps effectiveness, survey question on facilitating workshop and laboratory management, PBM's simplicity of use, duration required to obtain information, accuracy and up-to-date documentation, data-driven optimization for easy decisions related to laboratory management, regularly updated information, overall effectiveness and completeness of the information provided in PBM are measured.

For the impact on user work performance, PBM apps on helping to improve user productivity at work, help to reduce errors in laboratory management, assist in monitoring and reporting laboratory assets, help to assess and improve laboratory management practices was measured. Questions about PBM's role in meeting user needs for professional support in workshop and laboratory management were also included in the study.

4. Finding and Analysis

4.1 Effectiveness of PBM usage

To measure the effectiveness of PBM usage, survey question on i. facilitating workshop and laboratory management, ii. PBM's simplicity of use, iii. duration required to obtain information, iv. accuracies and up-to-date documentation, v. data-driven optimization for easy decisions related to laboratory management, vi. regularly updated information, vii. overall effectiveness and viii. completeness of the information provided in PBM, are measured.

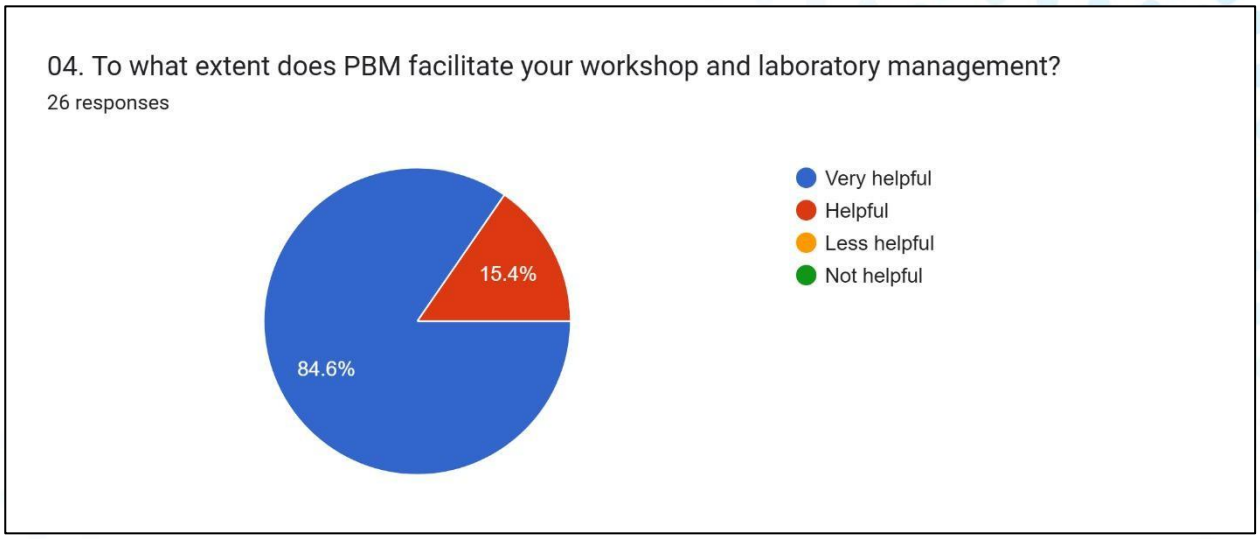

Figure 4.1: PBM function on facilitating workshop and laboratory management.

Figure 4.1 shows the findings on the percentage of PBM functions in facilitating user for workshop and laboratory management. It shows that 84.6% user responds that PBM very helpful in facilitate their workshop and laboratory management. While another 15.4% of the user said that PBM is helpful in facilitate their workshop and laboratory management. Therefore, overall findings show 100% of the user agreed PBM is very helpful in facilitate their workshop and laboratory management.

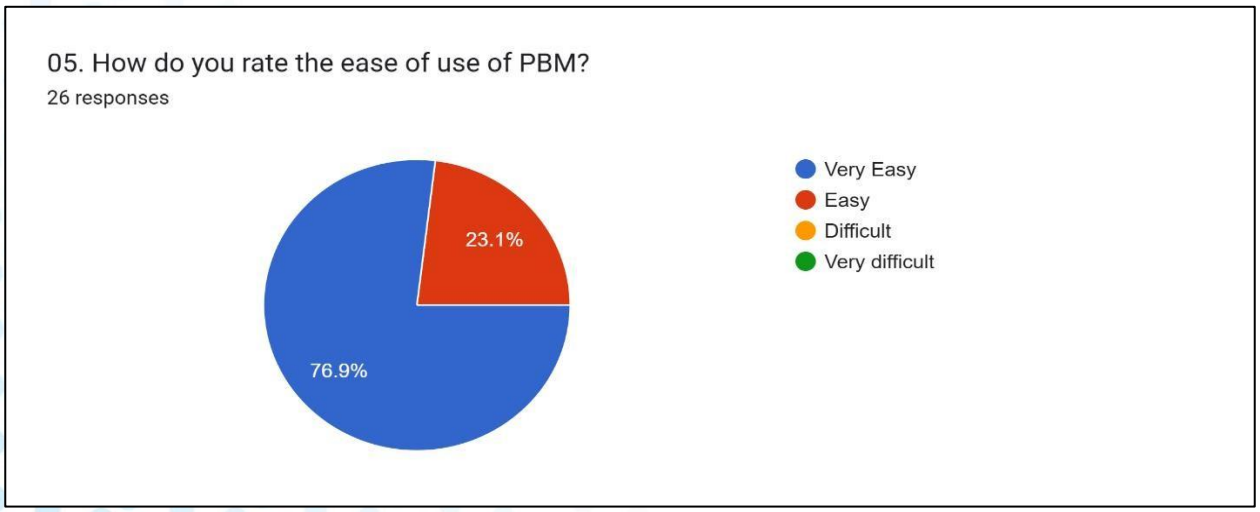

Figure 4.2: PBM's simplicity of use

Figure 4.2 shows the findings on the percentage of PBM's simplicity of use. According to it, 76.9% responds, PBM's is very easy to use and another 23.1% of user said PBM is easy to use. Therefore, overall findings show 100% of the user rate PBM is a user-friendly platform and easy to use.

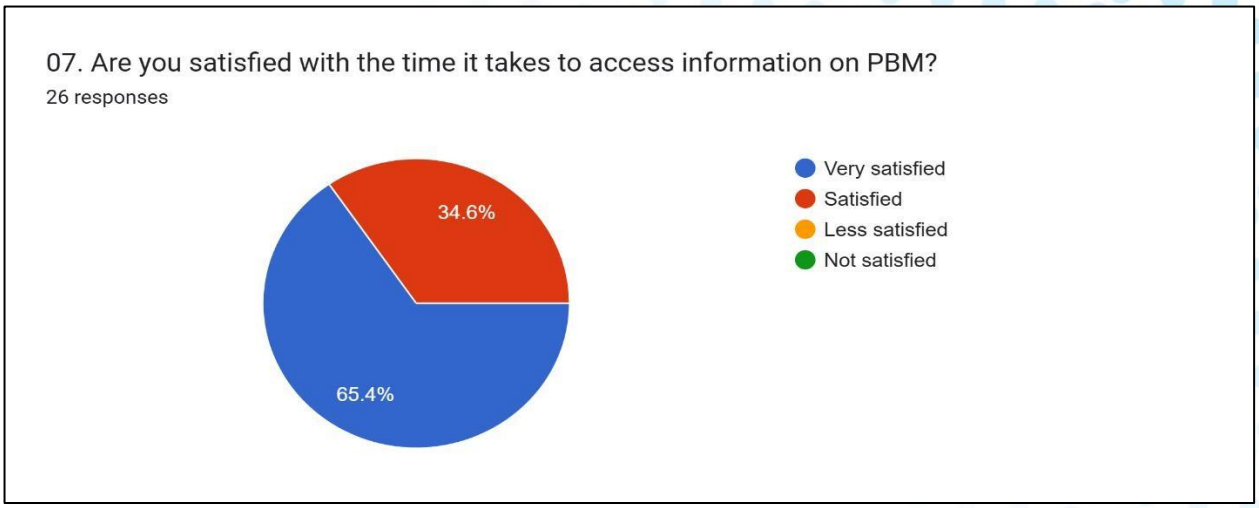

Figure 4.3: Duration required to obtain information

Figure 4.3 shows the findings on duration of time required to obtain information from PBM's. Data shows, 65.4 % of users very satisfied with the duration of times takes to access information in PBM's. Another 34.6% user satisfied with its performance in term of time durations. Therefore, overall findings show 100% of the user does not require much time to access information and users are very satisfied with the time takes to access information on PBM's.

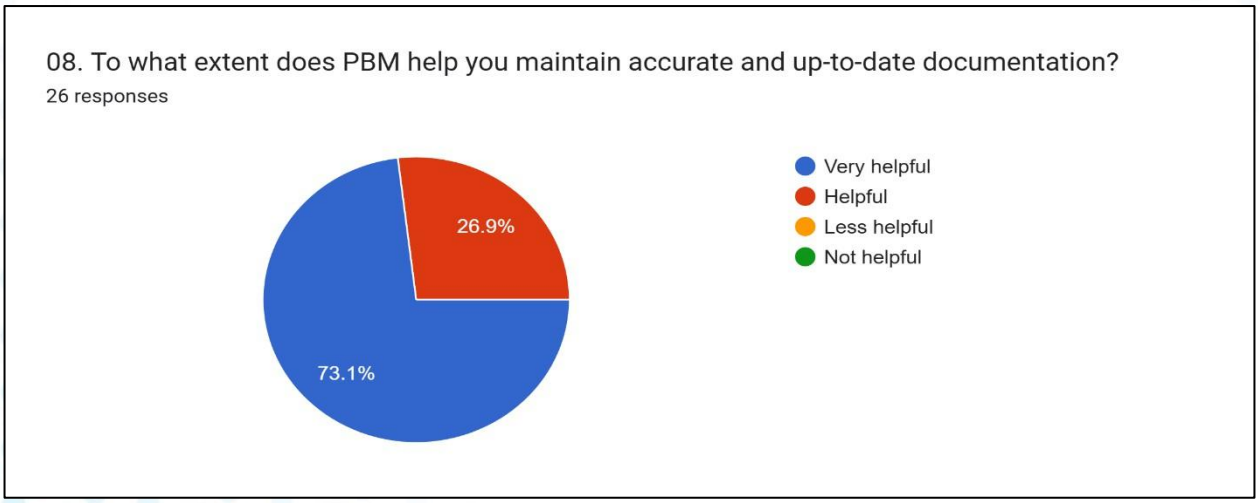

Figure 4.4: Accuracies and up-to-date documentation

Figure 4.4 shows the findings on accuracies and up-to-date documentation. Finding shows 73.1% of users said PBM's is very helpful in maintaining accurate and up-to-date documentation. Another 26.9% of users said PBM's is helpful in maintaining accurate and up-to-date documentation. Overall finding, PBM's are very helpful in maintaining accurate and up-to-date documentation.

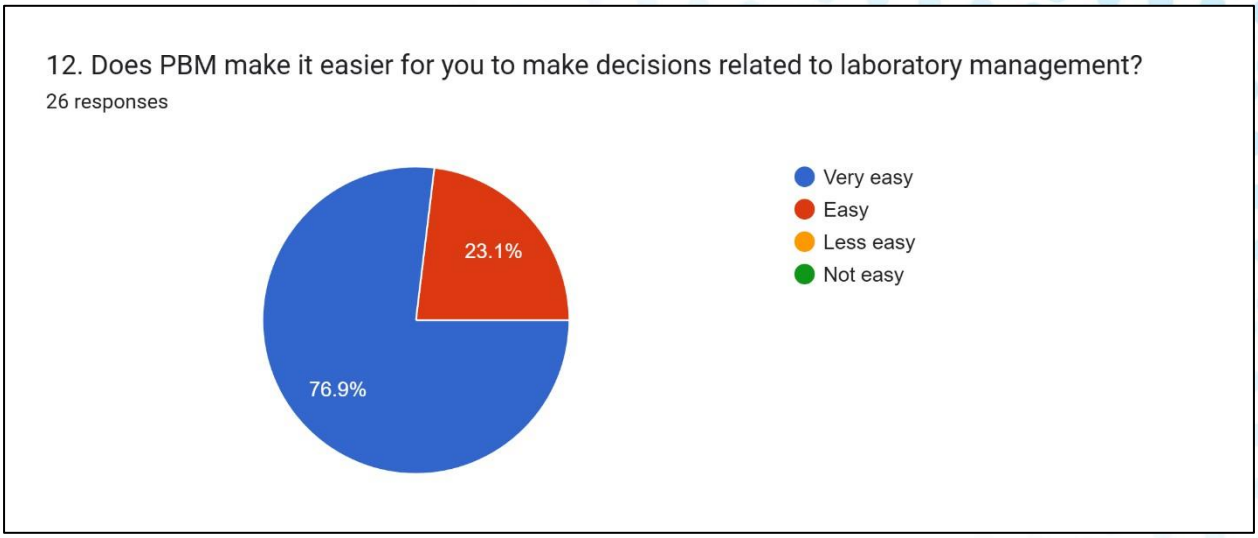

Figure 4.5: Data-driven optimization for easy decisions making

Figure 4.5 show the findings on data-driven optimization for easy decisions related to laboratory management. Based on the findings, 76.9% of users respond, by using PBM's it is very easy for them to make decisions related to laboratory management. While another 23.1% respondents said it is easy to make decisions related to laboratory management. This shows that by utilizing PBM apps functions, it is easier for users to make decisions related to laboratory management.

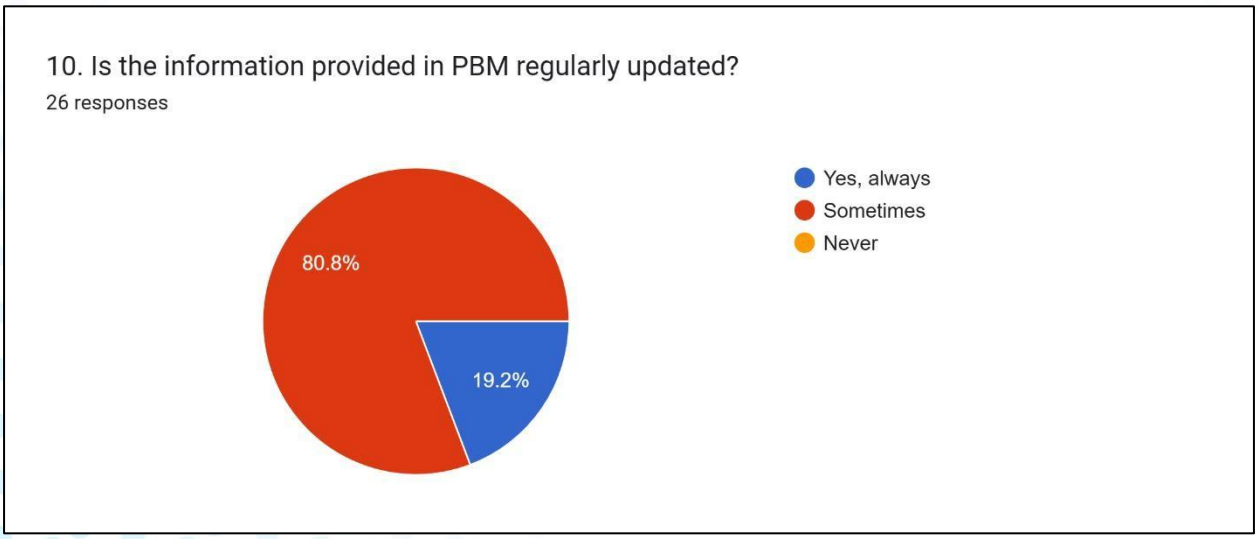

Figure 4.6: Regularly updated information

Figure 4.6 shows data on regularly updated information on PBM's. According to the data, only 19.2% of the information provided in ZPBM regularly updated information while another 80.8% respondent said it is sometimes updated. Overall, workshop and laboratory supervisor only update PBM when there is need to update.

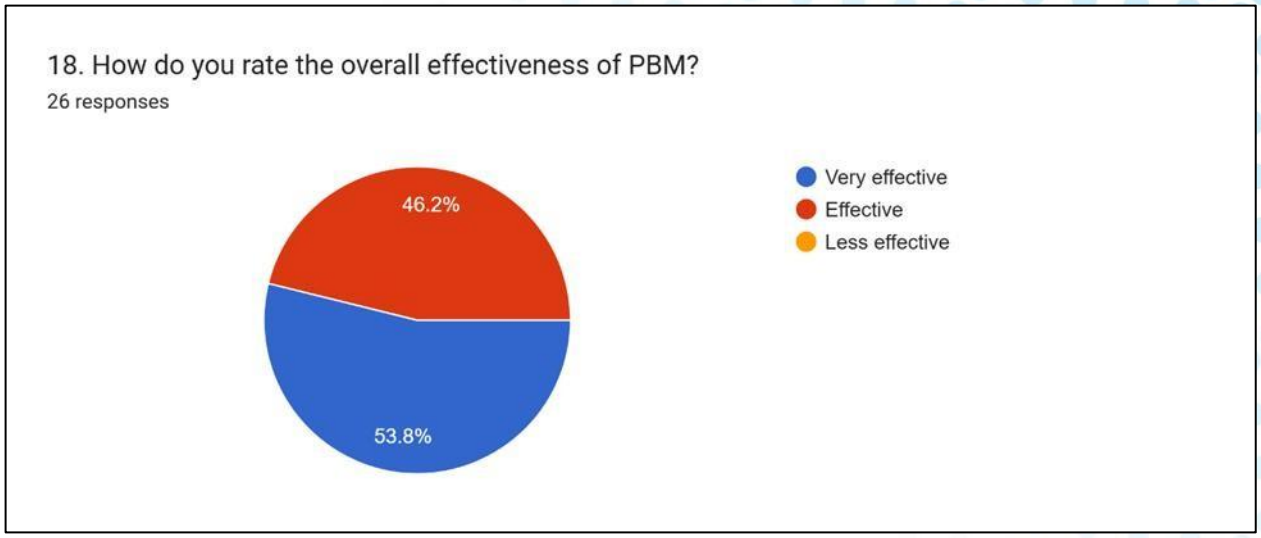

Figure 4.7: Overall effectiveness

Figure 4.7 shows data on overall effectiveness of PBM's. According to the data, 53.8% of the respondent said PBM's is very effective and 46.2% of the respondent said PBM's is effective. This means that overall rating said PBM's is very effective.

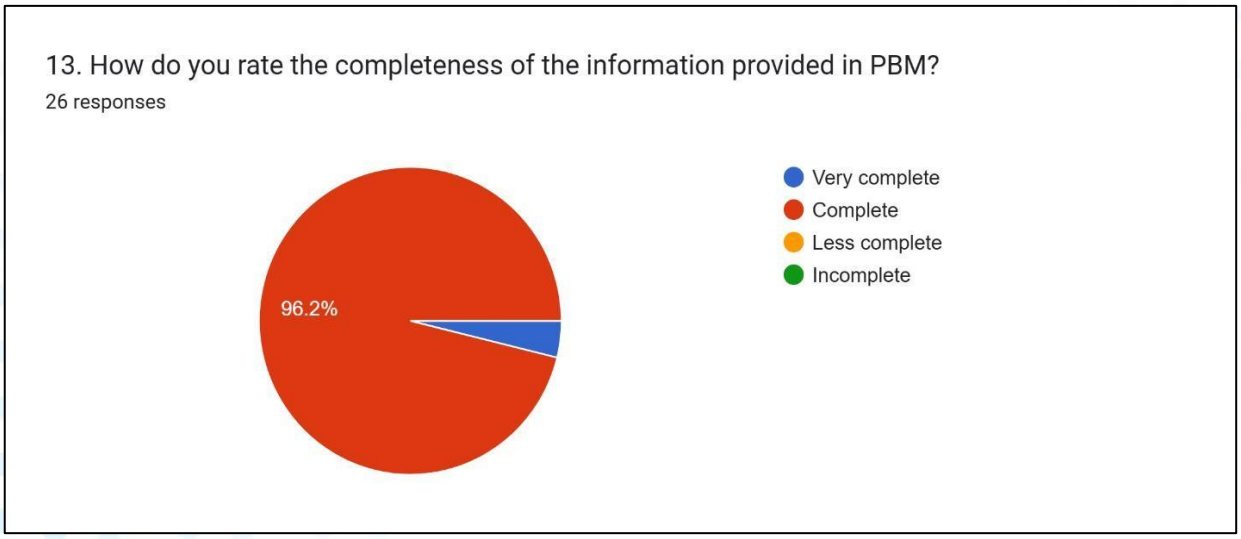

Figure 4.8: Completeness of information provided in PBM's

Figure 4.8: shows findings on the completeness of information provided in PBM's. Based on the findings, 96.2% of the respondent said information provided in PBM's are completed while 3.8% said it is very complete. Overall, PBM's provided complete information for users.

4.2 Impact on user work performance

For the impact on user work performance, survey question on i. helping to improve user productivity at work, ii. help to reduce errors in laboratory management, iii. assist in monitoring and reporting laboratory assets, and iv. help to assess and improve laboratory management practices was measured. Questions about v. PBM's role in meeting user needs for professional support in workshop and laboratory management were also included in the study.

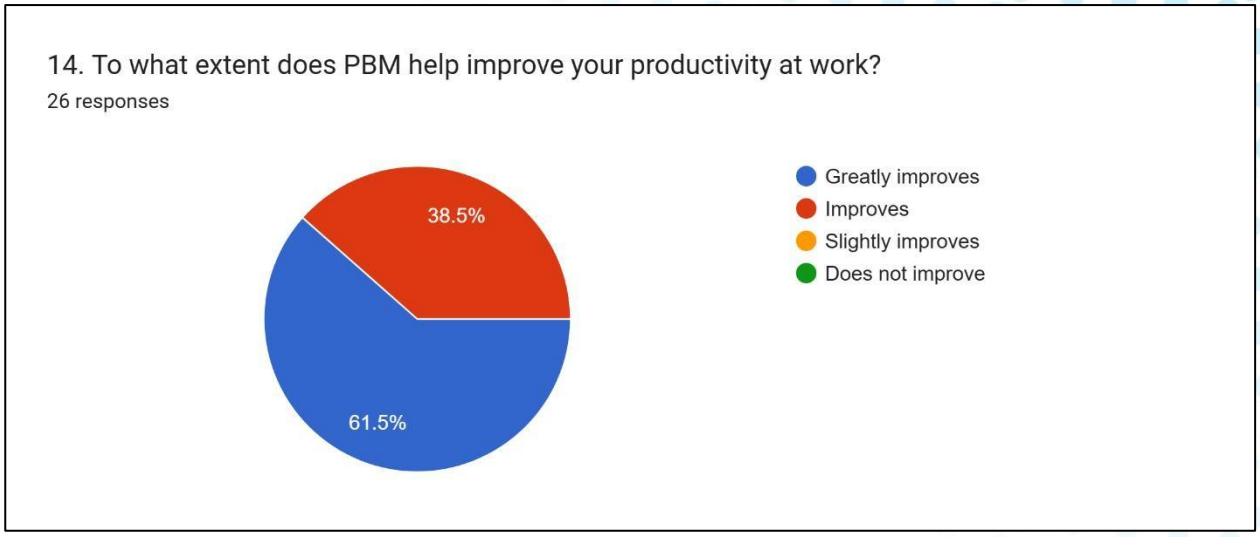

Figure 4.9: Improve on productivity

Figure 4.9 shows the finding of PBM's functions in terms of improved productivity. According to the findings, PBM's user said PBM greatly improves productivity at work. Another 38.5% of the user said PBM's improves their productivity at work. This result shows that PBM's has improved user productivity at work.

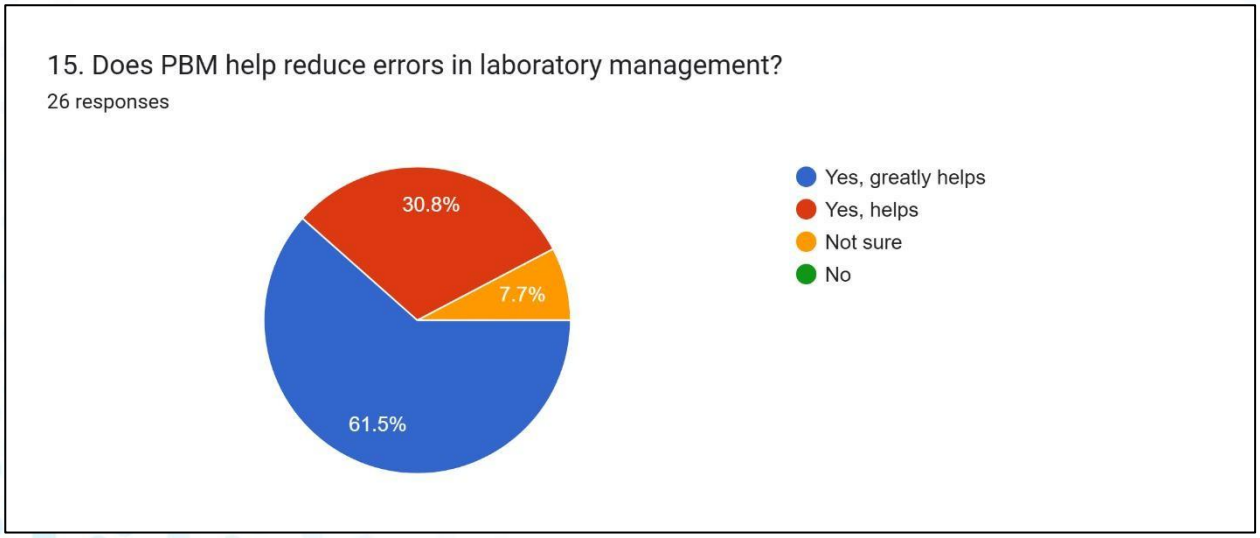

Figure 4.10: Help reduce error in laboratory management

Figure 4.10 on PBM's function to reducing error in laboratory management shows 61.5% user said PBM greatly help reduce errors in laboratory management and 30.8% user said PBM help reduce errors in laboratory management. However, 7.7% of user respond 'not sure' if PBM's help in reducing errors in laboratory management.

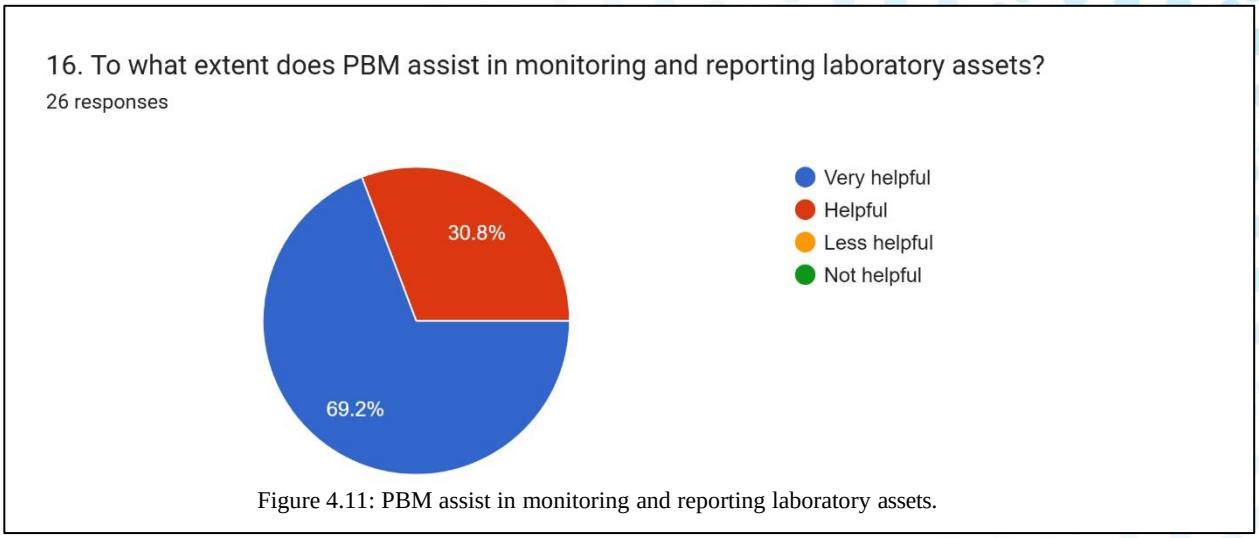

Figure 4.11: PBM assist in monitoring and reporting laboratory assets.

Figure 4.11 shows the result on PBM's function in term of assisting in monitoring and reporting laboratory assets. 69.2% user said PBM's is very helpful in assisting and monitoring works on reporting laboratory assets. While another 30.8% of users said PBM's is helpful. Overall result shows that PBM is very helpful in assisting in monitoring works and reporting laboratory assets.

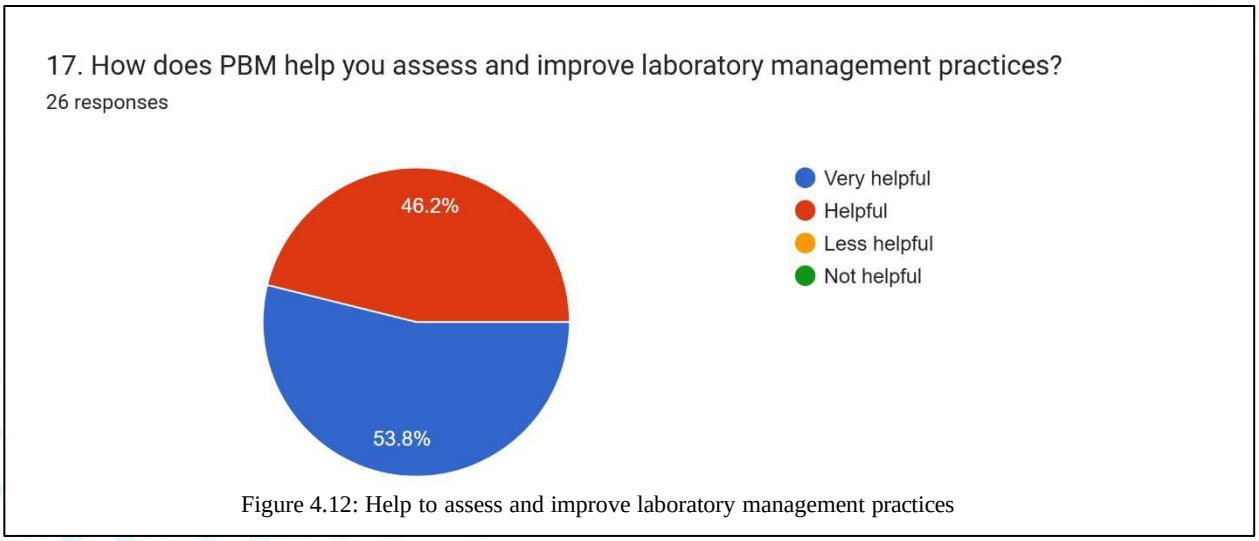

Figure 4.12: Help to assess and improve laboratory management practices

Figure 4.12 show the finding of PBM's in term of helping to assess and improved laboratory management practices. 53.8% of user said that PBM's is very helpful in assessing and improve laboratory management practice, and another 46.2% respondent said PBM's is helpful. This show that PBM's was successfully function as a tool to help user in assessing and improved laboratory management practice.

Figure 4.13: PBM support in professional needs in workshop and laboratory management

Figure 4.13 show the finding on PBM's support in professional needs in workshop and laboratory management. 65.4% user said PBM's greatly supports professional needs in workshop and laboratory management while the other 34.6% said it's support. Overall finding found that PBM greatly supports professional needs in workshop and laboratory management.

5. Conclusion and recomendations

'Pengurusan Bengkel Makmal (PBM)' apps have been successfully developed and has successfully achieved its objective in increasing efficiency in data management and giving positive impact on work performance. In term of effectiveness, PBM's very helpful in facilitate user workshop and laboratory management work. Based on the findings, user rate PBM as a user-friendly platform and easy to use. Furthermore, in term of duration required to obtain information, user does not require much time to access information, and users are very satisfied with the time takes to access information on PBM's. PBM's also helpful in maintaining accurate and up -to-date documentation. Thus, by utilizing PBM apps functions, it is easier for users to make decisions related to laboratory management. Even though, workshop and laboratory supervisor only update PBM when there is need to update, but PBM's data is still relevant as reference to date. Overall rating said PBM's is very effective and provided complete information for users.

In term of the Impact of PBM in Work Performance, result shows that PBM has improve supervisor productivity at work. It also greatly helps in reducing errors in laboratory management. Besides assisting in monitoring works and reporting laboratory assets, PBM was successfully function as a tool to help user in assessing and improved laboratory management practice. Overall rating says that PBM greatly supports professional needs in workshop and laboratory management. This innovation has demonstrated the p racticality and advantages of using the PBM apps in academic facility management by functioning as a comprehensive reference, guide, and information updated platform by centralizing information, automating processes, and reducing manual tasks.

Overall, based on the user feedback, this innovation project called 'Pengurusan Bengkel Makmal' (PBM) have been successfully developed and has successfully achieved its objective in increasing efficiency in data management and giving positive impact on work performance.

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KINABALU MULTIDISCIPLINARY ACADEMIC RESEARCH JOURNAL VOLUME 3, DECEMBER 2024
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POLITEKNIK KOTA KINABALU

Aplikasi Sistem Maklumat Geografi (GIS) dalam Pembangunan Sistem Inventori Aset Hidup Tumbuhan bagi Politeknik Merlimau, Melaka (PMM)

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Abstrak

Kertas kerja ini membentangkan pembangunan sistem inventori aset hidup tumbuhan Politeknik Merlimau, Melaka (PMM) menggunakan aplikasi Sistem Maklumat Geografi (GIS). Pembangunan sistem inventori ini dihasilkan bagi memperkemas pangkalan data sistem pengurusan aset hidup tumbuhan (TPT) sedia ada di PMM yang disimpan secara konvensional kepada GIS. Bertepatan dengan Program Penghijauan Malaysia melalui 'Kempen Penanaman 100 juta Pokok 2021-2025' yang telah dijalankan di PMM, aset hidup tumbuhan yang baru ditanam perlu didaftarkan mengikut Pekeliling Perbendaharaan Malaysia. Sistem ini dibangunkan menggunakan perisian ArcGIS Pro dengan gabungan atribut dan data spatial yang dicerap menggunakan peralatan *Global Navigation Satellite System* (GNSS) menjadikan sistem ini sangat membantu dalam melakukan kerja pengurusan dan penyelenggaraan terutama untuk pokok yang baru ditanam. Dengan sokongan aplikasi GIS, lokasi sebenar setiap pokok di sekitar kampus dapat dijejak dengan mudah mengikut jenis pokok dan segala maklumat inventori pokok seperti anggaran umur pokok, kod pendaftaran pokok dan sebagainya boleh diketahui. Akhir sekali, untuk memudahkan capaian data daripada pelbagai pihak terutamanya pihak Unit Pembangunan dan Penyelenggaraan (UPS) PMM kepada sistem ini, sistem ini juga telah diintegrasikan ke dalam paparan antaramuka interaktif dan laman web. Kesimpulannya, hasil daripada sistem ini diharap boleh dijadikan asas supaya sistem ini dapat dimanfaatkan kepada analisis GIS dan kajian pemetaan pokok yang lain.

KATAKUNCI: *aset hidup tumbuhan; pangkalan data pokok; pemetaan pokok; kampus hijau; Sistem Maklumat Geografi (GIS)*

Abstract

This paper presents the development of a plant life asset inventory system using Geographical Information System (GIS) application. The development of this inventory system was produced to streamline the plant life asset management system database at Politeknik Merlimau, Melaka (PMM) which is stored conventionally to a GIS. Coinciding with Malaysia's greening program through the '100 million Tree Planting Campaign 2021-2025' carried out at PMM, newly planted trees should be registered following the Malaysian Treasury Circular. This system was created using ArcGIS Pro software with a combination of attributes and spatial data collected using Global Navigation Satellite System (GNSS) equipment making this system very helpful in doing management and maintenance work for updated newly planted trees. With support GIS application, we can easily track the exact location of each tree around campus according to the types of trees and tree inventory information such as estimated tree age, tree registration code, etc. Finally, to facilitate data access from various parties especially the Development and Maintenance Unit of PMM through this system, this system also has been integrated into the interactive dashboard and website. In conclusion, the result of this system as a basis is hoped that this system can be utilized for other GIS analysis and study of tree mapping.

KEYWORDS: *plant life asset; tree database; tree mapping; green campus; Geographical Information system (GIS)*

1. Pengenalan

Berdasarkan (Pekeliling Perbendaharaan Malaysia, 2013) segala Aset Hidup Tumbuhan milik premis kerajaan perlu di uruskan meliputi Penerimaan, Pendaftaran, Penggunaan dan Penjagaan, Pemeriksaan, Pindahan, Pelupusan, Kehilangan dan Hapus Kira sebagaimana aset-aset kerajaan yang lain sebagaimana termaktub dibawah AM5: Tatacara Pengurusan Aset Hidup Tumbuhan (TPT). Tumbuhan pula didefinasikan apa-apa jenis tumbuhan atau apa-apa bahagian yang terhasil daripadanya termasuklah batang, dahan, ubi, bebawang, umbisi, rhizom, pokok penanti, kayu mata tunas, keratan, tut, keratan tunas, pelekap, akar, daun, bunga, buah, biji atau apa-apa jua bahagian atau keluaran lain dari sesuatu tumbuhan itu sama ada terputus atau tercantum. (Pekeliling Perbendaharaan Malaysia, 2013) juga mengkategorikan tumbuhan kepada 3 kategori iaitu tanaman kekal, tanaman bukan kekal dan bahan tanaman. (Pekeliling Perbendaharaan Malaysia, 2013) juga mendifinasikan tumbuhan kekal bermaksud tanaman yang jangka hayat ekonomik melebihi 3 tahun yang ditanam untuk tujuan pengeluaran hasil, pemerhatian teknologi, penyelidikan, ameniti dan pemuliharaan genetik tumbuhan. Bagi maksud pendaftaran aset, tumbuhan yang diterima melalui pembelian dengan wang Kerajaan termasuk untuk tujuan penyelidikan, hasil penyelidikan, hadiah, pembiakan, lucut hak, pindahan, ameniti dan sumber liar juga Bahan Tanaman yang akan dijadikan sebagai tanaman kekal atau tanaman bukan kekal hendaklah didaftarkan dibawah Tatacara Pengurusan Aset Hidup Tumbuhan (TPT). Manakala tumbuhan yang tidak perlu didaftarkan adalah tumbuhan yang tumbuh di kawasan hutan yang diwartakan dan tumbuhan yang tumbuh di tanah/ premis hak milik jabatan yang tidak memerlukan penjagaan dan penyelenggaraan.

Politeknik Merlimau, Melaka (PMM) sebagai salah sebuah institusi pendidikan awam juga tidak terkecuali terlibat dalam pengurusan aset hidup tumbuhan ini. Sebagai salah sebuah kampus yang telah mendapat pengiktirafan dunia *the 329th World's Most Sustainable University in 2023 UI Green Metric World University Rankings* dan kedudukan ke 16 Institusi Pendidikan Awam terbaik di Malaysia, penerapan amalan lestari hijau di dalam kampus sinergi kepada amalan mesra alam dan pendidikan untuk mempromosikan amalan lestari serta mesra alam di dalam politeknik melalui memperkasakan 7 bidang tumpuan dibawah Blueprint SmartGreen PolyCC (BSGPC) 2021-2026. (SmartGreen PMM, n.d). Salah satu bidang tumpuan tersebut adalah Bidang Tumpuan 3 Pengurusan Alam Sekitar dan Landskap dengan mengintegrasi amalan pengurusan alam sekitar dalam pengoperasian institusi melalui dasar-dasar dan prosedur bagi memastikan amalan alam sekitar terbaik diaplikasikan dalam urusan harian. Fokus dalam pengurusan landskap pula mamberi tumpuan ke arah mem beri kefahaman yang jelas tentang kepentingan kepelbagaian bio dan landskap terhadap kelestarian alam sekitar serta mewujudkan landskap yang dapat mengekalkan kepelbagaian bio setempat. (SmartGreen PMM, n.d). Aspek pengurusan dan penyelenggaraan pokok-pokok landskap di kampus adalah merupakan salah satu aspek yang sangat penting dan perlu diberi perhatian. Pokok-pokok yang diurus dan diselenggara dengan baik akan dapat memberi faedah dari segi fungsi, estetik dan ekologi bagi menghasilkan persekitaran yang kondusif dan berkualiti. Warga kampus juga semakin peka dengan isu-isu alam sekitar dan kepentingan pokok serta kawasan hijau. Salah satu usaha yang telah dijalankan PMM juga adalah melalui Program Penghijauan Malaysia 100 juta pokok 2021 - 2025: PMM Prihatin yang telah dijalankan pada 3 September 2022 yang bertepatan dengan Program Penghijauan Malaysia ke arah 'Kempen Penanaman 100 juta Pokok 2021-2025' yang telah dijalankan di PMM, aset hidup tumbuhan atau bahasa mudahnya pokok yang baru ditanam perlu didaftarkan mengikut Tatacara Pengurusan Aset Hidup Tumbuhan (TPT) supaya penanaman pokok tersebut dapat memaksimumkan faedah pada jangkamasa panjang.

Menurut (Perbadanan Putrajaya [PPJ], n.d), amalan arborikultur yang betul perlu dipraktikkan bagi memastikan penanaman pokok memberi manfaat untuk tujuan jangka masa panjang. Arborikultur adalah mengenai seni dan sains penanaman dan penjagaan pokok di persekitaran bandar yang melibatkan aktiviti pemantauan dan penyelenggaraan yang mana datanya perlu sentiasa dikemaskini. Ini termasuklah data-data seperti jenis pokok, bilangan pokok, lokasi dan kedudukan pokok, saiz pokok, status kesihatan semasa pokok. (PPJ,n.d.) juga menyatakan pengurusan data dan maklumat ini dapat diurus dengan baik melalui penghasilan inventori pokok yang berbantukan penggunaan teknologi seperti *Global Positioning System* (GPS), *Geographical Information System* (GIS) atau *Radio Frequency Identification* (RFID) yang memudahkan untuk merancang dan membuat keputusan yang baik tentang pengurusan berkaitan pokok.

Berdasarkan sesi temuramah yang dijalankan bersama Penolong Jurutera (Awam), Unit Pembangunan dan Selenggara (UPS), PMM mengatakan bahawa maklumat aset hidup tumbuhan kekal yang hendak ditanam dikira secara manual. Selain itu, nama pokok juga dirujuk melalui buku panduan jenis tumbuhan dan usia tumbuhan kekal juga dilakukan secara anggaran sahaja. mengatakan pihak UPS hanya menyimpan rekod tumbuhan kekal menggunakan sistem pengurusan fail secara manual dan separa komputer. Selain itu, beliau juga mengatakan tiada

lagi pangkalan data digital tumbuhan kekal di PMM. Hal ini demikian, menyebabkan dokumen berkenaan tumbuhan kekal itu mudah hilang dan susah untuk dikemaskini. Kaedah yang digunakan ini juga menyebabkan dokumen susah untuk dikemaskini contohnya, lokasi sebenar bagi setiap tumbuhan kekal tidak lengkap. Selain itu, jika berlaku pertukaran pegawai UPS, serahan maklumat tidak akan lengkap kerana mereka menggunakan sistem pengurusan fail secara manual dan separa komputer. Kajian awal seperti mengumpulkan data aset hidup tumbuhan tanaman kekal pernah dilakukan oleh pihak selenggaraan iaitu UPS sebelum ini di PMM. Walaubagaimanapun, kajian ini perlu diteruskan kerana belum terdapat data inventori aset hidup tumbuhan dan tiada rekod pangkalan data yang lebih sistematik menggunakan informasi teknologi GIS yang boleh dicapai dengan interaktif dan mudah.

Oleh itu, objektif utama bagi kajian ini adalah untuk merekabentuk sebuah pangkalan data inventori aset hidup tumbuhan Politeknik Merlimau menggunakan aplikasi GIS dan keperluan di dalam AM5: Tatacara Pengurusan Aset Hidup Tumbuhan (TPT).

2. Kajian Literatur

2.1 Pokok aset semulajadi

Pokok menurut (Wikipedia, 2024) adalah merupakan tumbuhan berkayu yang terdapat dalam alam tumbuhan. Pokok mempunyai akar, batang, dahan, dan daun. Beberapa spesies pokok tumbuh sehingga ketinggian 100 -meter (300 kaki) dan terdapat pokok yang mampu untuk hidup sehingga beberapa abad dan ada yang sehingga mencecah seribu tahun. Akar, batang, dahan, ranting, dan daun merupakan bahagian yang penting bagi sebatang pokok. Batang pokok umumnya terdiri daripada tisu penyokong xilem, dan tisu pengangkutan. Batang pokok akan membina gelang pertumbuhan apabila pokok semakin tua. Batang pokok akan semakin bertambah tinggi di atas permukaan tanah bagi membolehkan cabang dan ranting berdaun mendapatkan cahaya matahari. Susunan dahan pokok memberikan peranan penting untuk pendedahan cahaya matahari yang optima kepada daun. Sinaran cahaya matahari amatlah penting kepada pokok dalam penghasilan proses fotosintesis bagi menghasilkan kanji bagi pokok. Manakala definisi pokok di bawah Program Penghijauan Malaysia melalui kempen 'Program Penanaman
100 juta Pokok 2021-2025' adalah meliputi semua jenis pokok yang merupakan tumbuhan berkayu yang mempunyai akar, batang, dahan dan daun. (Kementerian Sumber Asli dan Kelestarian Alam [NRES],n.d)

Menurut National Geographic (seperti yang dinyatakan dalam Aishah Hanawi et al., 2017), menyatakan bahawa:

> ”Penebangan hutan boleh menyebabkan hakisan tanah. Tanpa perlindungan daripada pokok, tanah mudah menjadi kering disebabkan pendedahan kepada matahari sepanjang hari. Pokok juga membantu dalam pengekalan kitaran air dengan mengembalikan wap air kembali ke atmosfera. Akar pokok menyerap air hujan dan menggenggam tanah-tanih dengan ketat bagi mengelakkan hakisan dan keruntuhan tanah. Keseimbangan alam sekitar dapat dipelihara melalui penanaman pokok. Kestabilan ekosistem dan udara yang bersih membekalkan persekitaran yang sihat dan selesa.” (p.44)

Kenyataan ini juga disokong kajian Farah Ayuni Mohd Hatta (2020) menyatakan bahawa pokok bernilai penting dalam menjamin kelestarian persekitaran dan kesihatan manusia. Pokok di bandar perlu dipelihara dan penebangan pokok bukanlah solusi terbaik untuk mengelakkan pokok tumbang. Kejadian pokok tumbang dapat apat dielakkan sekiranya hal berkaitan pengurusan dan penyelenggaraan pokok diberi perhatian sepenuhnya pada peringkat awal lagi dengan mengambil kira faktor pemilihan spesies pokok bersesuaian, penyedia an ruang mencukupi dan penggunaan media tanaman yang baik.

Oleh itu jelaslah kepentingan pokok kepada ekosistem dan menjadi tanggungjawab semua agar aset semulajadi ini perlu di konservasi dan dilindungi.

2.2 Keperluan Sistem Inventori pokok dan GIS

Sistem Maklumat Geografi (GIS) adalah satu sistem untuk menangkap, menyimpan, memeriksa, mengintegrasikan, memanipulasi, menganalisis dan memaparkan data yang berkaitan dengan reruang yang berpandukan kepada bumi (Ang Kean Hua, 2015). GIS perlahan-lahan beralih daripada perisian desktop tradisional kepada persekitaran dalam talian berasaskan awan. pelbagai pemetaan web sumber terbuka yang tersedia termasuk Openweb GIS, MangoMap dan Mapbox.

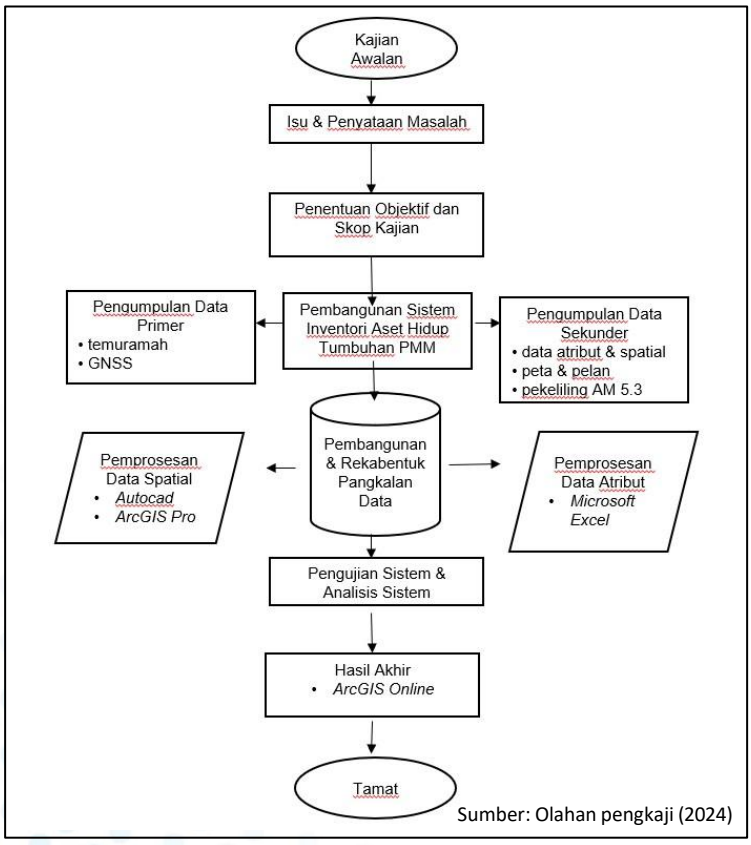
Jabatan Landskap Negara [JLN], n.d menyatakan kerja pengumpulan data dan penyediaan inventori pokok amat penting bagi kerja-kerja penilaian risiko pokok dan penilaian ekonomi pokok bagi pokok-pokok yang telah diinventori, seterusnya melaksanakan kerja-kerja konservasi bagi pokok yang bermasalah melalui cara pendekatan arborikultur dalam program pengurusan dan penyelenggaraan risiko pokok-pokok

(JLN,n.d.) juga menyatakan kategori pokok yang terlibat dalam program ini adalah pokok yang mempunyai nilai istimewa seperti nilai karektor semulajadi dan estetika yang tinggi, pokok-pokok endemic yang terdiri daripada spesies pokok yang hanya didapati tumbuh di tempat-tempat tertentu sahaja, pokok yang terancam di mana spesisnya menghadapi masalah kepupusan dan lain-lain pokok berisiko tinggi yang mempunyai ukur lilit melebihi 0.8m, di mana diameter batang pokok diukur 0.5m dari permukaan aras tanah.

Mohd Hambali (2020) menyatakan dalam kerja inventori pokok telah dijalankan dalam kawasan hutan gelam sebagai salah satu aktiviti projek penyelidikan. Tujuan inventori ini dilakukan bertujuan mendapatkan data bagi penilaian ekosistem di kawasan pertumbuhan hutan gelam, pengiraan isipadu dirian, pengiraan biojisim dan karbon. Kerja penandaan GPS juga dilakukan untuk setiap plot bagi tujuan pemetaan kawasan inventori. Disini dapat dilihat keperluan pemetaan pokok juga amat dipentingkan untuk mewujudkan sistem inventori pokok.

3. Metodologi

Penerangan proses pembangunan Sistem Inventori Aset Hidup Tumbuhan Politeknik Merlimau ini dapat diringkaskan melalui carta alir pada Rajah 3.0.

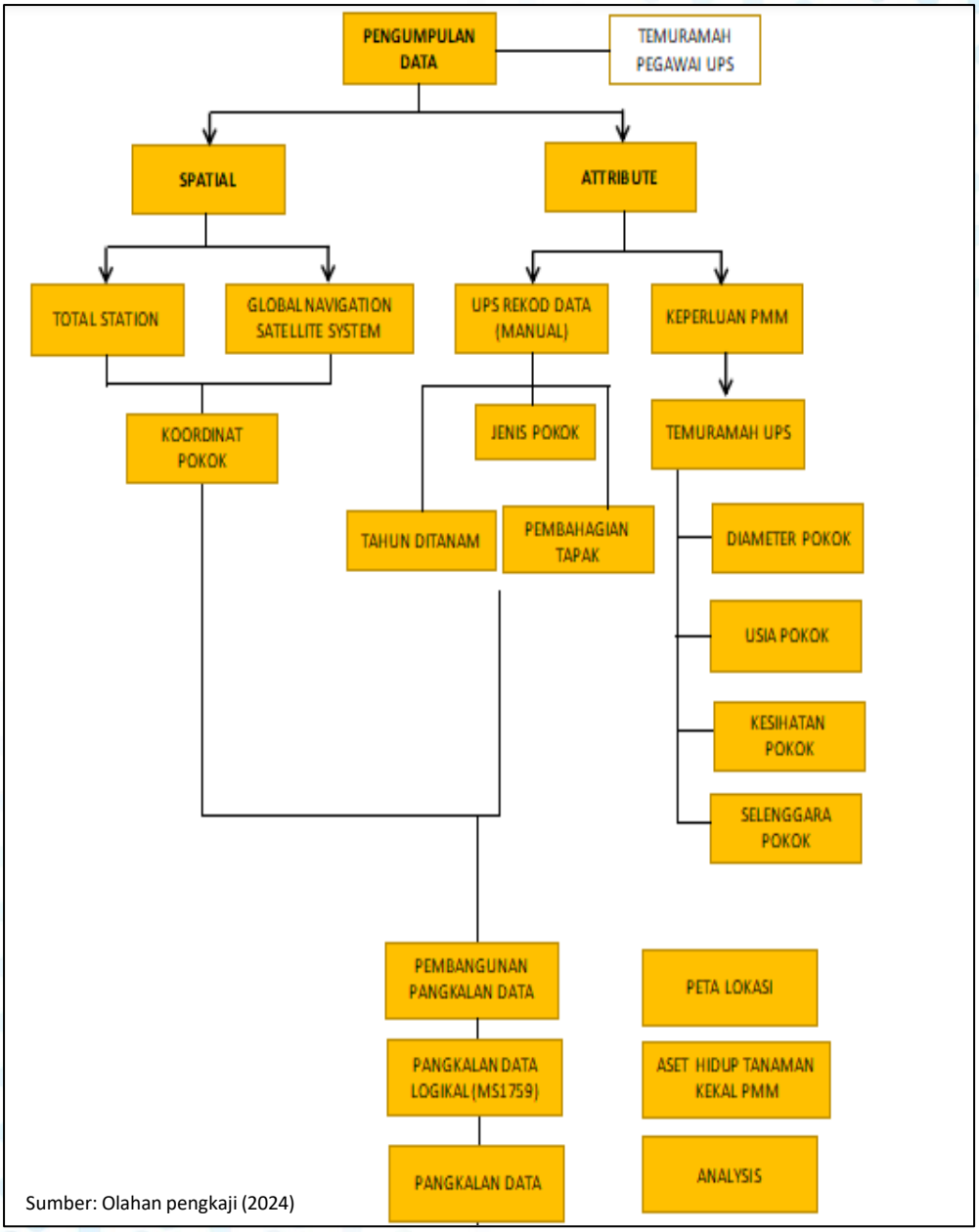


Rajah 1: Carta alir pembangunan Sistem Inventori Aset Hidup Tumbuhan PMM

3.1 Pengumpulan Data

Kerja pengumpulan data bagi sistem ini dibahagikan kepada dua bahagian iaitu pengumpulan data spatial dan data atribut *(non-spatial)* seperti yang ditunjukkan pada Rajah 2.

Rajah 2: Pengumpulan data atribut dan data spatial

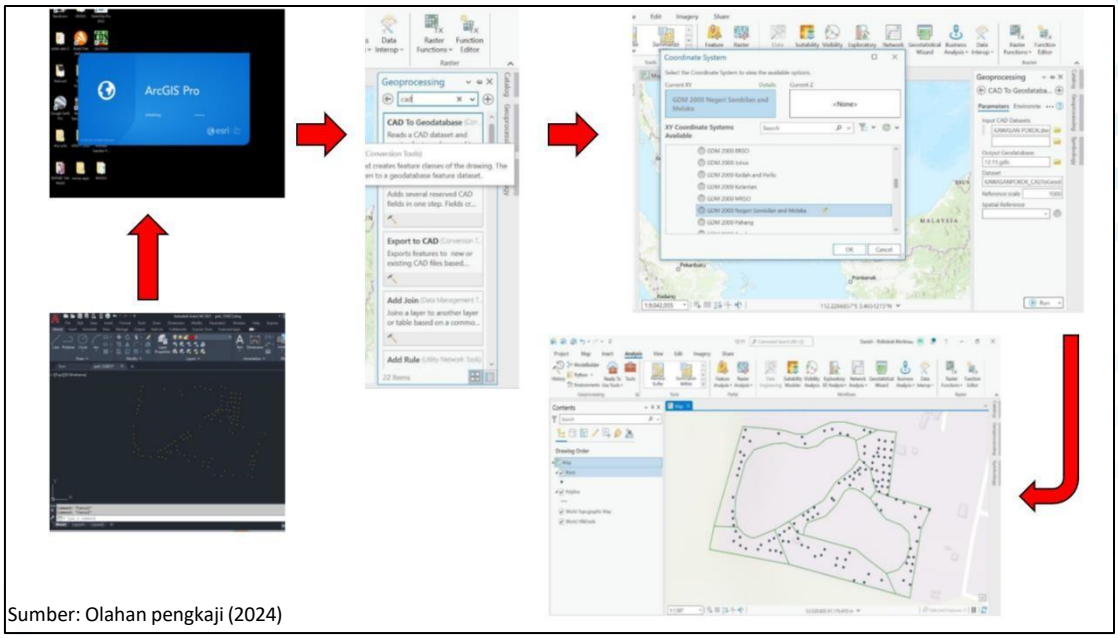


Sumber: Olahan pengkaji (2024)

Kelebihan penggunaan GIS adalah pada data spatial dimana maklumat spatial untuk pemetaan sistem ini diperolehi melalui cerapan di lapangan dengan menggunakan peralatan ukur terkini iaitu *Global Navigation Satellite System* (GNSS) bagi penentuan lokasi pokok mengikut kriteria di seluruh Politeknik Merlimau juga dari pelan lokasi Politeknik Merlimau. Manakala data atribut pula mengandungi data yang direkod oleh pihak UPS adalah jenis pokok, tahun tumbuhan ditanam dan pembahagian tapak menggunakan kaedah konvesional dalam perisian Microsoft Excel. Pihak UPS juga telah mencadangkan keperluan data baharu seperti diameter pokok, usia pokok, kesihatan pokok dan selenggaraan pokok.

3.2 Pemprosesan Data/Maklumat

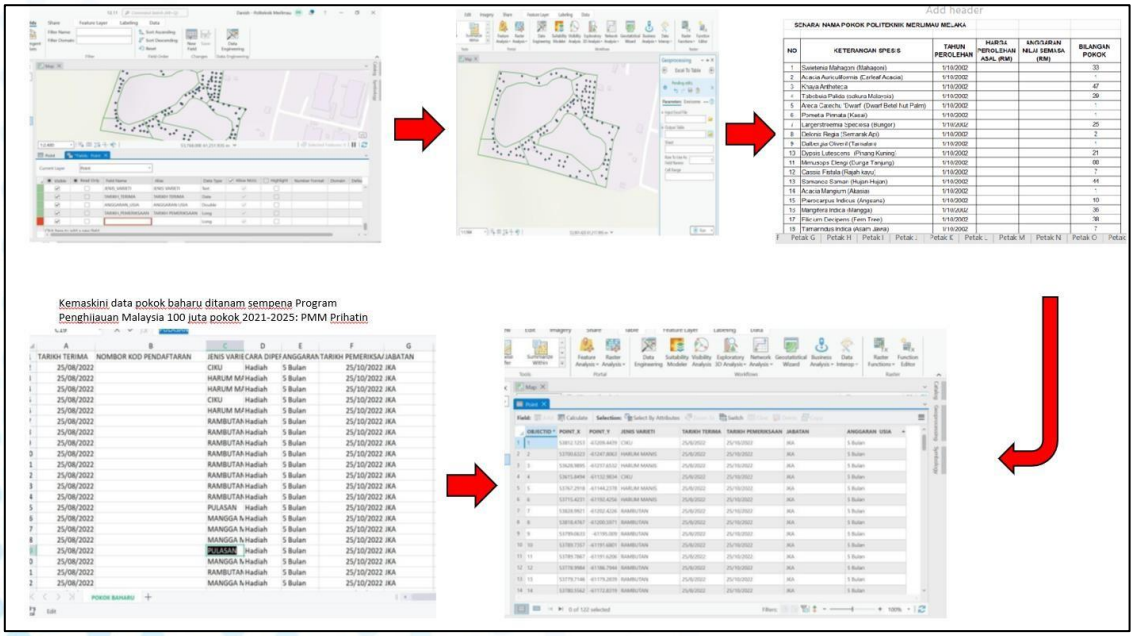
Data atau maklumat spatial yang dicerap dilapangan pula seterusnya akan diproses di perisian Autocad dalam bentuk 2D berformat dwg. Langkah seterusnya di perisian ArcGIS Pro, data tersebut ditukarkan daripada dwg kepada *geodatabase* melalui *geoprocessing* seperti ditunjukkan pada Rajah 2.



Sumber: Olahan pengkaji (2024)

Rajah 3: Proses *Geoprocessing* data dari perisian Autocad ke perisian ArcGIS Pro

Seterusnya, bagi kerja pemprosesan data atribut dari perisian Microsoft Excel ke spatial point pokok dalam perisian *ArcGIS Pro* dilakukan seperti yang ditunjukkan pada Rajah 3.3.



Rajah 4: Proses mengemaskini data atribut dari perisian Microsoft Excel ke spatial *point* pokok dalam perisian ArcGIS Pro

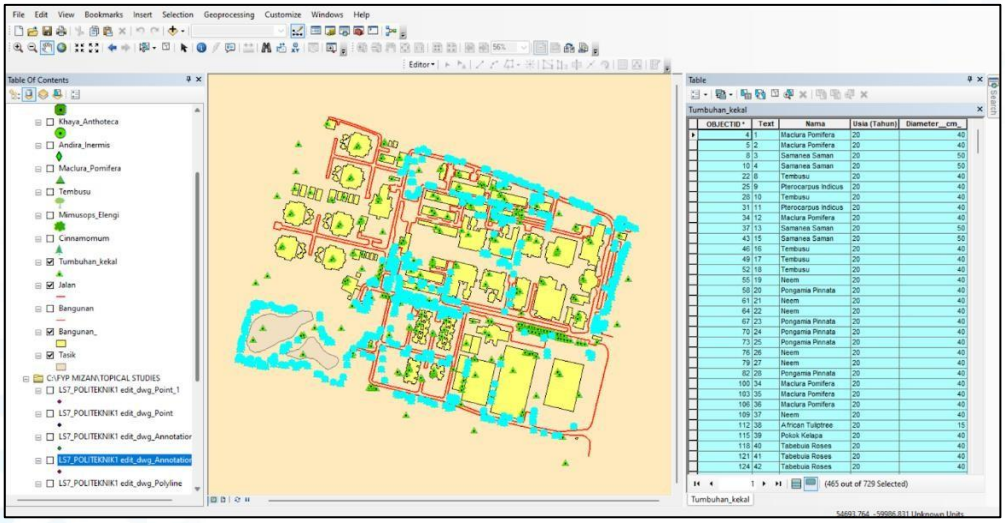
Gabungan kesemua data-data daripada pemetaan setiap lokasi pokok dan pembahagian kawasan pokok dikumpul, diproses dan dianalisis mengikut anggaran usia dan kemaskini variasi pokok baharu ditanam turut boleh dikemaskini terus ke dalam sistem bagi membolehkan langkah seterusnya dan penentuan capaian maklumat dilakukan sebagaimana yang dikehendaki.

4. Hasil dan Analisis Sistem

4.1 Pengujian dan analisis sistem

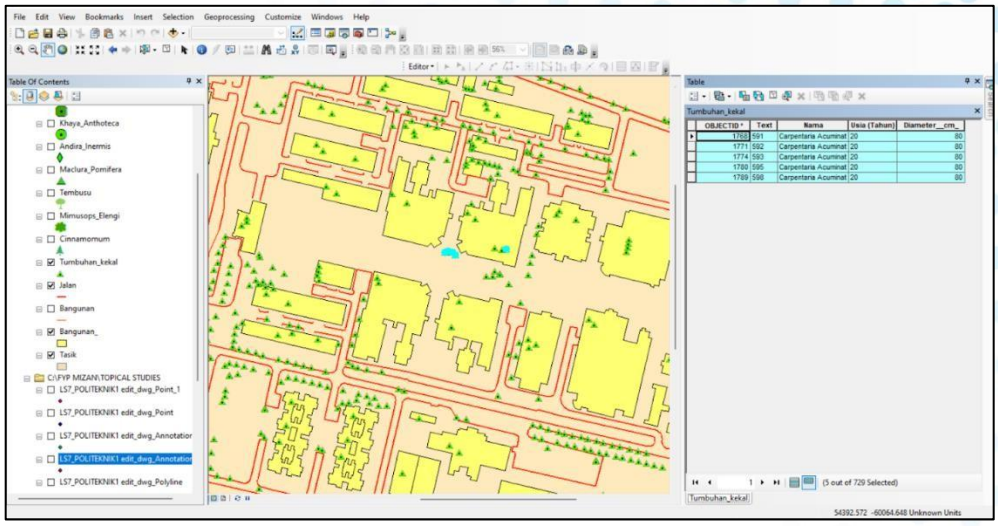
Bagi memastikan capaian maklumat yang telah di integrasikan ke dalam sistem dapat di capai sepenuhnya, pengujian ke atas sistem dengan melakukan beberapa analisis perlu dilakukan. Menurut Ramli Azlan Shah (2017), salah satu fungsi asas di dalam GIS iaitu analisis *Query* atau fungsi carian iaitu proses yang dilakukan apabila ingin mencari sesuatu maklumat di dalam mana-mana sistem pangkalan data walaupun tidak semestinya aplikasi GIS. Salah satu keistimewaan yang hanya perisian GIS sahaja boleh lakukan adalah *Spatial Query* di mana ia boleh menunjukkan lokasi terdapatnya maklumat tersebut dapat dipaparkan selain dari hanya melihat senarai jadual maklumat tersebut melalui *Attribute Query.* Dengan itu, ia boleh membantu di dalam membuat keputusan, melihat pola taburan dan hubung kaitan dengan maklumat-maklumat lain di atas paparan peta.

Dalam pembangunan sistem ini, analisis *Query* juga digunakan bagi menghasilkan beberapa pertanyaan antaranya analisis *query* tentang pokok tertua di PMM iaitu 20 tahun mengikut usia tahun penubuhan PMM. Mengunakan kaedah query ini, maklumat lokasi pokok yang terpilih akan ditonjolkan berwarna biru di kedua-dua peta dan jadual seperti di Rajah 4.1.



Rajah 5: Analisis query tentang maklumat dan lokasi pokok tertua yang berusia 20 tahun

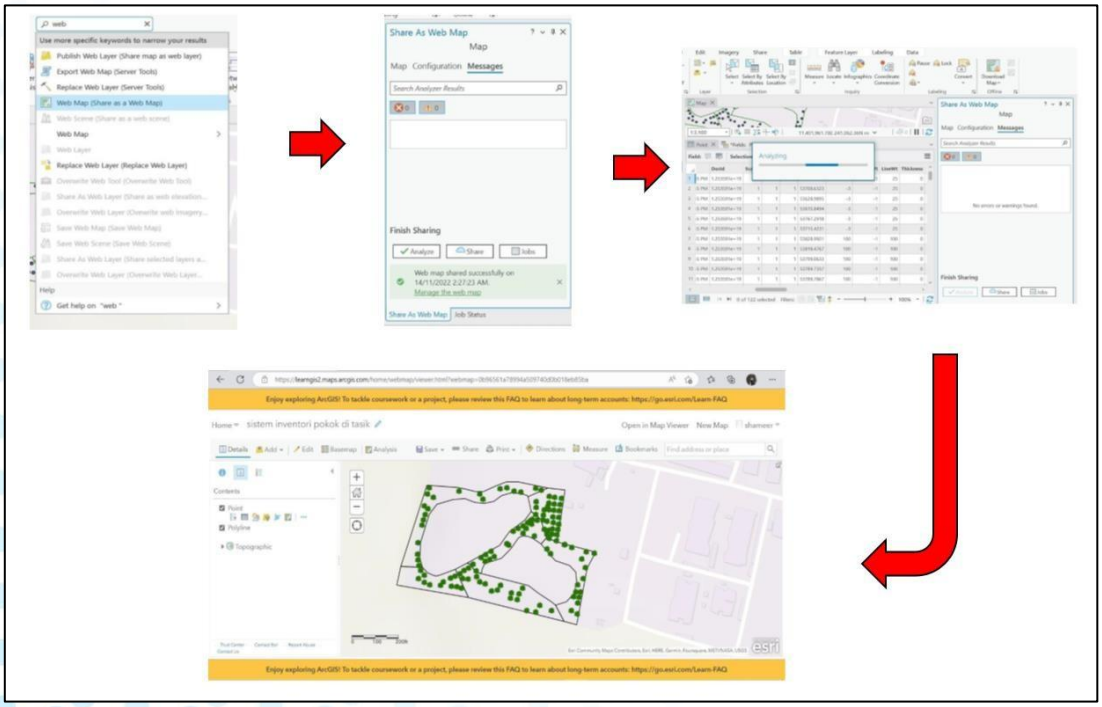
Seterusnya, layer baru akan dibuat untuk menguji analisis seterusnya tentang maklumat dan lokasi pokok berdiameter paling besar dan berisiko tinggi iaitu 80cm seperti saranan (JLN,n.d.) ditunjukkan pada Rajah 4.2.



Rajah 6: Analisis *query* tentang maklumat dan lokasi pokok berdiameter paling besar 80cm

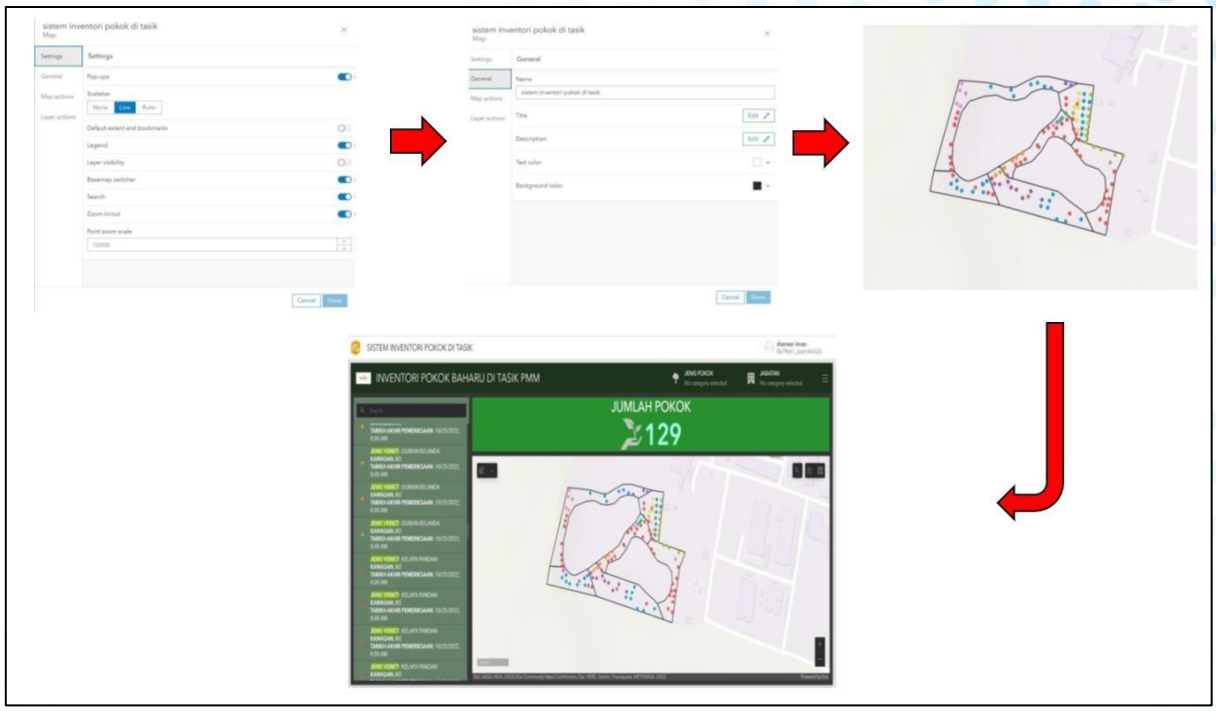
4.2 Hasil akhir dan paparan interaktif

Bagi memudahkan capaian maklumat ke atas sistem ini samada peta spatial atau maklumat senarai attribut, paparan antaramuka melalui perisian ArcGIS Online digunakan supaya maklumat dapat dicapai dengan mudah dan lebih interaktif. Kelebihan perisian ArcGIS Online ini disokong (West & Horswell, 2018) menyatakan bahawa perisian ArcGIS Online menawarkan antara muka yang ringkas dan mudah digunakan, dimana peta web membentuk asas platform dan aplikasi pemetaan web ini membolehkan pengguna memvisualisasikan, mener oka dan menganalisis pangkalan data geospatial dengan cepat dan mudah. Rajah 4.3 menunjukkan proses menerbitkan data dari perisian ArcGIS Pro ke ArcGIS online.

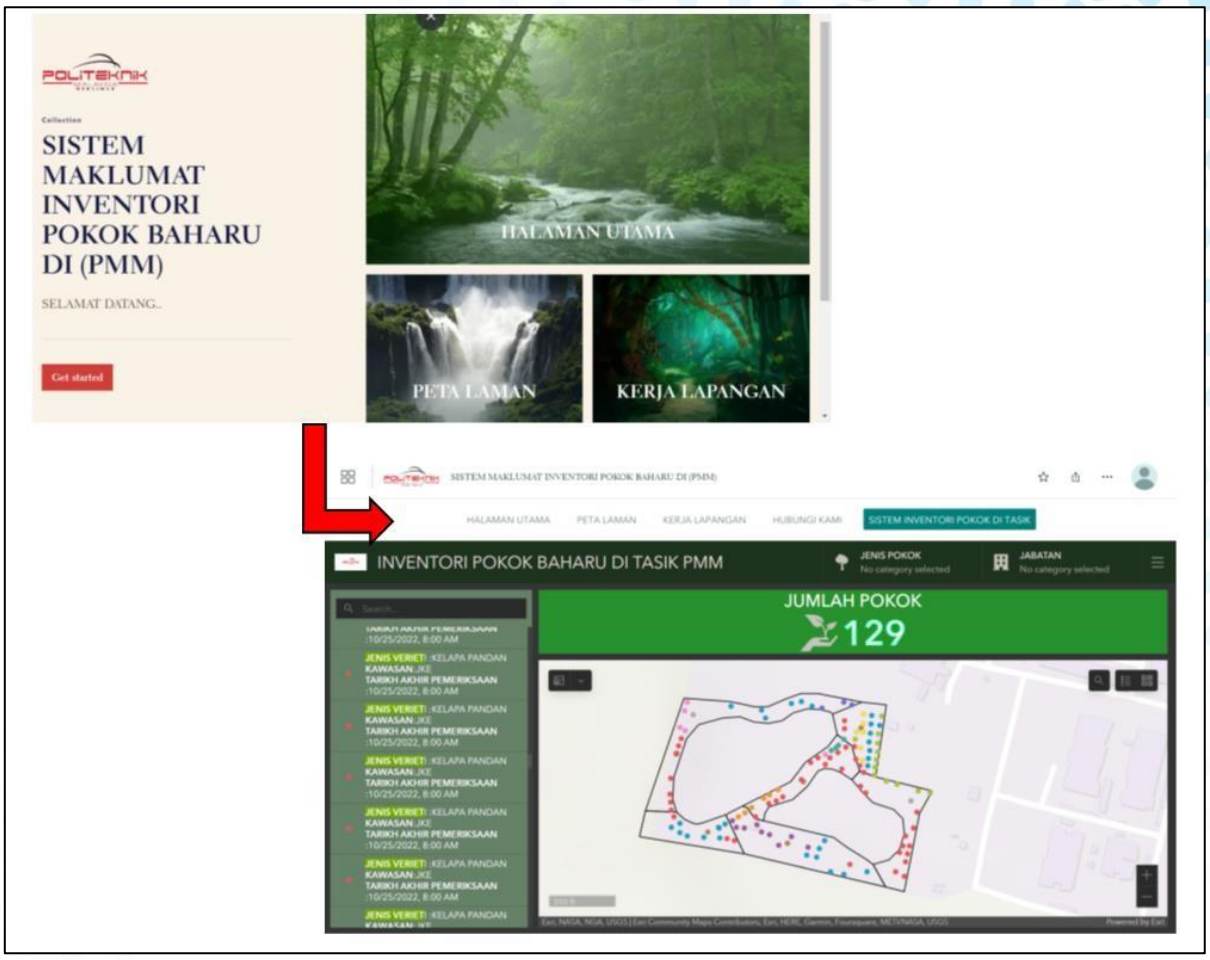


Rajah 7: Proses menerbitkan data dari perisian ArcGIS Pro ke ArcGIS online

Pengujian ke atas penghasilan antara muka *dashboard* turut dibuat sebagaimana contoh keperluan menambah maklumat yang perlu kemaskini dari penanaman 129 pokok baharu di kawasan tasik PMM seperti Rajah 4.4 dan Rajah 4.5 menunjukkan menu utama dashboard antara muka sistem ini.



Rajah 8: Proses mengemaskini peta pokok baharu dari map ke dashboard



Rajah 9: Dashboard halaman utama bagi Sistem Inventori Aset Hidup Tumbuhan PMM

5. Kesimpulan dan Cadangan

Bagi keseluruhan projek ini, objektif kajian telah tercapai di mana penentuan koordinat lokasi setiap pokok (data spatial) dengan tepat dan menyediakan satu kaedah mengesan lokasi setiap pokok. Selain itu, satu sistem pengurusan yang sistematik ke atas setiap pokok dapat disediakan di dalam kawasan projek termasuk aspek pemantauan dan penyelenggaraan pokok mengikut amalan arborikultur yang betul.

Bagi sistem ini data pokok sebanyak 603 batang pokok dan mempunyai 53 spesies pokok, di dalam Politeknik Merlimau Melaka.termasuklah kemaskini pokok buah-buahan baru yang ditanam sempena Program Penghijauan Malaysia 100 juta pokok 2021-2025: PMM Prihatin menjadikan 732 batang pokok dan tambahan 16 spesis baru. Sistem ini penting untuk menggantikan kaedah perekodan manual yang boleh memberikan impak positif kepada pihak pengurusan PMM. Kaedah konvensional yang berisiko dokumen hilang, data tidak dapat dikesan lagi menyebabkan penyelenggaran pokok tidak dapat dibuat berkala. Impak positif pembangunan sistem ini adalah menukarkan kaedah perekodan manual kepada kaedah perekodan secara atas talian. Selain itu, sistem ini mudah diakses oleh semua pihak pengurusan secara atas talian dimana-mana lokasi dan boleh disetkan kepada pengguna tertentu sahaja (restricted user) bagi tujuan keselamatan data.

Dengan adanya kemajuan pada masa kini, Sistem Maklumat Geografi (GIS) memainkan peranan penting dalam pelbagai bidang seperti mengumpulkan data atribut dan data spatial bagi memudahkan dan mempercepatkan proses penanaman semula di Politeknik Merlimau. Sebagai contoh, data spatial dapat mengetahui koordinat setiap tumbuhan yang ditanam, menganalisis kawasan yang bersesuaian bagi penanaman semula dan juga dapat mengetahui jenis guna tanah yang sesuai digunakan bagi proses penanaman semula di kawasan Politeknik Merlimau, manakala data atribut juga boleh mengumpulkan maklumat terperinci berkaitan aset hidup tumbuhan kekal seperti dapat mengetahui usia tumbuhan, nama tumbuhan dan bilangan tumbuhan yang

berada di kawasan Politeknik Merlimau.

Dengan adanya penghasilan sistem ini, diharapkan sistem ini dapat memudahkan pihak pengurusan bagi perekodan dan penyelenggaraan aset hidup tumbuhan Politeknik Merlimau Melaka (PMM) terutamanya kepada Unit Penyelenggaraan dan Selenggaraan (UPS), PMM agar dapat mengetahui butiran-butiran lokasi kedudukan serta maklumat bukan ruang (data atribut) pokok baharu di kawasan tasik (PMM) dan aset tumbuhan hidup sedia ada yang lain.

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POLITEKNIK KOTA KINABALU

The Outcome of a Detailed Energy Audit at the Chancellery, University of Malaya (UM)

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Abstract

The Chancellery Building is a central administration hub for the University of Malaya (UM) consolidating various administrative divisions into one facility. Government policy encourages all organizations, including industries and commercial building owners, to adopt Energy Management Systems (EnMS) for efficient energy use. Conducting an Energy Audit (EA) serves as the crucial initial step toward implementing these systems. The EA encompasses assessments of lighting and Indoor Air Quality (IAQ). The EA report revealed that annual electricity consumption was 2,435,186 kWh in 2022 and decreased to 2,268,711 kWh in 2023, with associated costs of RM 888,842.89 and RM 828,079.40 per year, respectively. The Building Energy Index (BEI) based on Net Floor Area (NFA), improved from 80.50 kWh/m²/yr in 2022 to 77.34 kWh/m²/yr in 2023, indicating a 3.16% improvement in building performance. Findings from the EA regarding room luminance or lux levels indicated that 68% of the 188 rooms are overlit, presenting an opportunity for delamping. The audit identified five Energy Saving Measures (ESM) with estimated investments provided for budgetary purposes. Implementing all measures could reduce energy consumption by 16.89%, saving 411,289.28 kWh annually and RM 159,227.27 in costs. The total investment required is approximately RM 99,283.00, with a projected payback period of 3.03 years. Implementation is expected to mitigate about 320.81 tons per year of carbon dioxide (CO_2), based on a greenhouse gas emission factor of 0.78 kgCO_2. Implementing these ESM would reduce Chancellery's annual energy consumption by approximately 2,023,896.72 kWh, saving RM 738,722.30 annually, a 16.89% reduction from the baseline. This would result in a new Building Energy Index (BEI) of 69 kWh/m²/yr.

Keywords: UM; EnMS; EA; BEI; ESM

1. Introduction

Energy consumption in commercial and institutional buildings plays a significant role in both operational costs and environmental impact. In Malaysia, buildings account for a substantial share of national energy use. To address this, the government encourages energy audits and Energy Management Systems (EMS) to boost efficiency. The University of Malaya (UM) has made efforts to lower its carbon footprint, with the Chancellery Building as a focal point for energy-saving improvements.

The Chancellery Building, an 11-story administrative hub at UM, falls under Tariff C1. It has a gross floor area (GFA) of 30,251.53 m^2 and a net floor area (NFA) of 29,301.72 square meters. In 2022, the building consumed 2,435,186 kWh of energy, resulting in a Building Energy Intensity (BEI) of 80.50 kWh/m²/year. An energy audit, conducted in collaboration with UM's Department of Development & Estate Maintenance and the UM Power Energy Dedication Center (UMPEDAC), sought to identify inefficiencies and propose Energy Saving Measures (ESM) to reduce operational costs and support UM's sustainability goals. This paper presents the audit's findings and recommendations, providing a framework for other institutions aiming to enhance energy efficiency in their buildings.

2. Literature Review

Energy efficiency in buildings is important for both economic and environmental reasons. Studies show that energy-saving technologies and practices can cut energy use by up to 30% in commercial and institutional buildings (Saidur, 2009). The International Energy Agency (IEA) reports that building energy management systems significantly reduce energy use, particularly in heating, ventilation, and air conditioning (HVAC) systems, which are major energy consumers (IEA, 2021).

In Malaysia, the MS1525:2019 Code of Practice provides guidelines for optimizing energy use. According to Wong et al. (2020), buildings following MS1525 standards can reduce energy intensity by 15 -25%. Energy- efficient lighting, such as LEDs, is also a cost-effective way to lower electricity use (Rahman et al., 2019).

Research shows the BEI is a reliable metric for benchmarking building performance, especially in energy - intensive settings (Ghazali et al., 2022). Reducing energy consumption requires interventions like better insulation, efficient HVAC, and improved lighting (Seghier et al., 2019).

EMS also play a key role, enabling real-time energy monitoring for proactive adjustments and further savings. Retrofitting buildings with EMS can cut energy use by up to 15% (Basu, Paul, & Syal, 2019).

In summary, energy audits, adherence to MS1525 standards, BEI benchmarking, and EMS are essential for improving energy efficiency in non-residential buildings like the Chancellery at UM. These tools not only save costs but also help meet global sustainability goals by lowering carbon footprints.

3. Methodology

3.1 Study Approach

The energy audit was conducted in several phases, starting with data collection on energy usage, building occupancy, and operational hours. The audit team employed data logging devices to monitor energy consumption from the building's main switchboards (MSB 1 and MSB 2) and conducted spot measurements on lighting and HVAC systems. Historical energy consumption data from 2022 was analyzed to establish a baseline for comparison.

3.2 Review of Building Operation and Utilization Factor

Since energy use is closely tied to facility operations, data on occupancy rates (hours per day, days per week) and environmental controls were gathered. Historical energy consumption data helped establish a cost baseline. Equipment manuals, building layouts, and random interviews with occupants provided insights into usage and equipment performance. The University of Malaya Power Meter Monitoring System (UMPMMS) was used to analyze the building's load profile and measure major energy-consuming systems. Additionally, spot measurements of indoor room conditions were taken. To conduct an EA at Chancellery, UM, various measurement and monitoring equipment were used. Prior to the EA, the audit team ensured that this equipment was recalibrated, ensuring that the collected field data were accurate and reliable for use in various levels of energy calculations.

3.3 Development of Energy Saving Measures (ESMs)

ESMs are strategies and technologies aimed at reducing energy consumption and improving efficiency in buildings and industries. Their main objectives are to lower operational costs, decrease carbon emissions, and ensure compliance with energy regulations. ESMs can generally be classified into two categories: Energy Conservation and Energy Efficiency.

Potential ESMs were identified through surveys and discussions with building staff, while monitoring data provided insights for calculating possible energy savings

4. Results

4.1 Energy Consumption Analysis

There are two major distribution stations (PPU) after the TNB transmission main intake (PMU) which are PPU1 and PPU2. UM has subscribed to the Green Electricity Tariff (GET) starting in February 2022. The GET value for PPU1 is 4,500,000 kWh per month while for PPU2 it amounts to 1,000,000 kWh per month. Table 1 shows the energy consumption for UM (PPU1 bill + PPU 2 bill) for the period from Jan 2022 to Sept 2023 including the total energy consumption for 6 consecutive months and annual energy consumption.

According to Table 1, it has been observed that the electricity consumption for UM over six consecutive months exceeds 3 million kWh. To comply with the Efficient Management of Electrical Energy Regulations (EMEER) 2008, Regulation 6 stipulates that an installation licensee or consumer with total net electrical generation or total net electrical energy consumption equal to or exceeding 3,000,000 kWh as measured at one metering point or more over any period not exceeding six consecutive months must appoint a Registered Electrical

Energy Manager (REEM). UM needs to hire a REEM to provide expert advice and assistance in electrical energy management and energy-saving measures. This will help UM identify and implement ESMs and subsequently monitor energy performance.

Table 1. Energy Consumption For UM from Jan 2022 to September 2023

UNIVERSITI MALAYA				
		NEW TARIFF (1 JAN 2014)		
TYPE		C1U		
ENERGY CONSUMPTION RATE RM/kWh		0.365		
MAX. DEMAND RATE RM/kW		30.30		
MONTH	**ENERGY CONSUMPTION**	**ENERGY COST**	**TOTAL ENERGY CONSUMPTION FOR 6 CONSECUTIVE MONTH**	**ANNUAL ENERGY CONSUMPTION**
	[kWh]	[RM]	[kWh]	[kWh]
Jan-22	5,613,210.00	2,269,648.45		
Feb-22	4,693,930.00	2,182,319.75		
Mar-22	5,986,750.00	2,718,914.85		
Apr-22	5,627,830.00	2,563,087.90		
May-22	5,833,630.00	2,700,945.90		
Jun-22	6,066,580.00	2,807,575.45	33,821,930.00	
Jul-22	5,596,520.00	2,512,086.20	33,805,240.00	
Aug-22	5,400,940.00	2,413,130.20	34,512,250.00	
Sep-22	5,166,900.00	2,320,861.15	33,692,400.00	
Oct-22	5,723,100.00	2,629,777.45	33,787,670.00	
Nov-22	5,940,180.00	2,695,834.40	33,894,220.00	
Dec-22	5,928,170.00	2,678,840.75	33,755,810.00	67,577,740.00
Jan-23	5,722,440.00	2,577,352.50	33,881,730.00	67,686,970.00
Feb-23	5,022,140.00	2,259,515.15	33,502,930.00	68,015,180.00
Mar-23	6,210,430.00	2,813,827.20	34,546,460.00	68,238,860.00
Apr-23	5,418,620.00	2,437,877.70	34,241,980.00	68,029,650.00
May-23	7,054,730.00	3,285,693.50	35,356,530.00	69,250,750.00
Jun-23	6,379,050.00	2,917,191.45	35,807,410.00	69,563,220.00
Jul-23	5,775,580.00	2,562,547.55	35,860,550.00	69,742,280.00
Aug-23	5,498,280.00	3,382,430.95	36,336,690.00	69,839,620.00
Sep-23	5,282,580.00	3,271,879.55	35,408,840.00	69,955,300.00
Total Annual Energy Consumption	119,941,590.00	56,001,338.00		
Average Monthly Electrical Energy Consumption	5,711,504.29	2,666,730.38		
Max Monthly Electrical Energy Consumption	7,054,730.00	3,382,430.95		
Min Monthly Electrical Energy Consumption	4,693,930.00	2,182,319.75		

Based on Fig. 1, it was found that the bill increased in August and subsequent months due to the tariff increase for the Green Electricity Tariff (GET) from RM0.037 per kWh to RM0.218 per kWh.

The baseline year selected is 2022, as complete data is available from January to December of that year, with the assumption that no ESMs were implemented prior to 2022. The data for 2023 covers only the period from January to September, as the energy audit will be conducted in October 2023.

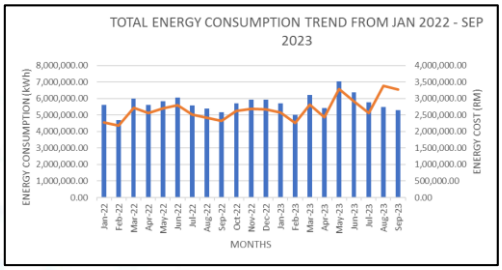


Fig. 1. Total Energy Consumption Trend for UM

4.2 Load Profile

During the audit, the main intake electrical load profile was logged to identify monthly energy usage trends. Chancellery, University of Malaya has two main intake points: MSB 1 and MSB 2. Ideally, load apportioning would involve using data loggers for accurate measurements. However, due to equipment and resource constraints, data collection was performed using a combination of data loggers, the UMPMMS, and the Electrical and Telephone Services Operation and Maintenance Manual, as well as the As-Built Drawing (Volume 2 of 2). For the UMPMMS, readings were manually recorded every 30 minutes over a 24-hour period. Data was collected using the UMPMMS from October 16, 2023 (Monday) to October 22, 2023 (Sunday), covering the period from

12:00 a.m. to 11:30 p.m. Table 2 and Fig. 2 display the measured daily energy consumption for MSB1 and MSB2, as well as the power demand trends for both MSB1 and MSB2, from October 16 to October 22, 2023.

Table 2. Measured Daily Energy Consumption for MSB1 and MSB2

		Weekdays						
		Weekend						
MSB 1+ MSB 2								
Date / Data	16.10.23	17.10.23	18.10.23	19.10.23	20.10.23	21.10.23	22.10.23
Total Daily kWh	7,628.75	6,982.15	7,161.30	7,617.05	7,609.30	552.30	586.70
Total Daily kW	15,257.50	13,964.20	14,322.60	15,234.10	15,218.60	1,104.60	1,173.40
Max kW	678.90	760.20	731.10	762.00	598.80	31.50	27.80
Min kW	3.10	2.50	2.70	2.80	2.60	2.80	3.00
Avg kW	158.93	145.46	149.19	158.69	158.53	11.51	12.22
Baseload kW (0.00 - 06.00a.m)	11.29	11.17	11.35	11.30	10.71	10.60	11.18
Percentage	1.66	1.47	1.55	1.48	1.79	33.65	40.22

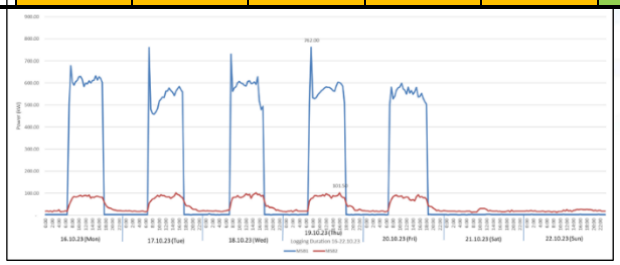


Fig. 2. Total Energy Consumption Trend From January to December 2022

The findings from load profile are summarized as follows: -

Maximum Demand recorded : 762kW; Minimum Demand recorded : 2.5kW

Average Demand : 113.50kW ; Average Baseload : 11.09kW

Average Baseload Weekdays : 11.16kW; Average Baseload Weekend : 36.93kW

Average Weekdays Baseload Working Hours (8.00 a.m – 17.00 p.m) : 328.87kW

Average Weekdays Baseload Non Working Hours (17.30p.m – 7.30 a.m) : 39.70kW

Average Weekend Load : 11.86kW

Average Weekdays time Baseload kW Lunch Hours (13.00 - 14.00 pm) : 331.58kW

Table 3 presents the measured daily energy consumption for MSB Chillers 1, 2, and 3, while Fig. 3 illustrates the power demand trends for these chillers from October 16 to October 22, 2023.

Table 3. Measured Daily Energy Consumption for MSB Chiller 1,2 and 3

		Weekdays						
		Weekend						
MSB CHILLER 1,2,3								
Date / Data	16.10.23	17.10.23	18.10.23	19.10.23	20.10.23	21.10.23	22.10.23
Total Daily kWh	4,622.70	4,123.40	4,244.20	4,534.15	4,587.65	14.85	16.85
Total Daily kW	9,245.40	8,246.70	8,488.40	9,068.30	9,175.30	29.70	33.70
Max kW	492.40	550.50	529.50	552.50	431.90	1.30	1.80
Min kW	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Avg kW	192.61	171.81	176.84	188.92	191.15	0.62	0.70
Baseload kW (0.00 - 06.00a.m)	0.66	0.55	0.86	0.56	0.50	0.44	0.66
Percentage	0.13	0.10	0.16	0.10	0.12	34.07	36.75

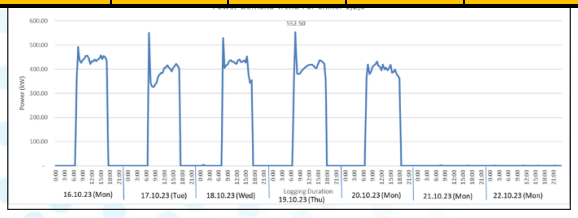


Fig. 3. Total Energy Consumption Trend From January to December 2022

The findings from load profile are summarized as follows: -

Maximum Demand recorded : 552.5kW; Minimum Demand recorded : 0.4kW

Average Demand : 131.81kW; Average Baseload : 0.61kW

Average Baseload Weekdays : 0.63kW; Average Baseload Weekend : 35.41kW

Average Weekdays Baseload Working Hours (8.00 a.m – 17.00 p.m) : 411.48kW

Average Weekdays Baseload Non Working Hours (17.30p.m – 7.30 a.m) : 31.12kW

Average Weekend Load : 0.66kW

Average Weekdays time Baseload kW Lunch Hours (13.00 - 14.00 pm) : 417.69kW

4.3 Load Apportioning

Data from the UMPMMS were used to compare load apportioning based on manual entries and staff-generated data. This analysis focuses on energy consumption measured in kilowatt-hours (kWh). The results are estimates derived from information collected from manuals and staff. Table 3 presents the load apportioning for each system in the Chancellery at UM, combining the totals of MSB1 and MSB2. From Table 4, we can conclude that Chillers, AHUs, and Lighting are the main Significant Energy Users (SEUs), with overall percentages of 45%, 19%, and 18%, respectively.

Table 4. Sigificant Energy User (SEU)

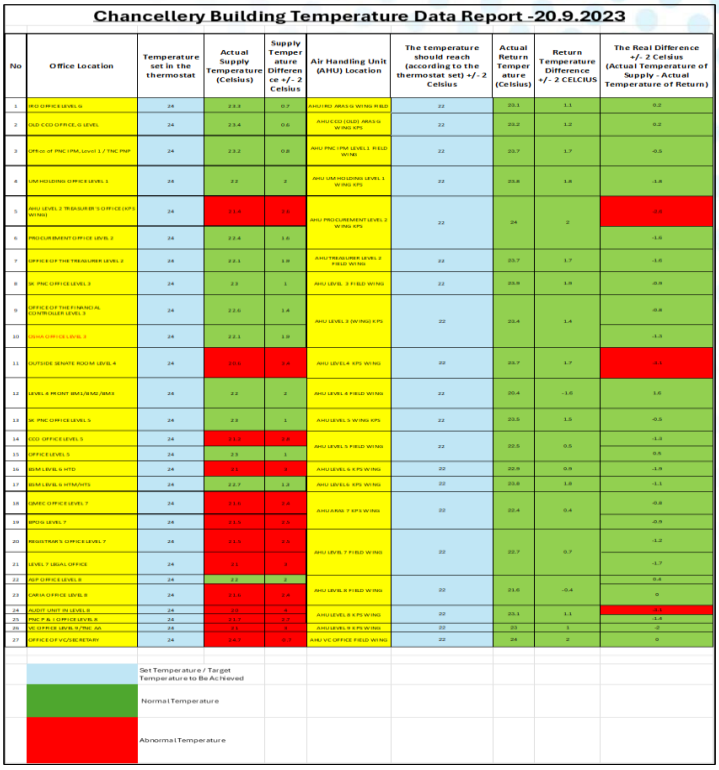
No	Name Of Equipment	Daily Energy Consumption	Annual Energy Consumption (kWh/yr)	Percentage Overall Usage Apportioning	Rangking	Total SEU
1	Chiller	4,431.00	1,107,750.00	45%	1	65%
2	AHU	1,858.50	464,625.00	19%	2	
3	Lighting	1,707.00	426,750.00	18%	3	
4	ACSU	878.34	219,584.26	9%	4	
5	Lift	778.50	194,625.00	8%	5	
6	Others	87.41	21,851.74	1%	6	
Total Energy Consumption			2,435,186.00			

4.4 Air Handling Unit (AHU)

There are a total of 20 AHU units located in the main block of the Chancellery at UM.

Table 5 displays the temperatures recorded around 12 PM on September 20, 2023, for all AHU units. At the time of measurement, the chiller set point had reached 48.0 degrees Fahrenheit (8.8°C). Based on the data obtained, several supply temperatures exceeded ±2 degrees Celsius (marked in red), which is attributed to the malfunctioning motorized actuator valve. The AHU supply units that exceeded this range are Levels 2, 4, 5, 6, 7, and 8. Further analysis revealed that most return temperatures remained within the normal range, with exceptions noted in AHU Levels 2, 4, and 8 of the KPS Wing, suggesting a possible leak or problematic coil sensor. Among the Energy Saving Measures (ESMs) that can be suggested is the replacement of the modulating valve for the Air Handling Unit System (AHU).

Table 5. Sigificant Energy User (SEU)



Chancellery Building Temperature Data Report -20.9.2023

No	Office Location	Temperature set in the thermostat	Actual Supply Temperature (Celsius)	Supply Temperature Difference +/- 2 Celsius	Air Handling Unit (AHU) Location	The temperature should reach (according to the thermostat set) +/- 2 Celsius	Actual Return Temperature (Celsius)	Return Temperature Difference +/- 2 CELCIUS	The Real Difference +/- 2 Celsius (Actual Temperature of Supply - Actual Temperature of Return)
1	HO OFFICE LEVEL 6	24	23.1	0.7	AHU HO (MASS WING) FIELD	22	23.1	1.1	0.2
2	OLD CCO OFFICE-6 LEVEL	24	23.4	0.6	AHU CCO (OLD) (MASS WING KPS	22	23.2	1.2	0.2
3	Office of PNC (PM, Level 1 / TNC PMF	24	23.2	0.8	AHU PNC (PM LEVEL1 FIELD WING	22	23.7	1.7	-0.5
4	UM HOUSING OFFICE LEVEL 1	24	22	2	AHU UM HOUSING LEVEL 1 WING KPS	22	23.8	1.8	-1.8
5	AHU LEVEL 2 TREASURER 'S OFFICE (KPS WING)	24	21.4	2.6	AHU PROCUREMENT LEVEL 2 WING KPS	22	24	2	-2.6
6	PROCUREMENT OFFICE LEVEL 2	24	22.4	1.6					-1.6
7	OFFICE OF THE TREASURER LEVEL 2	24	22.1	1.9	AHU TREASURER LEVEL 2 FIELD WING	22	23.7	1.7	-1.6
8	SK PNC OFFICE LEVEL 3	24	23	1	AHU LEVEL 3 FIELD WING	22	23.9	1.9	-0.9
9	OFFICE OF THE FINANCIAL CONTROLLER LEVEL 3	24	22.6	1.4	AHU LEVEL 3 (WING) KPS	22	23.4	1.4	-0.8
10	CEMA OFFICE LEVEL 3	24	22.1	1.9					-1.3
11	OUTSIDE SENATE ROOM LEVEL 4	24	20.6	3.4	AHU LEVEL4 KPS WING	22	22.7	1.7	2.1
12	LEVEL 4 FRONT WM,WMS,WMX	24	22	2	AHU LEVEL 4 FIELD WING	22	20.4	-1.6	1.6
13	SK PNC OFFICE LEVEL 5	24	23	1	AHU LEVEL 5 WING KPS	22	23.5	1.5	-0.5
14	CCO OFFICE LEVEL 5	24	21.2	2.8	AHU LEVEL 5 FIELD WING	22	22.5	0.5	-1.3
15	OFFICE LEVEL 5	24	23	1					0.5
16	BEM LEVEL 6 HTD	24	23	1	AHU LEVEL 6 KPS WING	22	22.9	0.9	-1.9
17	BEM LEVEL 6 HTM/HTS	24	22.7	1.3	AHU LEVEL 6 KPS WING	22	23.8	1.8	-1.1
18	SBMC OFFICE LEVEL 7	24	21.6	2.4	AHU (MM) 7 KPS WING	22	22.4	0.4	-0.8
19	BPDG LEVEL 7	24	21.5	2.5					-0.9
20	REGISTRAR'S OFFICE LEVEL 7	24	21.5	2.5	AHU LEVEL 7 FIELD WING	22	22.7	0.7	-1.2
21	LEVEL 7 LEGAL OFFICE	24	21	3					-1.7
22	AVP OFFICE LEVEL 8	24	22	2	AHU LEVEL 8 FIELD WING	22	21.6	-0.4	0.4
23	CAMA OFFICE LEVEL 8	24	21.6	2.4					0
24	AUDIT UNIT IN LEVEL 8	24	20	4	AHU LEVEL 8 KPS WING	22	23.1	1.1	3.1
25	PNC P & I OFFICE LEVEL 8	24	21.7	2.3					-1.4
26	VC OFFICE LEVEL 9 (TNC GA	24	22	2	AHU LEVEL 9 KPS WING	22	23	1	-2
27	OFFICE OF VC/SECRETARY	24	24.7	-0.7	AHU VC OFFICE FIELD WING	22	25	2	0

Set Temperature / Target Temperature to Be Achieved

Normal Temperature

Abnormal Temperature

4.5 Lighting

Lighting and luminance levels were assessed using zoning techniques, with illuminance readings taken from the Lower Ground Floor (LGF) to Level 9 of the Chancellery building. Some rooms were inaccessible due to security concerns, meetings, or technical issues.

According to MS1525:2019, lighting should provide an appropriate visual environment for tasks, with specific illumination levels for different areas.

Table 6 summarize the findings of the energy audit regarding room luminance levels. It was recorded that 68% of the 188 rooms are overlit, indicating an opportunity for delamping. External light also contributed to overlighting, with blinds used to reduce glare. Conversely, 15% of the rooms were underlit. Delamping can help lower energy consumption effectively.

Table 6. Proportion of Illuminance Level

Category	No of Room	Percentage
Within range (±20%)	29	15%
Overlit (More than +20%)	128	68%
Underlit (Lower than -20%)	31	16%
Total	188	100%

4.6 Indoor Air Quality (IAQ)

Poor indoor environments can cause various symptoms, including headaches, fatigue, sinus issues, dizziness, shortness of breath, eye irritation, and coughing, impacting health, comfort, job satisfaction, and productivity. Since people spend most of their time indoors, they expect a healthy and comfortable environment.

To assess indoor conditions, two key factors were examined: air quality parameters (temperature and humidity) and air contaminants (CO_2). MS1525:2019 and the Industry Code of Practice on Indoor Air Quality 2010 (DOSH 2010) provide guidelines for evaluating these factors. MS1525:2019 recommends indoor temperatures between

24°C to 26°C and humidity levels between 50% to 70%, while DOSH 2010 suggests a temperature range of 23°C to 26°C and humidity levels between 40% to70%. DOSH 2010 also advises CO_2 levels below 1000 parts per million (ppm). The data from 188 rooms were collected, and Fig. 4 shows that 54% of the rooms are uncomfortably cold, 43% fall within the recommended range, and 3% are uncomfortably warm. Fig. 5 shows a scatter plot of temperature vs. room number, indicating that most data points fall outside the DOSH recommendation. It's important to note that rooms colder than the recommended temperature can increase energy consumption due to higher air conditioning use.

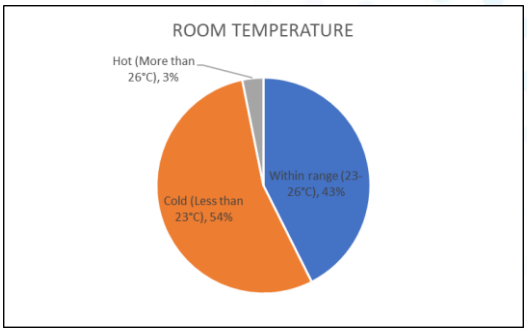


Fig. 4. Proportional Overview of Rooms Temperature Levels

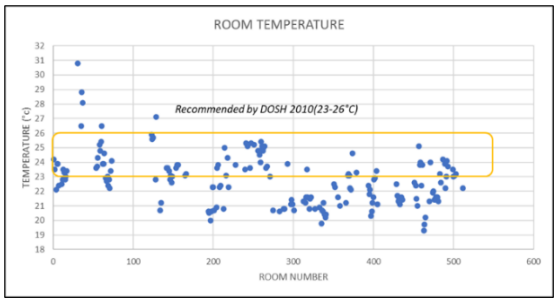


Fig. 5. Room Temperature Levels Distribution

Table 7 shows that 89% of the rooms, equivalent to 167 rooms, have comfortable relative humidity levels within the recommended range. Additionally, 4% of the rooms are uncomfortable due to high humidity (too wet), and 7% are uncomfortable due to low humidity (too dry).

Table 7. Proportion of Rooms Humidity Levels

Category	No of Room	Percentage
Within range (50-70%)	167	89%
Wet (More than 70%)	8	4%
Dry (Less than 50%)	13	7%
Total	188	100%

Table 8 indicates that 96% of the total 188 rooms require improvement in terms of carbon dioxide levels. Fig. 6 shows a scatter plot of CO_2 vs. room number, with most data points falling outside the MS1525 recommendation. The readings show that no room measured a value higher than 1000 ppm, ensuring compliance with the upper limit specified in the Industry Code of Practice on Indoor Air Quality by DOSH. While excessive fresh air intake can lower CO_2 levels below 700 ppm, which is considered safe, it requires the air conditioning system to use more energy to cool the air before supplying it to the rooms. The Chancellery at UM could improve this situation by providing just enough fresh air to meet legal requirements. Engaging an Energy Saving Company (ESCO) to re - evaluate conditions during the implementation of these improvements would help ensure both energy savings and regulatory compliance

Table 8. Proportion of Rooms' Carbon Dioxide Levels

Category	No of Room	Percentage
Within range (700-1000ppm)	8	4%
Below range (Less than 700ppm)	180	96%
Over range (More than 1000ppm)	0	0%
Total	188	100%

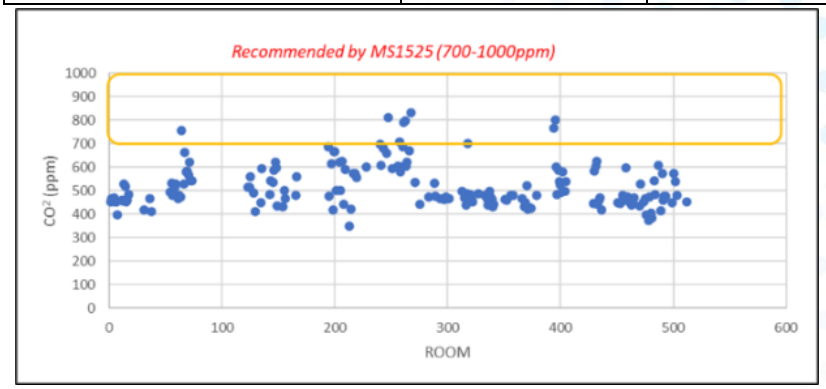


Fig. 6. Carbon Dioxide Levels Distribution

4.7 Building Energy Index (BEI)

The Building Efficiency Index (BEI) benchmarks energy performance in buildings both externally and internally. External benchmarking compares energy use between buildings, typically measured in energy consumption per square meter per year (kWh/m²/year). However, differences in defining "areas" and "operation hours" across buildings limit the reliability of these comparisons. As outlined by the Sustainable Energy Development Authority (SEDA, 2013) in "Method to identify BEI, NET BEI, GFA, NFA, ACA," Gross Floor Area (GFA), Net Floor Area (NFA), and Air Conditioning Area (ACA) are measured using Autodesk AutoCAD 2024 software. Load profile findings are in Table 9, and BEI results are in Table 10.

Table 9. kWh/Year Energy Index

No	Type Of Index	Energy Index
1	Building Energy Index $(BEI)_{GFA}$	83.11
2	Building Energy Index $(BEI)_{NFA}$	80.50
3	Air-Conditioning Energy Index (AEI)	87.80
4	Lighting Energy Index (LEI)	14.10

Table 10. BEI for 2022 and 2023

	Total Annual Energy Consumption	NFA (m^2)	BEI
2022 (Baseline)	2,435,186.00	29,301.72	80.50
2023 (Current)	2,268,711.00		77.43

5. Energy Saving Measures (ESM) and Recommendations

ESMs were identified through the evaluation of site survey data and analysis of monitoring data. Each ESM is described in the "Rationale" section prior to its energy savings calculations. This description is intended as a general overview and should not be assumed to include all details necessary for implementation. ESMs should be evaluated to determine if a complete mechanical or electrical design is required before implementation. Certain assumptions were made for the calculations of some ESMs. The recommendations discussed below are divided

into three categories: No / Low-Cost Measures, Medium-Cost Measures, and High-Cost Measures. Table 11 shows the summary of the ESMs. The implementation of the proposed ESMs is expected to result in a 16.89% reduction in energy consumption. By implementing all five measures, the building will save a total of 411,289.28 kWh annually, resulting in a cost saving of RM 159,227.27 and a CO_2 reduction of 320.81 tons per year. The overall payback period for the investment is 3.03 years.

Table 11. Summary of ESMs

	No	Energy Saving Measures	Potential Saving		Investment	Payback Period	CO2 Reduction	Overall Percentage	Priority
			Energy (kWh)	Cost (RM)	Cost (RM)	Year	Ton / Year		
Mid Cost	1	Energy Management System (EnMS)	24,351.86	8,888.43	5,000	0.56	18.99	1.00%	1
No Cost	2	Reduce daily air conditioning system operating hours at lunchtime by 1 hour	52,750.00	19,253.75	-	-	41.15	2.17%	2
	3	De-lamping of triple-tube fluorescent lamps (remove 1 tube).	90,165.60	42,017.17	-	-	70.33	3.70%	3
High Cost	4	Replacement of New Modulating Valve for Air Handling Unit (AHU)	73,558.80	26,848.92	45,000.00	1.68	57.38	3.02%	4
	5	Replacement of 4" T5 Fluorescent Light Tube to T8 LED 18W	170,463.02	62,219.00	49,283.00	0.8	132.96	7.00%	5
		Total	**411,289.28**	**159,227.27**	**99,283.00**	**3.03**	**320.81**	**16.89%**	

6. Discussion

The results show that optimizing HVAC systems, especially by reducing operating hours and improving Air Handling Unit (AHU) efficiency, offers the most significant energy savings. Switching to LED lighting will also greatly reduce energy use, as lighting accounts for a large share of the building's electricity. Implementing an Energy Management System (EMS) will enable continuous monitoring and uncover more opportunities for optimization.

7. Conclusion

The energy audit of the Chancellery Building at UM reveals significant energy efficiency gains. Implementing the recommended ESMs could cut energy use by 16.89%, saving RM 159,227.27 annually and reducing CO_2 emissions by 320.81 tons / year. These measures support UM's sustainability goals and set a standard for future audits and optimizations. Future research could explore the long-term effects of ESMs and investigate additional energy-saving technologies like renewable energy and advanced building automation systems.

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POLITEKNIK KOTA KINABALU

Water Volumes and pH Dependence in the Performance of Micro-bacterial Voltaic Cells for Wastewater Treatment Application

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Abstract

Energy sources which are eco-friendly, sustainable, green and renewable, are in great demand nowadays. Biomass, oil, charcoal, biofuel, hydropower, nuclear and natural gas as examples, are projected to be depleted by 2050. Therefore, an alternative energy source from wastewater was created and a micro-bacterial voltaic cell (MBVC) was designed in this work as a promising technology for wastewater treatment. In this paper, the influences of water volumes and pH level in the performance of MBVCs are reported. The MBVC uses the voltaic cell working principle. The volumes of water varied between 300 mL and 600 mL, while the pH levels changed from 2.0 to 6.0. The results indicate that the optimum pH of 3.0 significantly improved the microbial activity, attributed to the optimal voltage output, whereby the maximum output voltage is 1.25 volts, while the optimum volume of water is 600 mL contributed to the maximum and optimum voltage of 1.35 volts. By optimizing both parameters, the performance of the MBVC was enhanced. Our findings suggest that the optimization of pH and volume of water influences internal resistance and substrate availability, which affects the overall cell performance thus, this study provides a crucial insight in optimizing the performance of the cell and offers further improvement of energy production for wastewater treatment application.

Keywords: Micro-bacterial; Voltaic cells; Water volumes; pH; Wastewater

1. Introduction

Wastewater pollution is a global issue causing severe health and environmental impacts. It involves the discharge of untreated sewage, industrial waste, and agricultural runoff into water bodies, contaminating rivers, lakes, and oceans with pollutants like heavy metals, pathogens, nutrients, and toxic chemicals. This pollution disrupts aquatic ecosystems, biodiversity, and habitats, and has economic ramifications on sectors like agriculture, fishing, and tourism. Addressing wastewater pollution requires improved waste management practices, advanced treatment technologies, and stronger regulatory frameworks. Currently, many industries are focusing on non - renewable energy sources to meet their daily needs and wants. The increase in the standard of living and the rapid development of technology have resulted in higher demand for energy use over time. The use of these energy sources causes a gradual decline in the existing non-renewable energy storage supply.

As a solution, the introduction of renewable energy is a solution to sustainable energy based on natural resources such as solar, wind, water, biomass, and geothermal. This method is a sustainable, environmentally friendly approach to electricity production and can contribute towards the reduction of carbon dioxide gas (CO_2) emissions to the ecosystem [1]. Among the renewable energy sources that are young and cheap the proton exchange membrane fuel cell (PEMFC) is the technology that produces electricity from hydrogen reaction. This biologically based fuel cell technology known as Microbial Fuel Cell (MFC) is a device that converts chemical energy into electrical energy. This conversion process takes place continuously as long as there are pollutants such as sewage to be consumed by the microorganisms. Microorganisms will act as catalysts to convert the chemical energy stored in organic matter directly into electrical energy [2]. Electric current can be produced either by using pure culture or mixed culture, but the latter is more suitable for more complex sources such as wastewater [3].

The MFCs offer an eco-friendly solution to both wastewater treatment and electricity generation by using microorganisms to oxidize organic substrates and produce electric current [4]. The MFCs have emerged as a sustainable alternative to conventional wastewater treatment plants, generating bioelectricity through the process of oxidizing organic matter. Recent advances in MFCs fundamentals and process parameters highlight their

potentials for energy-neutral or energy-producing treatment [5]. The present study emphasizes the considerable potentials of micro-bacterial voltaic cells (MBVCs) in producing electricity from the bacterial activity of sewage water. This technology holds significant promise for sustainable energy solutions in future energy sources.

Herein, the effect of water volume and pH level on the performance of MBVCs, particularly the production of the voltage is reported. Through extended experimentation, the research aims to assess the effectiveness and efficiency of these systems, revealing a continuous improvement in performance over time.

2. Literature Review

2.1 Review on the current energy status

In a recent study, M.H. Khoshgoftar Manesh et al., reported that the world's population is expected to increase by 2050 to 9.6 billion [6]; thus, the current energy source is not enough to meet the needs. Accordingly, wastewater from humans will increase as well. This will eventually lead to limited energy sources but severe water pollution. Consequently, alternative source of energy is highly needed. An energy capable of directly harvesting electrical energy from wastewater should be considered to resolve the mentioned problems. Moreover, according to the *International Energy Agency*, reported in 2022, [7] the global energy electricity demand was projected to reach 28.7% in the last 2 years.

On the other hand, Fu Feng et al., in 2024 reported that the microbial fuel cell (MFC) is a cell that utilizes microorganisms to directly convert the chemicals from wastewater into electrical energy source. They generate electrical energy from anaerobic fermentation process. In addition, this energy can optimize resource utilization and resolve the current energy crisis as previously mentioned [7]. According to J.M. Sonawane et al., in 2023, the MFCs is the technology that could resolve the problem of toxicity in water and cleaning the environment, by applying redox principle to degrade organic substances, and then converting them into electrical energy sources [8].

Furthermore, according to the world annual energy report in 2020 [9], other alternative energy sources such as biomass, oil products, coal and fossils would no longer be sustainable, while the energy sources such as solar cell, wind energy and hydro-electric energy would not be practical due to high cost-maintenance and technical handling. Hence, a renewable, sustainable, eco-friendly and abundant energy source was created in this work.

2.2 Review on the principal working of MFC's/MBVC's

The year 1910 represents the beginning of the fuel cell based on microbacterial. It was introduced by Potter M.C. who reported on the production of electricity from *Escherichia coli* as a catalyst. The current was obtained via oxidation process using the yeast as the catalyst and platinum electrodes [10]. However, the production of energy then was low. Last year, Ouyang T.C. and his research team reported that the power output of MCS was still small even though much effort was employed [11]. Therefore, further research works on other effects on the performance of MBVC's were initiated by our research team to improve the power generation, particularly the voltage output. In brief, they used sugar fermentation in wastewater and combined with power generation fo r water treatment and energy production [12].

According to D. Bose et al., microbial fuel cells (MFC's) are cells capable of generating electricity by diverting the electrons released from the bacterial activity present in the wastewater [13]. Hence, the bacteria must be active bacteria which act as a catalyst [14]. In our study, we are focusing on Micro-bacterial Voltaic Cells (MBVC's) that employ the working principle of voltaic cell and electrochemical cells [15]. Specifically, in this study, we evaluate the effect of water volume and pH of water on the MBVC's performance in generating the electricity energy.

Furthermore, our MBVC's utilize two types of electrodes which are anode representing the anaerobic process and cathode representing the water. The hydrogen ion from acetic acid that is generated by the bacteria, will flow from anode to cathode via a membrane plasma or membrane bridge which contains agar powder. At the same time, the electron generated from bacteria, will flow from anode to cathode via wire and electrode that are set up in between the two columns. Our project is similar to that reported by M.H. Khoshgoftar Manesh et al., [16]. However, our research group has managed to set up a cell with simple handling, and the appliances of the cell are from waste and recycled materials. Yet, the voltage and current values are attainable at a low cost and i n a simple way.

3. Methodology

3.1 Apparatus and materials

In the MBVC's system, a graphite electrode serves as the cathode and a zinc electrode as the anode. The system includes an aerobic column, which stores tap water to support oxygen-rich microbial processes, and an anaerobic column, which holds wastewater, facilitating microbial activity in a hydrogen ion-deprived environment. A proton exchange membrane, such as parafilm, is used to separate the water and wastewater compartments while allowing hydrogen ions to pass through. A multimeter is employed to monitor and record the voltage generated during the process. The setup uses 100 mL of wastewater in the anaerobic column and varying amounts of tap water (100 - 600 mL) in the aerobic column.

3.2 Preparation of MBVC

In this preparation, an advanced dual-compartment microbial bio-electrochemical cell (MBVC) is proposed for the simultaneous treatment and separation of water and wastewater. The MBVC comprises anodic and cathodic chambers, each equipped with metal electrodes: graphite at the anode and zinc at the cathode, facilitating redox reactions essential for the treatment process. To maximize ion exchange and system efficiency, a proton exchange membrane (PEM), more precisely a parafilm, separates these chambers and permits hydrogen ions to pass into the aerobic column selectively. The optimization of system parameters, including pH and the volume of tap water in the aerobic column, is detailed in Table 1.

Table 1: Summary of parameters optimization.

Parameters	pH	Volume of Tap Water (mL)
Optimization values	2.0	300
	3.0	400
	4.0	500
	5.0	600
	6.0	600

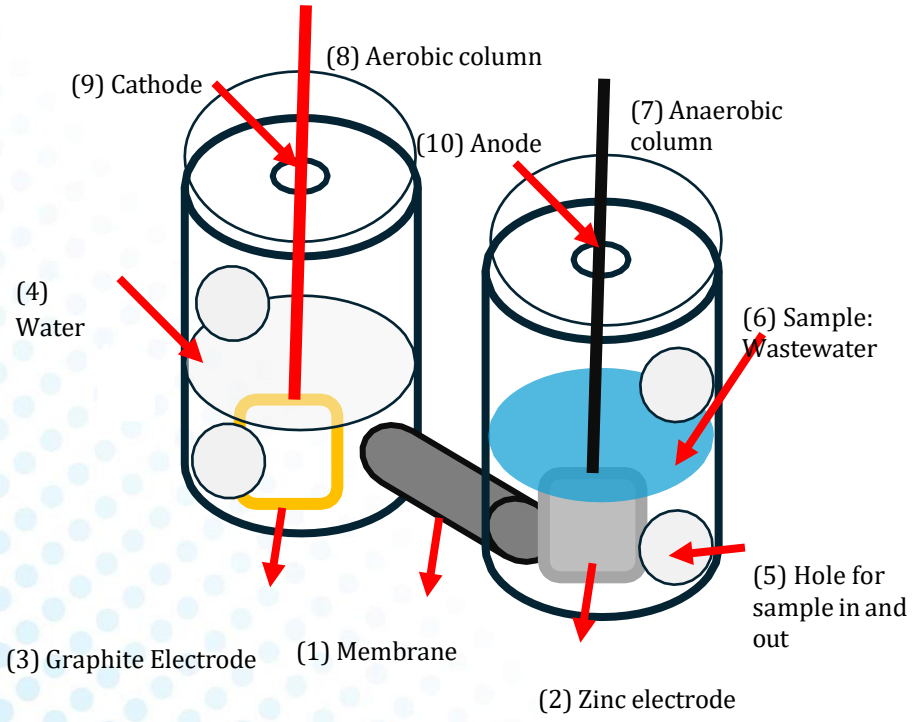

Figure 1: The dual compartment of MBVC

The design integrates aerobic and anaerobic columns for storing water and wastewater, respectively. The anaerobic column, containing 100 mL of wastewater, serves as a source of biocatalyst, while tap water is placed in the aerobic column to support microbial activity under oxygen-rich conditions. Over a 15-day period (360 hours), the system's performance was monitored by recording the voltage using a digital multimeter. The configuration, as illustrated in Figure 1, aims to optimize the redox reactions at the electrodes, driven by the electrochemical potential difference, thereby promoting efficient pollutant degradation and resource recovery.

3.3 The measurement of pH value and water volumes

To evaluate the performance of MBVC, the measurement of water volume was conducted. In this study, the volume of tap water was manually measured using a measurement cylinder in four different volumes of 300 mL, 400 mL, 500 mL and 600 mL. Then, the water was poured directly into the aerobic column. The reason that these four volumes of water were selected is to maintain a balance in the water volume and to ensure optimal dissolved oxygen levels. Moreover, too little water such as less than 200 mL could lead to oxygen limitation. In addition, , the selection is due to the wastewater used in this study which was only 100 mL. The selected volumes of water were then poured into the aerobic column and finally , the voltage value was measured by multimeter and recorded in the table data sheet for 15 days as shown in Figure 3.

To further clarify the performance of MBVC, the optimization of pH value in the aerobic column is necessary. The pH value was controlled by 5% of acetic acid and measured by a pH meter. Then the pH values were set at 2.0, 3.0, 4.0, 5.0 and 6.0, and monitored for 15 days. Finally, the voltage values were recorded periodically throughout 15 days in the table data sheet and the results were graphed as depicted in Figure 2.

4. Results and Discussion

Figure 2 shows the voltage recorded from the MBVC for 15 days (360 hours) of digestion. The data showed the highest voltage recorded when pH=3.0 with a range of voltage of 1.18 to 1.25 V. Followed by pH 4.0 and 2.0 with a range of voltage of 1.08 to 1.15 V and 1.03 to 1.12 V, respectively. While pH=5.0 showed the voltage value was in the range of 0.93 to 0.98 V, and the lowest voltage value was shown in pH=6.0 with a range of 0.82 to 0.85 V. The difference could be due to the availability of oxygen that affects the efficiency of the MBVC, resulting in different values of voltage.

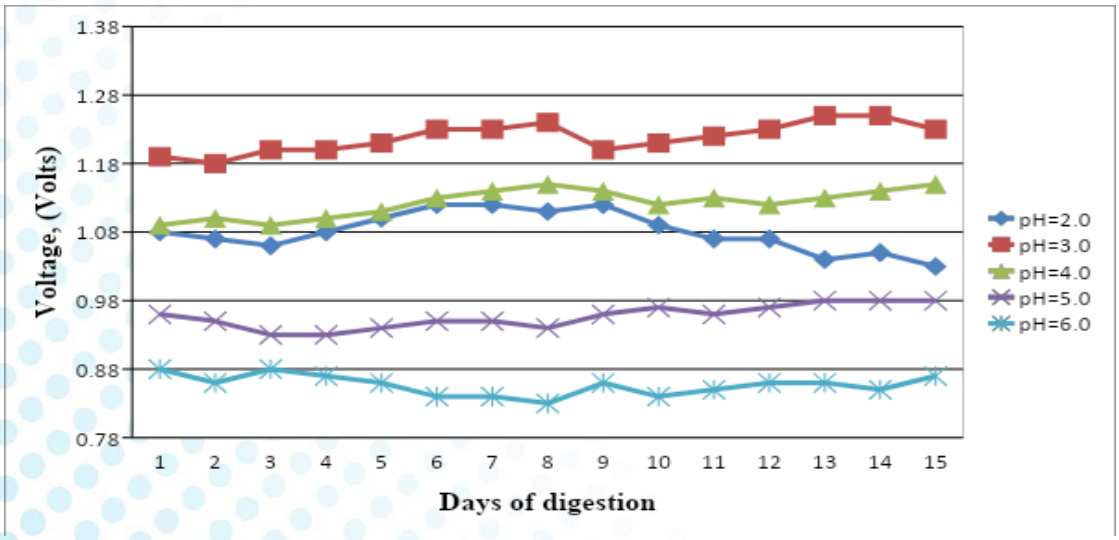

Figure. 2**:** The performance comparison in terms of voltage at different pH used in aerobic column

In the MBVC, the pH of water at the cathode plays an important role in the performance. Several studies had reported that the cathode column in MBVC typically involves a reduction reaction, such as the reduction of oxygen

to water. A more acidic and basic environment in the cathode could affect the solubility of the oxygen [17 -18]. Thus, this reduces the electron flow between the anode and the cathode columns, and directly influences the voltage output. Likewise, a slightly acidic pH at the cathode could be beneficial to optimize the performance and longevity of the MBVC [19]. This was observed when at pH=3.0, the highest voltage output was obtained compared to the others. Therefore, this study suggested that the electron transfer efficiency was the highest at pH 3.0, which used septic wastewater as the substrate. A properly regulated pH level ensures the right concentration of hydrogen ions, thereby enabling efficient electron transfer between the anode and the cathode [20].

Additionally, pH can also affect the electrodes at the cathode column. For instance, at low pH, the increased concentration of hydrogen ions can enhance the cathodic reduction reaction, but it can also cause corrosion to the electrodes. At high pH, the formation of insoluble compounds can impede the electrode reactions [21]. So, it can be concluded that an extreme pH could increase the corrosion, thus the lifetime would decrease, and the cost of maintenance would increase [22-23]. However, other studies (Table 2) also revealed that the type of substrates used and MBVC design can also influence the different values of output voltage.

Table 2. Comparison of pH and volume of tap water from previous studies that produce the highest voltage output.

Type of wastewater	pH	Volume of Tap Water (mL)	Max Voltage Output	References
Industrial wastewater	6.54	None	0.80	[21]
Municipal food waste Synthetic	5.7	None	0.64	[20]
wastewater	none	250	0.40	[24]
Synthetic wastewater	none	1000	1.23	[25]
Septic wastewater	3.0	600	1.35	Present study

Figure 3 presents the voltage recorded from the MBVC in 15 days (360 hours) of digestion. The data showed the highest voltage recorded was 600 mL volume of tap water with a range of voltage of 1.30 to 1.35 V. Followed by 500 mL and 400 mL volumes of tap water with ranges of voltage of 1.27 to 1.31 V and 1.24 to 1.27 V, respectively. The lowest voltage was shown in a 300 mL volume of tap water with a range of 1.20 to 1.24 V.

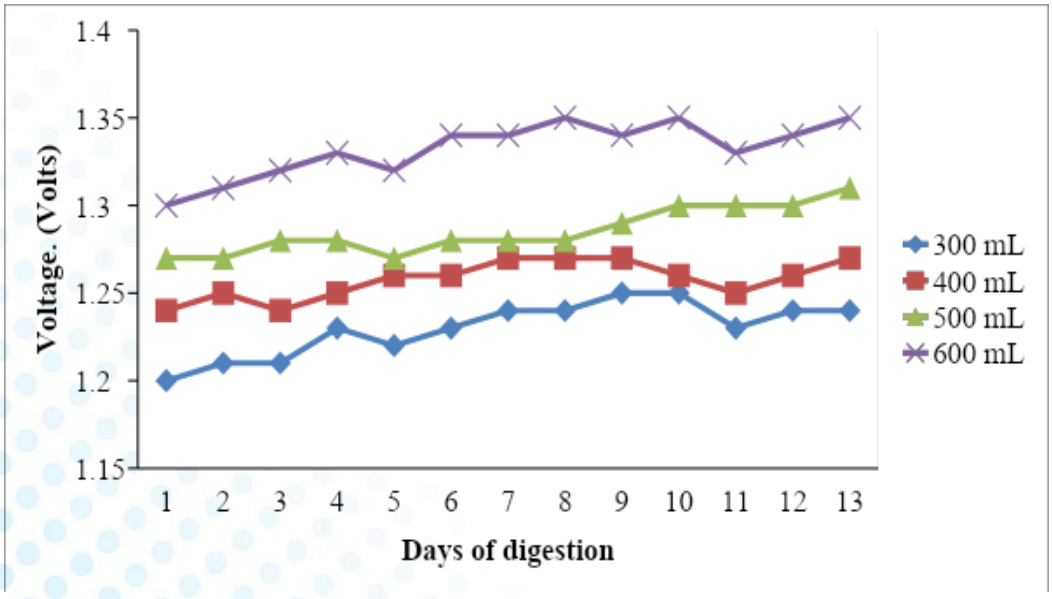

Figure 3**:** The performance comparison in terms of voltage at different volumes of tap water used in the aerobic column.

Based on the data in figure 3, the highest volume of tap water (600 mL) used with the addition of wastewater sample (100 mL) gave the highest voltage value. In the aerobic column of MBVC, oxygen is the key electron acceptor in the cathode column. The volume of water can influence the availability of the oxygen in the column. A larger volume of tap water could support better oxygen diffusion and availability which then could enhance the efficiency of the MBVC [24]. However, other studies have stated that maintaining a balance in the water volume is essential

for optimal dissolved oxygen levels. Too little water could lead to oxygen limitation, while too much could cause issues with gas diffusion. Moreover, unsuitable volume of water could also cause other practical issues such as flooding and reduced electrode contact [25-26].

Thus, optimizing the volume of tap water could be crucial for enhancing the performance of the MBVC. An optimal tap water volume can improve mixing or agitation, which ensures even distribution of oxygen. Additionally, an adequate amount of tap water at the cathode can influence the rate of electrochemical reactions, as insufficient oxygen availability can slow down the oxygen reduction reaction and thereby reduce the voltage output. Furthermore, this optimization helps to minimize operational issues by avoiding flooding. Additional research has also indicated that variations in MBVC design and the type of substrates used can affect fluctuations in output voltage as shown in Table 2 [26-27]. This data can serve as a reference for larger scale studies that involve larger amounts of samples and tap water volumes.

5. Conclusion

In conclusion, this study demonstrates that micro-bacterial voltaic cells (MBVCs) can be a viable alternative energy source for wastewater treatment. By investigating the effects of pH levels and water volumes on the performance of MBVCs, this study found the optimal conditions to significantly enhance microbial activity and voltage output. Specifically, a pH level of 3.0 and a water volume of 600 mL yielded the highest voltage outputs of 1.25 volts and 1.35 volts, respectively. These findings suggest that optimizing these parameters can reduce internal resistance and improve substrate availability, leading to a better overall cell performance. This research provides important insights for enhancing MBVC efficiency, offering a promising avenue for sustainabl e energy production in wastewater treatment applications. The current study showed that the pH value and water volume are crucial parameters in improving voltage production in future works.

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