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PREFACE

It is with profound appreciation and pride that I introduce the 2025 edition of the *Jurnal Pengajian Umum* (JPUM), published by the Department of General Studies, Politeknik Kota Kinabalu. This special issue features a selection of research papers presented at the *6th International Conference on Applied Sciences, Information and Technology* (ICo-ASCNITech) 2025, organised by Politeknik Ibrahim Sultan. This publication signifies the fruitful outcome of a strategic collaboration between the Department of General Studies, Politeknik Kota Kinabalu, and Politeknik Ibrahim Sultan.

This initiative reflects our shared aspiration to cultivate a strong research culture and to promote academic excellence within the polytechnic community. The selected articles encompass a broad spectrum of disciplines — including education, ethics, social sciences, language, and culture — demonstrating the interdisciplinary nature and relevance of General Studies in addressing the challenges of a rapidly evolving world.

Each paper presented in this issue embodies the intellectual depth, scholarly discipline, and creative insight of our researchers. Collectively, these works contribute meaningfully to the enrichment of academic discourse and to the advancement of knowledge across diverse fields. More importantly, they reflect the spirit of collaboration and innovation that continues to shape the future of Malaysia's Technical and Vocational Education and Training (TVET) landscape.

I wish to extend my deepest appreciation to all contributing authors, reviewers, and members of the editorial and organising committees for their dedication and professionalism. Their collective effort has made this publication a reality. It is my sincere hope that this edition of JPUM will serve not only as a repository of valuable research but also as an inspiration for continued scholarly engagement and collaboration among educators, researchers, and practitioners alike.

Qamariah binti Makmud

Head, Department of General Studies

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AI-Assisted Learning in Higher Education: Comparing Student Independence and Cognitive Development in Polytechnic and University College Contexts

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ABSTRACT

This study aims to investigate the differences in dependency on artificial intelligence (AI) tools and cognitive development among students from polytechnics and university colleges in Malaysia. Three main objectives were identified: (1) to examine the differences in AI dependency between students from polytechnics and university colleges, (2) to investigate the differences in cognitive development among students from both types of institutions, and (3) to explore the use of AI tools in students' learning across both institutions. Through using a mixed-methods approach, the following research assesses the cognitive development, institutional differences, and AI dependency levels in the AI combination. Quantitative results from the independent t-tests present that university college students ($M = 3.1075$) depict a relatively higher reliance on AI tools compared with polytechnic students ($M = 2.6152$). Nevertheless, university college students scored higher cognitive development scores ($M = 3.4449$ vs $M = 3.0650$), with a significant difference ($p < .001$). Moreover, the qualitative thematic analysis identifies AI tools, particularly ChatGPT, were widely used to support learning, especially in problem-solving and academic writing. However, challenges in using these tools were noted, including issues with the accuracy and relevance of answers provided, especially in subjects requiring clarity and precision. Overall, this study highlights that institutional background plays an important role in how students utilize AI tools, as well as the recommendations to overcome the challenge faced by both institutions in order to produce independent learners who are prepared for the evolving demands of the future workforce.

Keywords: AI-assisted learning, ChatGPT, higher education, polytechnic, university college, student independence, cognitive development

1. INTRODUCTION

The integration of Artificial Intelligence (AI) tools in higher education has become the fastest growing user application to transform the new era of teaching and learning processes. This usage is becoming more widespread, especially in relation to enhancing students' learning and growth. ChatGPT has proven to be particularly beneficial in academic settings, such as providing students with academic information and answers in a more comprehensible way, which they will rely on and thus can directly reduce their academic stress (Rani et al., 2023).

Several studies explore the role of AI in education, particularly in enhancing cognitive development, problem-solving skills, and promoting independent learning. Recent research emphasizes how AI applications like ChatGPT, as an adaptive learning system, and virtual assistants offer personalized support that enables students to navigate complex concepts, thereby increasing their engagement with learning materials. Moreover, AI-driven tools are recognized for fostering creative thinking and active problem-solving, equipping students to face real-world challenges effectively (BMC Psychology, 2023; Ryu & Han, 2021; Kafai & Burke, 2015). Although tools like ChatGPT have proven to be highly beneficial and effective, they also present challenges, functioning much like a double-edged sword. Users may

become increasingly dependent on it, raising concerns about privacy and potential misuse. Furthermore, there is a risk of it being exploited for negative purposes (Kasaneci et al., 2023; Okoye et al., 2024). The use of AI tools is highly flexible and adaptable, depending on the context and situation. As a result, the effect of AI tools can differ based on the educational structure, available resources, and the characteristics of the student population. Zhang et al. (2022) highlight that successful AI integration relies on contextual adaptation aligned with the institution's resources and student demographics, shaping how AI is implemented and perceived across different educational environments.

To gain insight into this perspective, this research aims to investigate the influence of AI-supported learning on students' independence and cognitive growth in polytechnics compared to university colleges. While polytechnics tend to focus on practical, hands-on learning as part of their technical and vocational training, university colleges place more emphasis on theoretical knowledge and research-based education. By studying how students in these different environments use AI tools like ChatGPT, this study seeks to identify the comparison of the usage, AI Dependency and cognitive development among students. The outcomes are expected to offer insights that can inform policy on AI use in ensuring proper AI usage among students toward effective learning practices.

1.1. Problem statement

The tendency for students to replicate responses generated by AI tools such as ChatGPT, without adequately filtering or critically evaluating these answers, poses significant challenges to cognitive development within educational contexts. Research indicates that while AI applications offer personalized learning opportunities, they also create potential ethical dilemmas that can negatively impact students' learning behaviors. For instance, according to Adel, Ahsan, and Davison (2024), the convenience of obtaining instant answers from ChatGPT may lead students to bypass essential processes of critical thinking and analysis. This reliance on AI-generated content can diminish their engagement with learning materials, resulting in a superficial understanding of complex concepts. Additionally, Ahsan et al. (2023) argue that the tendency to directly replicate AI responses undermines essential interactions between teachers and students, which are crucial for collaborative and effective learning, ultimately risk altering educational content and hindering the development of students' interpersonal skills, which are essential for their growth as holistic individuals.

These findings highlight the importance of developing educational strategies that promote responsible AI usage. It is essential that students are encouraged to interact critically with AI-generated information, fostering genuine cognitive development and maintaining educational integrity. Ongoing research is essential as well to explore how AI technologies like ChatGPT can be integrated into learning practices while supporting deeper learning experiences among students in different educational settings.

1.2. Research Objectives

- 1.2.1. To investigate the differences in dependency levels on AI tools between students in polytechnics and those in university colleges.
- 1.2.2. To investigate the differences in cognitive development among students from polytechnics and university colleges.
- 1.2.3. To explore the effective integration of AI tools in student learning, in both polytechnic and university college settings.

2. LITERATURE REVIEW

In recent years, AI has gained significant attention to improve student performance and engagement in higher education. AI platforms such as ChatGPT have been shown to offer personalized learning experiences and real-time feedback, which enhance student achievement (El-Bishouty et al., 2022). Research indicates that AI tools can help students with technical challenges, provide guidance on writing, and assist with research (Nath & Banerjee, 2024). This capacity for customization makes AI a powerful tool for advancing both independent learning and cognitive development.

Cognitive development, which includes skills such as critical thinking, creativity, and problem-solving, is one of the core objectives of higher education to align with the National Education Philosophy, aiming to produce holistic students. AI tools are often viewed as valuable resources for fostering these skills. Studies indicate that students utilizing AI platforms are better equipped to address intricate problems and engage in profound learning experiences, attributable to the tailored assistance afforded by AI (Tang & Deng, 2022).

However, the question of whether AI promotes or inhibits student independence remains unresolved. Although AI can help students learn autonomously, there are concerns that too much reliance on these tools could prevent students from developing their own problem-solving strategies (Adel et al., 2024).

The educational environment strongly influences how students engage with AI tools. Polytechnics, which emphasize Technical and Vocational Education and Training (TVET) and project-based learning, offer students with more structured, industry-focused curricula. For example, students who often work on projects tied to industry needs, use AI to assist with coding, problem-solving, and other technical tasks (Amdan et al., 2024). The practical orientation of polytechnics may lead to different learning patterns and attitudes toward AI use compared to students in private institutions, which focus more on theoretical learning. Based on study conducted by Ab Hamid et al. (2023) in Politeknik Besut, Terengganu, it is believed that the learning experience is enriched with the integration of AI technology to optimize students' learning in the field of TVET by using AI tools for technical support, such as coding and data analysis, and for solving engineering problems. In contrast, institutions of higher learning, which offer a broader range of programs in fields like business, arts, and sciences, emphasize research and individualized learning. A study by Nath & Banerjee (2024) demonstrates that ChatGPT has a positive impact on the writing skill development such as grammar, vocabulary and sentence structures. This divergence in educational focus leads to different patterns of AI usage, with private college students using tools like ChatGPT more for creative assignments and theoretical work.

To ensure fairness, it is critical to address these gaps in order to provide all students with equitable access for effective engagement with AI tools. By bridging the disparities between polytechnics and university colleges, we can facilitate a more balanced educational landscape where students can leverage AI technologies to enhance their learning experiences. This can ultimately lead to improved academic outcomes, regardless of the institution's focus or resources available.

3. RESEARCH METHODOLOGY

This research employs a mixed-methods approach to explore the study objectives. A quantitative methodology will be used to gauge AI dependency levels and examine indicators of cognitive development among students from polytechnics and university colleges. This comparative framework facilitates statistical evaluation, offering measurable insights into AI reliance and cognitive growth across student groups (Creswell & Creswell, 2018). To supplement the quantitative findings, a qualitative component will be incorporated using semi-structured interviews with students. This qualitative dimension aims to uncover effective practices and challenges in AI integration within educational contexts, adding depth to the statistical data (Merriam & Tisdell, 2016).

3.1. Population and Sampling

The study targets students and faculty members from specific polytechnic and institution of higher learning. To ensure a balanced representation, a convenience sampling method will be used to select student participants from each type of institution because it is cost-effective and time-efficient. This method helps capture a comprehensive perspective on dependency level and cognitive outcomes across different educational contexts. Additionally, purposive sampling will be employed for selecting interview participants, focusing on individuals who actively engage with using AI tools, as their insights will be particularly relevant.

3.2. Data Collection Instruments

Two primary tools will facilitate data gathering. First, a 5-point Likert scale questionnaire will assess students' reliance on AI tools, allowing participants to express their degree of agreement or disagreement, which supports quantitative analysis. A cognitive development scale will also be used to assess critical skills such as problem-solving and analytical thinking, important in understanding the cognitive effects of AI tool use. The second tool, an interview protocol, will direct the qualitative data collection. Comprising open-ended questions, it aims to capture participants' views on effective AI practices, integration challenges, and potential improvements, allowing them to discuss their personal experiences in detail (Cohen, Manion, & Morrison, 2018). The instrument is adapted from Ab Hamid et al. (2023) which is related to the similar context of this research.

3.3. Data Analysis

The quantitative data will undergo analysis through independent t-tests to compare AI dependency levels and cognitive markers between polytechnic and private college students. These statistical tests, conducted via SPSS 27/28, are suited for determining notable differences between the groups concerning AI usage and cognitive development measures (Field, 2018). The qualitative data will be analyzed using thematic analysis to identify recurring themes from interview responses. This process involves multiple reviews of transcripts to create a coding framework, enabling the discovery of trends and effective practices in AI integration (Braun & Clarke, 2006).

3.4. Ethical Consideration

This research will strictly adhere to ethical guidelines to ensure participant confidentiality and uphold their rights. Each participant will be asked to provide informed consent, which will outline the study's objectives, data confidentiality, and their right to withdraw at any time (American Psychological Association, 2020). Moreover, all responses will be anonymized, and the collected data will be securely stored in line with institutional protocols to protect participant privacy.

4. RESULT

An independent t-test was conducted to examine differences in dependency levels between polytechnic students ($n = 160$) and university college students ($n = 89$). Levene's test for equality of variances did not yield a significant result, $F(1, 247) = 1.053$, $p = 0.306$, suggesting that the assumption of equal variances was appropriate. The t-test results revealed a meaningful disparity between the two groups, $t(247) = -5.192$, $p < .001$. On average, polytechnic students demonstrated a lower dependency level ($M = 2.6152$, $SD = 0.72631$) compared to their counterparts in university college ($M = 3.1075$, $SD = 0.70028$). The mean difference was -0.49237 , with a 95% confidence interval ranging from -0.67915 to -0.30558 , reinforcing the presence of a notable gap in dependency tendencies between these institutions. The calculated effect size, Cohen's $d = -0.687$, aligns with Cohen's (1988) classification of a moderate to large effect. It is shown as in table 1 as below.

Table 1: Independent Samples t-Test for Dependency Level

Group	n	M	SD	F	p (Levene's)	t (df)	p (t-test)	Mean Difference	Cohen's d
Polytechnic Students	160	2.6152	0.7263	1.053	.306	-5.192	< .001	-0.49237	-0.687
College University Students	89	3.1075	0.7003						

An independent samples t-test was conducted to compare cognitive development scores between polytechnic and university college students. Levene's test for equality of variances was not significant, $F(1, 247) = 0.649$, $p = .421$, indicating that equal variances were assumed. The results showed a

statistically significant difference between the two groups, $t(247) = -3.904$, $p < .001$. The mean cognitive development score for polytechnic students ($M = 3.0650$, $SD = 0.72043$) was significantly lower than that of college university students ($M = 3.4449$, $SD = 0.76322$). The mean difference was -0.37994 , 95% CI $[-0.57163, -0.18826]$, suggesting a notable variation in cognitive development between institution types. The effect size of Cohen's d was -0.73596 , indicating a moderate to large effect size.

Table 2. Independent Samples t-Test for Cognitive development

Group	n	M	SD	F	p (Levene's)	t (df)	p (t-test)	Mean Difference	Cohen's d
Polytechnic Students	160	3.0650	0.72043	0.64 9	.421	-3.904	< .001	-0.379	-0.516
College University Students	89	3.4449	0.76322						

The data collected through interviews with the three respondents from polytechnic and university college respectively, offer a relatively strong foundation focusing on their roles in enhancing comprehension, problem-solving, and academic engagement. For clarity, respondents from polytechnic will be designated as Interviewee 1 through 3, and Interviewee 4 through 6 for university college respectively. Evaluating the transcripts reveals main themes, which reveal ChatGPT's ultimate role in student learning. Furthermore, the findings may suggest intriguing linkages with previous studies on decision heuristics (experiments and behavioural) and usability issues (heuristic evaluations and others), that invite further investigations.

4.1. Theme 1-Utility of ChatGPT in Learning

Three respondents focused on using ChatGPT in multiple aspects of their learning protocols. The primary function as presented within the interviews is to offer insights, answer queries, and produce ideas that support the completion of tasks along with academic growth. Respondents frequently used the AI tool to prepare assignments, specifically in subjects that need language construction or problem-solving. The respondents from university college were more exact in their usage, namely in programming and refined academic search. It is common for them to prompt ChatGPT by inserting entire code segments to debug errors, learning of new programming languages whereby ChatGPT was used for code generation and at times to generate an entire code for a different context based on existing code. On the latter, Interviewee 4 explained that for an AI project that enabled users to play on non-physical piano keys, he prompted ChatGPT by pasting existing source code for a normal keyboard and asked for code generation of the equivalent for a musical piano key. For language related task, one of the respondents (a polytechnic respondent) mentioned that using ChatGPT to create English scripts for a presentation, is a task that presented challenges because of their low English proficiency. The university college respondents were in agreement expressing that for non-computing courses that require lots of writing, ChatGPT was relied on, although for computing courses, being conscious of plagiarism issue, they would use ChatGPT for ideas generation for their own writing and elucidation. Interestingly Interviewee 6 shared how he would write in Mandarin, used ChatGPT to translate and online AI-to-human text converter (like <https://www.humanizeai.pro/>) to make the final output resemble a regular student work.

On maths problems, Interviewee 2 mentioned using ChatGPT exclusively for this and complimenting its reporting capability to offer brief and step-by-step explanations as required. This related feature of presenting the breakdown of complicated challenges within manageable steps is specifically considerable for improving understanding in the technical domains. Interestingly, this was contradicted by Interviewee 4 that ChatGPT was not useful in explaining the workings of a math solution. When attempting to prompt for step-by-step detailed workings, Interviewee 4 deemed the answer problematic and in disagreement with his accepted, lecturer-supplied answer. As such he categorically dismissed ChatGPT for maths problem, although using the same satisfactorily in other areas.

Along with the academic applications, respondents also presented the non-academic uses of ChatGPT, including it being a research and budget-friendly product or retrieving insights about general topics. Such dual functionality visualizes the flexibility of ChatGPT as an academic aid and a tool for personal exploration, presenting it as a versatile option for students.

4.2. Theme 2- Challenges in Using ChatGPT

Though the respondents reported the advantages retrieved from ChatGPT, they also highlighted multiple challenges that delayed the platform's effectiveness. A major issue was reported to be the response's irrelevancy or occasional inaccuracy, specifically when the queries were not correctly phrased or presented. Interviewee 1 furthermore noted that relatively poorly framed questions led to answers that did not coincide with their intended needs or expectations. For instance, when retrieving recommendations for budget-friendly phones, ChatGPT repeatedly presented the high-end devices, requiring more refinements or revisions in the query. The second challenge was related to the challenges of several answers, which needed more effort to clarify or simplify. The respondents reported the need to rephrase the questions or retrieve other explanations when the responses of ChatGPT were found to be either too detailed or vague. The issue was specifically explained in the subject's demanding precision, including Mathematic and Engineering Science.

The university college respondents would agree with aforementioned observations, but nuanced by ChatGPT inability to express disagreements more assertively. For example, when presented with initial suppositions or ideas, despite after several promptings and refinements, the results were unsatisfactory, they would abandon the current chat and start anew. The respondents attributed this problem as due to the AI's inherent learning model. This in turn may explain the unsatisfactory experience of using ChatGPT for math problems experienced by Interviewee 4 earlier. Meanwhile Interviewee 6 would simply switch to alternative tool like Grok (<https://x.ai/>)

Technical challenges have also emerged to be consistent barriers with Interviewee 1 reporting that slow internet connectivity was a delay in accessing ChatGPT. These obstacles hinder the learning process along with identifying the reliance on external factors for ChatGPT's extreme functionality. In fact, Interviewee 6 reported subscribing to ChatGPT (approximately RM120 monthly subject to currency exchange rate) and so benefitted from better learning models. Respondents from university college seem to side step the technical barrier considerably, either through financial means, better in campus facility or resourcefulness (like resorting to alternative AI tools).

4.3. Theme 3-Learning Outcomes

The conducted interviews provided information regarding the way how ChatGPT influences learning outcomes, particularly regarding understanding and problem-solving. These outcomes are also nuanced by the pedagogical approach employed in the learning environment, resulting in significant differences in ChatGPT utility. In Malaysia, the highest Malaysian Qualification Framework (MQF) programme level 3 for a polytechnic institution typically would be level 3: cognitive domain level 3 (C3) at application, affective domain level 2 (A2) at responding and psychomotor domain level 3 (P3) at guided response. For a university college offering a degree programme (MQF Level 4), the domains would be set at C4 (analysis), A3 (valuing) and P4 (mechanism). The subsequent findings would be better appreciated taking into account these nuances.

Beginning with polytechnic respondents, they reported that employing ChatGPT further motivated them to engage with the learning materials in multiple ways, consisting of acts such as learning outcomes, understanding, and problem-solving. It was also revealed that ChatGPT, in various ways, helps in breaking down complex explanations. These actions rectify the descriptions by creating a thorough integration with the subject matter. According to the majority of respondents, ChatGPT is beneficial for learning, and their opinions of it were largely good. Additionally, the participants appreciated ChatGPT's capacity to support various language issues and offer prompt responses. It was made abundantly evident, nevertheless, that ChatGPT should be utilised in conjunction with conventional learning

resources rather than in place of them. The respondents also discussed how ChatGPT helps people become more independent by helping them solve problems and write assignments without help from humans. By offering a platform for self-directed writing, ChatGPT encouraged participants to learn the subjects at their own pace and convenience. Additionally, it was especially helpful in circumstances where the usual support networks such as lecturers and classmates were unavailable. The university college respondents, in turn, treat ChatGPT beyond assignment writing to generating actual solutions to serious problems: coding. They seemed to demonstrate autonomy in learning and valuing when they express relegating ChatGPT utility to idea generation rather than lower-level thinking order tasks like writing. When forced to do so, they exercise integrity by using it sparingly like for non-computing courses, language translation of original work and “humanizing” the end result using relevant tool.

Table 3. Comparisons between polytechnic and university students in various areas on AI tool utilization

Area	Polytechnic Students	University College Students
AI dependency	Medium to low	High
AI for language	High	Medium
AI for higher-order thinking (e.g. analysis, synthesis, evaluation etc.)	Limited	High
Infrastructure impediments	High	Low
Perceived weaknesses	Not a substitute for face-to-face learning	Lack of confidence in tackling math-related problems

5. DISCUSSION

The findings indicate that the institutional background substantially influences the way how students continue to engage with the AI tools, impacting their dependency and cognitive development. University college students exhibited a substantially increased dependency on AI tools, including ChatGPT, with a mean dependency score of 3.1075 in comparison to 2.6152 for polytechnic students. Such a difference is significant statistically and dictates that university college students rely more on AI tools for the completion of academic tasks. Nevertheless, this situation did not hinder cognitive development; instead, it showed an increase with the mean of 3.4449 compared to polytechnic students ($M = 3.0650$). It is affirming with the findings done by Nath, Chakraborty, and Banerjee (2024) with the private college students that their regular usage of ChatGPT has a positive impact on their writing and grammar skill development which is most likely to related with the cognitive development. The cause behind such reliance may be the coursework nature in university college, which frequently focuses on theoretical learning, academic writing, and research-intensive tasks (Zhai et al., 2024). The AI tools offer supportive findings in such areas by producing content, assisting with language-related issues, and summarising the research materials in consideration. In a learning environment that requires analysing, autonomous learning and mechanistic proficiency, AI tools are essential for productivity, especially for a typical time constraint and multiple concurrent projects.

Alternatively, polytechnic students depicted a relatively lower AI dependency level. Their relatively lower average usage may dictate more regarding the traditional methods followed by the hands-on problem-solving techniques in which students engage in real-world applications other than theoretical description. This situation is consistent with Alias et al. (2023) who found that students in Polytechnic Malaysia are less likely to rely on ChatGPT as their primary source for answers and inquiries about learning topics, preferring instead to seek help from lecturers and peers. Furthermore, the usage patterns within them may suggest a relatively uniform approach toward learning, reflecting the continuous teaching methods or the resource limitations in the polytechnic environment. This is also in line with the finding from research done by Anayochukwu, A. (2024) towards one of the technical colleges in Enugu State, Nigeria which is similar with the polytechnic context, demonstrates that students indicate limited reliance on AI tools because of inadequate technological infrastructure and limited exposure to advanced technologies. Moreover, according to the interview findings, polytechnic student expressed the result in responses from ChatGPT did not align with their intended goal or expectations, which shows that the minimal exposure to effective AI usage in order to obtain the desire answer. This situation may lead to less likely to rely on ChatGPT compared to University College students as they are more familiar in utilizing ChatGPT to achieve relevant outcomes.

A relatively higher reliance level on AI tools was depicted among university college students. However, the findings exhibit that Cognitive Development Scores are relatively higher for the students from the university college ($M = 3.4449$) in comparison to the polytechnic students ($M = 3.0650$). The marginal difference may indicate that university college students perceive higher advantages from AI tools in building problem-solving and critical thinking skills. A relatively higher usage may dictate that university college students use AI tools for tasks needing information synthesis and theoretical research, which may improve cognitive development in such areas. The study findings correspond with those reported by Nath et al. (2024) that students who used ChatGPT regularly had a high level of confidence in their writing abilities as well as can boost up their cognitive development on writing skill. Again, this is consistent with the interview findings supporting the notion that the pedagogical approach in the learning environment may influence the utility of AI tools.

The study also underscores how students from both polytechnic and university college integrate ChatGPT into their learning in various ways, especially for academic tasks such as assignments, problem-solving, and language support. The tool's ability to provide prompt and structured responses as well as being able to break down complex topics into simpler do enhance their understanding, particularly in technical subjects. However, challenges such as providing inaccuracies and lacking logical coherence in responses, difficulty in framing effective queries, and technical limitations like internet connectivity were identified as barriers to effective use among them.

On the issues of inaccuracies and lack of coherence, the previously mentioned contradictory view on using ChatGPT for maths problems and alleged lack of assertiveness of the AI tool to disagree, may be explained by Suri et al (2024) who concluded that GPT-3.5 (one of the ChatGPT models) did exhibit human decision heuristics. The implication is that human biases might be subtly introduced into the learning model via training data. As a result, accuracy of ChatGPT may be influenced by factors like irrelevant numerical anchors (when prompted with higher numbers, the model may yield higher estimates), overweight recent examples, how options are being presented and endowment effect. Despite facing these challenges, students still generally perceive ChatGPT as a beneficial tool to their learning.

A quantitative method is used to validate specific phenomenon (Tay et al 2024) and this study has established that: (1) There is a significant difference in the dependency levels on AI tools between students in polytechnics and students in university colleges, being that the latter demonstrated higher dependency. (2) There is a significant difference in cognitive development levels between students from polytechnics and students from university colleges, being that the latter has higher cognitive development score. The qualitative interview, which explores broad phenomena, not only triangulate the above, but also suggests explanations and further studies. For example, the factor of human decision heuristics may suggest a similar study (Suri et al 2024) but with adjustments to the current study's context. Also, pedagogical differences attributed to the learning environment and its bearing on how the students will utilize AI tools, require further study like Wang et al (2025) that uses heuristics evaluation with the focus on better understanding of usability. The results from these would enable the polytechnic and university college to draft better informed policies, guidelines and other recommendations. It is in light of the current findings and these future studies that the subsequent recommendations are made.

6. RECOMMENDATIONS

Polytechnics and university colleges must execute AI literacy programs that allow students with the deserved skills required to evaluate AI-generated content critically. It is essential for university college students to realize the importance of independent learning and critical thinking, despite their higher cognitive development. Institutions should implement targeted strategies to reduce over-reliance on AI, emphasizing its role as a supportive tool rather than a replacement for cognitive effort. For example, students should be encouraged to use AI for idea generation and clarification of concepts, while always verifying the information through reliable academic sources. Furthermore, educational workshops or training on AI literacy can help students develop deeper insight about AI-generated content, allowing

them to question the relevance and accuracy of the information provided. Furthermore, instructors must combine AI tools within a structured manner into the curricula, assigning their use with the academic goals (Morales et al., 2024) and they must focus on utilizing AI for analytical and research reasoning.

On the other hand, without compromising the development of critical thinking skills, polytechnic institutions should consider incorporating AI usage into their curriculum while ensuring that students are trained to evaluate AI responses effectively and use them responsibly. Polytechnics must include AI within the skill-based training regime to ensure that AI serves to be a complement other than an ultimate replacement for the typical research methods. Educational institutions may also build policies that responsibly guide the usage of AI, refraining from over-dependency along with extending the potential of AI to improve learning. Lastly, investment in the digital infrastructure is mandatory to acknowledge the technical challenges and ensure that all the students have access to the AI tools that support their development in academics. This initiative affirms the suggestion by Alias, Aziz, and Kambaruddin (2023) who carried out a similar topic stated that TVET institutions need to consider to provide sufficient resources, AI application training and encourage responsible usage to create a conducive AI learning environment. These also align with the government's efforts in integrating the elements of Artificial Intelligence (AI) into the education curriculum to enhance the quality of education nowadays. (Global Education Monitoring Report Team, 2023).

7. CONCLUSION

Across both institutions, it is crucial for educational leaders to establish clear policies that promote ethical and balanced use of AI tools. Polytechnic institutions must focus on embedding AI within skill-based training programs, ensuring that AI supports rather than replaces traditional teaching and learning methods. Equally important is fostering critical thinking by training students to assess AI-generated content responsibly. University colleges, on the other hand, should address to reduce the risks of over-dependence on AI by encouraging reflective practices and reinforcing foundational academic skills alongside AI usage. In line with national efforts to embed AI into the education curriculum, institutions must provide adequate resources, providing appropriate AI literacy training for lecturers and students, as well as guidance to create a supportive and responsible AI learning environment. Ultimately, these steps will contribute to produce independent learners who are prepared for the evolving demands of the future workforce.

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Tinjauan Keberkesanan Instrumen Penaziran Akademik di bawah Skop Jaminan Kualiti dalam memastikan Pematuhan terhadap Standard Akreditasi di Institusi POLYCC

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ABSTRAK

Kajian ini dijalankan untuk meninjau keberkesanan instrumen Penaziran Akademik (PeNA) yang dilaksanakan oleh Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) dalam memastikan pematuhan institusi terhadap standard akreditasi, khususnya dalam konteks sistem jaminan kualiti akademik. Dalam era pendidikan tinggi yang semakin mencabar dan berorientasikan kualiti, keberkesanan mekanisme pemantauan dalaman seperti PeNA amat penting untuk memastikan institusi pendidikan latihan dan vokasional (TVET) kekal kompetitif dan relevan. Kajian ini memfokuskan kepada lima skop utama dalam jaminan kualiti iaitu struktur jaminan kualiti, pengauditan akademik, akreditasi program pengajian, pemantauan pelaksanaan program serta pematuhan terhadap standard akreditasi. Kaedah kajian menggunakan pendekatan kualitatif iaitu melalui pemerhatian untuk mendapatkan data daripada institusi-institusi PolyCC. Hasil kajian mendapati bahawa instrumen sedia ada relevan namun masih memerlukan beberapa penambahbaikan berdasarkan keperluan standard akreditasi semasa. Hasil kajian telah mengenal pasti beberapa syor penting bagi penambahbaikan instrumen penaziran melibatkan beberapa perkara seperti keperluan pelaksanaan training for trainers (TOT) berkala, pelaksanaan elemen close the loop berdasarkan teguran Panel Penilai, keperluan pelaksanaan lawatan penandaarasan, pelaksanaan analisa keberkesanan penambahbaikan berterusan (CQI) dan pembangunan formula yang diperkembangkan bagi mengira nisbah pensyarah terutama melibatkan institusi kecil. Selain itu, cabaran lain yang dikenal pasti termasuk kekangan sumber manusia, perbezaan kefahaman terhadap instrumen, dan ketidakkonsistenan dalam pelaksanaan antara institusi. Kajian ini mencadangkan agar instrumen PeNA dikemaskini bagi pelaksanaan akan datang melibatkan semua institusi di bawah JPPKK.

Kata kunci: penaziran akademik, jaminan kualiti, standard akreditasi

1. PENGENALAN

PeNA merupakan satu proses sistematik yang dilaksanakan bagi menilai dan memantau pelaksanaan aspek akademik di institusi pendidikan tinggi. Ia bertujuan memastikan semua program pengajian mematuhi standard dan garis panduan yang ditetapkan oleh badan akreditasi serta pihak berkepentingan lain. Proses ini penting untuk menjamin kualiti penyampaian pendidikan dan memastikan program memenuhi piawaian akreditasi. Di bawah JPPKK, PeNA dilaksanakan secara berkala di Politeknik dan Kolej Komuniti menggunakan instrumen penaziran yang dibangunkan khusus. Instrumen ini menilai lima skop utama: struktur jaminan kualiti, pengauditan dalaman, akreditasi program, pemantauan pematuhan standard, dan pematuhan kepada keperluan badan akreditasi. Ia juga berfungsi sebagai panduan kepada penazir serta rujukan bagi institusi dalam melaksanakan penambahbaikan berterusan (CQI).

Namun begitu, pelbagai isu timbul seperti ketidakseimbangan pelaporan sendiri, pelaksanaan tindakan susulan yang tidak konsisten, dan tahap kefahaman berbeza terhadap kriteria dalam instrumen. Ini menunjukkan perlunya penambahbaikan kerana perubahan dasar pendidikan dan akreditasi memerlukan instrumen yang fleksibel dan sentiasa dikemaskini. Menurut Barnett (1992), jaminan

kualiti bukan sekadar menilai hasil, tetapi juga proses dan pengurusan akademik. Oleh itu, penaziran akademik perlu dilihat sebagai satu proses strategik yang mampu mencerminkan budaya kualiti secara holistik dalam institusi, bukan sekadar memenuhi keperluan akreditasi secara formal.

1.1. Penyataan Masalah

Terdapat ketidakkonsistenan yang ketara dalam pelaksanaan dan pelaporan aktiviti jaminan kualiti antara institusi TVET di bawah JPPKK. Keadaan ini berpunca daripada faktor seperti perbezaan tahap kefahaman staf, kekangan sumber manusia serta kemampuan sistem pengurusan kualiti yang berbeza. Menurut kajian oleh Ismail et al. (2022), pelaksanaan jaminan kualiti di institusi TVET awam di Malaysia sering kali tidak selaras akibat kekurangan latihan sistematik kepada tenaga pengajar serta interpretasi yang tidak seragam terhadap garis panduan kualiti. Situasi ini menjejaskan keseragaman pelaporan serta keberkesanan pemantauan terhadap pelaksanaan program pengajian yang ditawarkan. Selain itu, tafsiran yang berbeza terhadap keperluan standard akreditasi seperti pelaksanaan CQI, dokumentasi aktiviti PdP dan bukti pematuan turut menimbulkan ketidakselarasan dalam pelaksanaan penaziran. Kajian oleh Ramli & Abdullah (2023) turut mendapati bahawa perbezaan kefahaman dalam kalangan pegawai penaziran berkait keperluan standard MQA menyumbang kepada penilaian yang tidak konsisten, lantas mengurangkan integriti proses penjaminan kualiti. Perbezaan ini menyebabkan institusi gagal melaksanakan proses jaminan kualiti secara menyeluruh dan sistematik.

Instrumen penaziran akademik yang digunakan pada masa ini dilihat masih mempunyai ruang untuk penambahbaikan dari segi struktur, kandungan dan pelaksanaannya. Keperluan kepada semakan berkala berdasarkan keperluan semasa, maklum balas lapangan serta perkembangan standard akreditasi mengurangkan keberkesanan instrumen tersebut sebagai alat kawalan mutu dalaman. Seperti yang dinyatakan oleh Norazlan et al. (2022), ketiadaan semakan instrumen secara berkala menyebabkan ketidakupayaan instrumen sedia ada menangani cabaran semasa berkait pelaksanaan standard OBE dan pematuan CQI. Situasi ini menyukarkan usaha JPPKK dalam memastikan pematuan institusi terhadap kehendak akreditasi secara konsisten. Akhirnya, kelemahan dalam sistem penaziran boleh memberi kesan besar terhadap keupayaan institusi memperoleh atau mengekalkan akreditasi program pengajian. Ia juga boleh menjejaskan kredibiliti JPPKK sebagai badan penyelaras TVET di peringkat nasional. Oleh itu, kajian sistematik terhadap keberkesanan instrumen penaziran amat penting bagi memastikan PeNA benar-benar berfungsi sebagai mekanisme kawalan kualiti yang proaktif dan relevan

1.2. Objektif

- Mengenal pasti tahap keberkesanan instrumen penaziran dalam skop jaminan kualiti yang digunakan oleh JPPKK.
- Menilai tahap pematuan institusi terhadap standard akreditasi berdasarkan lima skop utama di bawah jaminan kualiti.
- Mencadangkan penambahbaikan terhadap instrumen penaziran bagi meningkatkan mutu pelaksanaan PENA

1.3. Skop

Kajian ini memfokuskan kepada lima komponen utama penaziran akademik yang berteraskan jaminan kualiti, iaitu struktur jaminan kualiti, aktiviti pengauditan akademik, akreditasi program pengajian, pemantauan terhadap pematuan standard akreditasi, dan pematuan terhadap keperluan standard tersebut. Struktur jaminan kualiti menyediakan asas kepada pengurusan sistematik, manakala pengauditan berperanan menilai keberkesanan pelaksanaan dasar dan proses akademik. Akreditasi program pula memberi pengiktirafan rasmi terhadap kualiti sesuatu program, disusuli dengan pemantauan berterusan bagi memastikan pematuan terhadap piawaian yang ditetapkan.

1.4. Kepentingan Kajian

Kajian ini amat penting kepada JPPKK dalam memperkukuh sistem jaminan kualiti akademik di institusi TVET. Melalui kajian ini, JPPKK dapat menilai kesesuaian dan keberkesanan instrumen sedia ada serta memperbaiki dasar dan garis panduan berkaitan pemantauan kualiti. Kajian ini juga memberi impak kepada pihak pengurusan institusi dalam meningkatkan kefahaman serta kecekapan melaksanakan amalan jaminan kualiti secara sistematik. Instrumen yang ditambah baik mampu mengesan ketidakpatuhan lebih awal, sekali gus menyokong pelaksanaan CQI secara berkesan. Selain menyumbang kepada kecemerlangan institusi, kajian ini turut menyokong aspirasi nasional dalam memperkukuh pendidikan TVET sebagai pemacu pembangunan negara. Penaziran akademik yang mantap membantu memastikan kebolehpasaran graduan dan meningkatkan reputasi institusi di peringkat global. Hasil kajian juga membuka ruang kepada penyelidikan lanjutan serta menyumbang kepada pengkayaan ilmu dalam bidang penjaminan kualiti pendidikan tinggi di Malaysia.

2. SOROTAN KAJIAN

PeNA merupakan proses sistematik yang dilaksanakan secara berkala bagi menilai pelaksanaan program pengajian, pematuan terhadap garis panduan dan piawaian, serta pelaksanaan aktiviti akademik yang ditetapkan. Dalam konteks institusi pendidikan tinggi seperti politeknik dan kolej komuniti, PeNA bertindak sebagai mekanisme kawalan dalaman yang dapat mengesan kelemahan, merancang penambahbaikan serta menjamin kualiti penyampaian program secara menyeluruh. Menurut Sidek (2020), penaziran akademik yang dilaksanakan secara terancang dan menyeluruh bukan sahaja membantu mengenal pasti ketidakpatuhan terhadap standard, malah mampu memperkukuh budaya kualiti dalam kalangan warga akademik. Proses ini turut memastikan kejelasan peranan, akauntabiliti pelaksanaan, serta keberkesanan penyampaian pengajaran yang berasaskan hasil pembelajaran.

Tambahan pula, PeNA dapat dijadikan sebagai alat refleksi dalaman yang penting bagi institusi pendidikan tinggi. Ia bukan hanya bertujuan menilai pematuan secara dokumentasi, tetapi turut memberi penekanan kepada pelaksanaan sebenar di peringkat pelaksana program dan pengurusan akademik. Kajian oleh Yassin, Abas dan Jalil (2021) mendapati bahawa institusi yang mengamalkan penaziran secara konsisten lebih bersedia menghadapi audit luaran dan akreditasi kerana telah melalui proses dalaman yang ketat dan menyeluruh. Instrumen penaziran yang baik juga perlu meliputi semua skop dalam jaminan kualiti termasuk reka bentuk kurikulum, pelaksanaan aktiviti pengajaran dan pembelajaran, penilaian pelajar, pentadbiran program dan keberkesanan CQI. Namun demikian, kajian lepas juga menunjukkan bahawa penaziran tidak akan memberi kesan yang optimum sekiranya instrumen yang digunakan tidak lengkap, tidak dikemaskini atau tidak diselaraskan dengan keperluan semasa akreditasi. Menurut Ali dan Mohd Zain (2022), banyak institusi menghadapi kesukaran untuk menterjemah piawaian akreditasi kepada bentuk pelaksanaan kerana ketiadaan instrumen penaziran yang seragam dan berpanduan kepada garis panduan akreditasi yang terkini. Situasi ini mengakibatkan ketidakkonsistenan dalam pelaporan dan kekeliruan semasa proses audit. Musnida (2024) pula melalui kajian terhadap institusi pendidikan tinggi awam di Malaysia, menegaskan bahawa audit dalaman seperti PeNA perlu diberi perhatian serius kerana ia memainkan peranan penting dalam pemantauan risiko, ketelusan tadbir urus dan penjajaran pelaksanaan akademik terhadap objektif strategik institusi. Dapatan ini mengukuhkan keperluan PeNA dilaksanakan secara konsisten sebagai satu komponen penting dalam amalan pengurusan kualiti akademik yang berkesan.

Struktur jaminan kualiti merupakan asas penting dalam sistem pendidikan tinggi yang berkesan. Menurut Kementerian Pendidikan Tinggi (2019), struktur ini merangkumi dasar, polisi, mekanisme pemantauan dalaman dan luaran, serta prosedur CQI yang terancang. Struktur yang kukuh bukan sahaja memastikan institusi sentiasa selaras dengan kehendak piawaian akreditasi, tetapi turut membolehkan pelaksanaan program pengajian berlaku secara konsisten dan berkualiti. Tanpa struktur yang jelas dan teratur, institusi mungkin menghadapi cabaran dalam mengintegrasikan keperluan agensi akreditasi ke dalam pelaksanaan akademik harian, seterusnya menjejaskan kualiti output pendidikan dan pengiktirafan program oleh badan profesional. Institusi pendidikan di bawah JPPKK beroperasi dalam

persekitaran yang dinamik dan dipandu oleh pelbagai garis panduan yang ditetapkan oleh badan akreditasi. Kejelasan struktur jaminan kualiti yang menghubungkan aspek polisi, tanggungjawab organisasi, instrumen penilaian serta tindakan pembetulan adalah amat penting. Hassan dan Rahman (2020) menegaskan bahawa keberkesanan sesuatu sistem jaminan kualiti terletak pada bagaimana setiap komponen dalam struktur tersebut berinteraksi dan berfungsi secara bersepadu.

3. METODOLOGI

Instrumen kajian yang digunakan dalam penyelidikan ini merangkumi kaedah pemerhatian berstruktur, yang bertujuan untuk mengumpul data secara langsung berkenaan pelaksanaan aktiviti penaziran akademik di institusi-institusi TVET di bawah seliaan JPPKK. Kajian ini menggunakan pendekatan pemerhatian berstruktur sebagai kaedah utama pengumpulan data adalah kerana untuk menilai secara langsung pelaksanaan aktiviti PeNA di institusi yang terlibat. Pendekatan ini dipilih kerana ia membolehkan penyelidik memperoleh gambaran yang lebih autentik, konkrit dan berfakta berkaitan pelaksanaan sebenar komponen jaminan kualiti di peringkat institusi, tanpa bergantung sepenuhnya kepada persepsi atau interpretasi individu. Data yang diperolehi merupakan data langsung dari analisis item PeNA berdasarkan skop jaminan kualiti.

Pemerhatian ini difokuskan kepada aspek-aspek kritikal dalam skop jaminan kualiti, termasuk struktur jaminan kualiti, pelaksanaan pengauditan dalaman, pengurusan akreditasi, serta pemantauan pematuhan terhadap standard akreditasi seperti yang digariskan oleh badan akreditasi. Kajian ini dijalankan di beberapa institusi politeknik dan kolej komuniti di bawah JPPKK yang telah terlibat dalam PeNA dan pengauditan dalaman bagi tempoh tiga tahun kebelakangan ini. Pemilihan lokasi dibuat secara persampelan bertujuan ini adalah untuk mendapatkan maklumat daripada institusi yang mewakili pelbagai saiz, lokasi dan tahap pencapaian akreditasi. Responden kajian terdiri dari pengurus instruksional peringkat institusi, jabatan dan juga program, termasuk pensyarah bidang.

Responden kajian terdiri daripada golongan yang terlibat secara langsung dalam pelaksanaan dan pemantauan jaminan kualiti, termasuk Timbalan Pengarah Akademik, Ketua Jabatan dan Ketua Program, Pegawai Kualiti/Pegawai Akreditasi dan sebahagian kecil dari Pensyarah kanan dan penyelaras program. Manakala institusi yang terlibat pula ialah dari Politeknik Bagan Datuk (PBD), Politeknik Melaka (PMK), Kolej Komuniti Ampang (KKAS), Kolej Komuniti Tanjung Piai (KKTP), Politeknik Sultan Salahuddin Abdul Aziz Shah (PSA) dan Kolej Komuniti Kota Melaka (KKKM).

4. DAPATAN

Secara keseluruhannya, dapatan data adalah berdasarkan Jadual 1 di bawah.

**Jadual 1: Purata Skor Data Instrumen PeNA Skop Jaminan Kualiti
Bagi Politeknik & Kolej Komuniti Tahun 2020 – 2024**

Komponen	Skor (%) Politeknik	Skor (%) Kolej Komuniti
A: Struktur Jaminan Kualiti	57	43
B: Aktiviti Pengauditan	70	34
C: Akreditasi	87	74
D: Pemantauan standard	70	53
E: Pematuhan standard	40	57

Berdasarkan skor dalam Jadual 1, institusi politeknik mencatat pencapaian tertinggi dalam Akreditasi Program Pengajian dengan 87%, menunjukkan tahap pematuhan yang baik terhadap keperluan standard akreditasi. Aktiviti Pengauditan Jaminan Kualiti Akademik dan Pemantauan Program Pengajian pula masing-masing memperoleh skor 70%, mencerminkan pelaksanaan audit dan pemantauan berada pada tahap sederhana kukuh. Dalam konteks ini, Razalli et al. (2023) menekankan bahawa pengurusan dalaman melalui aktiviti penzairan akademik memperbaiki konsistensi pelaksanaan struktur audit; namun, impaknya terhadap kawalan kualiti secara menyeluruh bergantung kepada pengintegrasian CQI dan latihan staf berterusan. Walaupun begitu, masih terdapat keperluan

untuk meningkatkan keberkesanan dan konsistensi pelaksanaan kedua-dua aktiviti ini agar lebih menyeluruh dan berimpak.

Dapatan kajian yang menunjukkan skor hanya 57% bagi Struktur Jawatankuasa Jaminan Kualiti dan 40% bagi Pematuhan terhadap Keperluan Standard Akreditasi mengesahkan masih wujud kelemahan ketara dalam pengurusan kualiti dalaman institusi TVET. Kajian oleh Kayyali (2023) mendapati pelaksanaan standard akreditasi dalam kalangan pensyarah kolej komuniti terjejas oleh kekurangan latihan, ketidakfahaman terhadap keperluan TTAC, serta pelaksanaan yang tidak konsisten, sekali gus menjelaskan tahap pematuhan yang rendah. Sementara itu, semakan sistematik oleh TVET@Asia (2023) menunjukkan bahawa struktur jaminan kualiti di institusi TVET Malaysia masih bersifat fragmentasi, kurang penyelarasan dan tidak disokong oleh mekanisme pelaporan serta pemantauan yang mantap. Kedua-dua dapatan ini secara langsung menyokong keperluan untuk memperkukuh peranan jawatankuasa kualiti, memperkemas sistem dokumentasi dan pelaporan, serta melaksanakan tindakan susulan yang lebih sistematik dan berfokus kepada keberkesanan pelaksanaan standard akreditasi dalam memastikan jaminan kualiti yang lebih berkesan dan menyeluruh.

Manakala bagi institusi Kolej Komuniti, pencapaian tertinggi dicatatkan dalam aspek Akreditasi Program Pengajian dengan skor 74%, menunjukkan pengurusan proses akreditasi berada pada tahap memuaskan. Hal ini sejajar dengan penemuan Razalli et al. (2023) yang menekankan bahawa reformasi terhadap Academic Performance Audit (APA/PeNA) pasca COPPA 2017 telah meningkatkan tahap pematuhan dan pelaporan institusi Kolej Komuniti terhadap standard akreditasi MQA. Tambahan pula, kajian oleh Isa, Tengku Mohd & Yasin (2024) menunjukkan bahawa Kolej Komuniti mampu memainkan peranan penting dalam sistem TVET Malaysia melalui penglibatan aktif dalam inisiatif pensijilan dan pengiktirafan profesional, sekaligus menyokong prestasi akreditasi yang lebih stabil dan sistematik. Walaupun begitu, skor 74% ini masih belum mencapai tahap cemerlang — menandakan keperluan untuk memperkukuh aspek dokumentasi, eviden latihan, pelaksanaan CQI dan pemantauan hasil pembelajaran secara berterusan agar pematuhan agensi akreditasi dapat dipenuhi sepenuhnya.

Pemantauan Program Pengajian pula menunjukkan skor 53%, menggambarkan pelaksanaan semakan berterusan terhadap program masih bersifat sederhana. Ini menunjukkan institusi perlu meningkatkan pemantauan berkala terhadap pelaksanaan kurikulum dan pencapaian hasil pembelajaran pelajar. Manakala Pematuhan Kepada Keperluan Standard Akreditasi hanya mencatat 57%, menandakan pelaksanaan terhadap garis panduan badan akreditasi seperti MQA masih tidak konsisten, dan boleh menjejaskan status akreditasi sekiranya tidak diperbaiki. Skor Struktur Jawatankuasa Jaminan Kualiti pula berada pada tahap rendah iaitu 43%, menunjukkan bahawa peranan jawatankuasa dalam menggerakkan agenda kualiti masih lemah. Ini termasuk kekurangan dalam aspek dokumentasi minit mesyuarat, pelaksanaan keputusan serta pemantauan tindakan susulan. Lebih membimbangkan, Aktiviti Pengauditan Jaminan Kualiti Akademik hanya memperoleh skor 34%, membuktikan pelaksanaan audit dalaman tidak menyeluruh dan tidak konsisten, sekali gus menimbulkan risiko ketidakpatuhan terhadap syarat akreditasi.

Secara perbandingan melibatkan data di dalam Jadual 1 di atas, dapat dirumuskan bahawa pencapaian skor pelaksanaan PeNA bagi institusi Politeknik secara umumnya lebih tinggi berbanding Kolej Komuniti dalam tempoh 2020 hingga 2024. Ini menunjukkan bahawa institusi Kolej Komuniti perlu memberi tumpuan segera kepada aspek audit dalaman, pemantauan program, serta pemantapan struktur jaminan kualiti bagi memastikan pelaksanaan PeNA dapat dijalankan dengan lebih berkesan dan menyeluruh.

4.1. Perbincangan

4.1.1. Jawatankuasa Audit Dalaman

Ketiadaan struktur pelantikan yang mantap serta kekurangan latihan dalaman khusus untuk ahli jawatankuasa ini menyebabkan fungsi audit dalaman sebagai mekanisme kawalan sebelum dan selepas (pre-audit dan post-audit) tidak dapat dilaksanakan dengan optimum. Ini menjejaskan keupayaan institusi untuk memantau, mengenal pasti, dan menambah baik kelemahan dalam sistem jaminan kualiti

secara berterusan. Latihan dalaman yang berfokus perlu dilaksanakan bagi membangunkan kefahaman, kemahiran teknikal audit, serta keupayaan analitikal jawatankuasa dalam mengendalikan proses audit berdasarkan keperluan standard akreditasi. Tanpa intervensi ini, potensi jawatankuasa ini sebagai pemacu peningkatan tadbir urus dan pematuan institusi tidak dapat direalisasikan sepenuhnya, sekali gus memberi risiko terhadap pencapaian kualiti institusi TVET

4.1.2. Pelaksanaan dan Menyediakan Laporan Audit Kualiti Luaran

Walaupun institusi telah melaksanakan dan menyediakan laporan audit kualiti luaran berkaitan akademik dalam tempoh masa yang ditetapkan oleh badan akreditasi, masih terdapat kelemahan dalam memastikan pelaksanaan tindakan susulan berasaskan dapatan dan saranan daripada laporan external examiner. Ketiadaan mekanisme *close the loop* yang sistematik menyebabkan maklum balas terhadap penambahbaikan tidak ditangani sepenuhnya atau dilaksanakan secara konsisten. Ini berpotensi menyebabkan berulangnya ketidakpatuhan terhadap standard akreditasi serta menjejaskan pencapaian kualiti program akademik yang ditawarkan. Menurut Biggs dan Tang (2011), pelaksanaan *elemen close the loop* dalam jaminan kualiti pendidikan adalah penting untuk memastikan bahawa maklum balas penilaian luaran benar-benar digunakan untuk memperbaiki proses dan hasil pembelajaran, dan bukan sekadar memenuhi keperluan dokumentasi. Tanpa penutupan proses ini, proses audit kualiti luaran akan kehilangan keberkesanannya kerana tidak berlaku peningkatan berterusan dalam penyampaian program akademik. Tambahan pula, dokumen *Code of Practice for Institutional Audit* (COPIA) menegaskan bahawa institusi perlu membuktikan tindakan susulan terhadap penemuan audit melalui dokumentasi, pelaporan penambahbaikan, dan bukti pelaksanaan sebenar bagi memenuhi prinsip CQI. Jika tindakan susulan tidak dilaksanakan secara menyeluruh, ia memberi implikasi negatif terhadap kredibiliti institusi dalam audit berikutnya dan seterusnya menjejaskan penilaian kualiti keseluruhan institusi (MQA, 2020).

4.1.3. Mempamerkan salinan Sijil Perakuan Akreditasi

Walaupun program akademik telah menerima Sijil Perakuan Akreditasi dan mempamerkannya di lokasi fizikal seperti yang ditetapkan oleh badan akreditasi, terdapat keperluan untuk memperluaskan akses maklumat ini kepada pengguna secara dalam talian. Penyediaan dan kemaskini maklumat akreditasi program, termasuk nombor kod Malaysian Qualifications Register (MQR), di portal web institusi dan Portal Ambilan JPPKK masih belum dilaksanakan secara menyeluruh. Kekurangan paparan maklumat ini berpotensi mengurangkan ketelusan institusi dalam memaklumkan status akreditasi program kepada pihak berkepentingan seperti pelajar, ibu bapa, majikan, dan agensi luar. Oleh itu, institusi perlu memperkemas proses kemaskini maklumat akreditasi dengan memasukkan butiran sijil dan kod MQR bagi setiap program di portal web institusi dan Portal Ambilan JPPKK. Langkah ini selari dengan amalan terbaik dalam jaminan kualiti dan kehendak semasa badan akreditasi untuk meningkatkan akauntabiliti serta ketelusan maklumat pendidikan tinggi.

4.1.4. Tahap Pematuan Terhadap Standard Akreditasi

Dapatan kajian menunjukkan bahawa tahap pematuan terhadap standard akreditasi dalam kalangan institusi di bawah JPPKK adalah baik terutamanya dalam aspek dokumentasi dan pengurusan kurikulum. Sebahagian besar responden melaporkan bahawa institusi telah berjaya menyusun dan menyimpan dokumen-dokumen berkaitan standard akreditasi dengan teratur, merangkumi kursus pengajian, profil program, laporan pengajaran dan pembelajaran, serta penilaian hasil pembelajaran pelajar (PLO). Aspek ini dianggap sebagai kekuatan utama kerana berkait rapat dengan keperluan penyediaan eviden semasa penilaian akreditasi dijalankan oleh agensi seperti MQA atau ETAC. Namun begitu, apabila diperhalusi kepada aspek pelaksanaan penambahbaikan berterusan CQI, didapati bahawa tahap pematuan masih berada pada tahap sederhana dan memerlukan perhatian serius. Sebilangan responden menyatakan bahawa proses CQI dijalankan secara *ad hoc* dan tidak disokong oleh sistem pemantauan berstruktur. Proses pelaporan CQI juga dilihat lebih bersifat formaliti, tanpa pelibatan menyeluruh dari semua peringkat termasuk pelajar, industri dan alumni. Ini secara langsung

memberi kesan kepada keberkesanan tindakan penambahbaikan, yang seharusnya bersifat responsif dan berasaskan data semasa.

4.1.5. Penyediaan dokumen penilaian sendiri

Ketua Program bertanggungjawab menyediakan dokumen penilaian sendiri yang lengkap bagi memenuhi keperluan pengelasan akreditasi program. Namun, terdapat cabaran dalam memastikan kualiti dan komprehensifnya penyediaan dokumen ini, terutamanya dari aspek pematuan terhadap standard terkini serta penambahbaikan berterusan. Penyediaan SAR yang kurang menyeluruh boleh menjejaskan kredibiliti program semasa proses audit akreditasi. Pelaksanaan lawatan penandaarasan ke institusi lain yang cemerlang dalam aspek penyediaan SAR dapat membantu Ketua Program memahami amalan terbaik (best practices) dalam penyediaan dokumen penilaian sendiri. Menurut Harvey dan Newton (2007), penandaarasan merupakan strategi berkesan untuk mempercepatkan pembelajaran organisasi dengan membandingkan prestasi dan pendekatan kerja terhadap institusi yang lebih berjaya. Selain itu, *Malaysian Qualifications Agency* (MQA) (2017) menggariskan keperluan agar institusi pendidikan tinggi sentiasa mengemaskini dokumen penilaian sendiri berdasarkan maklum balas audit luaran dan amalan terbaik industri. Tanpa pelaksanaan lawatan penandaarasan yang sistematik, Ketua Program mungkin menghadapi kekangan dalam mengenal pasti standard industri semasa dan teknik dokumentasi yang berkesan, sekali gus boleh menjejaskan usaha institusi untuk mengekalkan status akreditasi program. Oleh itu, penganjuran dan pelaksanaan lawatan penandaarasan secara berkala perlu dijadikan sebahagian daripada strategi peningkatan kualiti penyediaan SAR dan pembangunan profesional Ketua Program.

4.1.6. Perancangan pelaksanaan CQI

Institusi bertanggungjawab membentangkan perancangan pelaksanaan CQI sebelum pelaksanaan, serta mengemukakan laporan penuh keberkesanan selepas tindakan CQI dilakukan untuk disahkan oleh pihak pengurusan tertinggi. Namun, terdapat kelemahan dalam aspek perancangan yang sistematik dan pemantauan terhadap keberkesanan langkah CQI yang diambil. Ini menyebabkan inisiatif CQI yang dilaksanakan tidak memberi impak maksimum terhadap peningkatan kualiti akademik dan pengurusan. Menurut Al-Harthy (2020), kejayaan sesuatu inisiatif CQI bergantung pada kekuatan perancangan awal dan mekanisme pemantauan berterusan untuk menilai keberkesanan tindakan yang dilaksanakan. Selain itu, *Malaysian Qualifications Agency* (MQA) (2017) juga menekankan bahawa institusi perlu membuktikan amalan CQI mereka melalui dokumentasi lengkap yang merangkumi perancangan, pelaksanaan, pemantauan hasil serta tindakan susulan bagi memastikan penambahbaikan adalah berasaskan data dan bukti yang sahih. Tanpa pelaksanaan pemantauan yang berstruktur, institusi berisiko menghasilkan laporan CQI yang sekadar memenuhi keperluan dokumentasi tanpa memberikan impak sebenar terhadap kualiti program atau sistem pengurusan akademik. Oleh itu, adalah penting bagi institusi untuk memperkukuhkan pendekatan CQI melalui perancangan rapi, pelaksanaan terancang, dan pemantauan sistematik bagi mencapai peningkatan berterusan sejajar dengan amalan terbaik pengurusan pendidikan tinggi.

4.1.7. Bilangan pensyarah dalam bidang yang mencukupi

Keberkesanan pelaksanaan pengiraan nisbah pensyarah terhadap pelajar sangat bergantung kepada pembangunan formula yang tepat untuk mengukur kecukupan dan kesesuaian jumlah pensyarah dalam sesuatu program. Walaupun terdapat garis panduan yang menetapkan bilangan pensyarah mengikut standard program, sering kali berlaku kekurangan pensyarah di beberapa institusi, yang boleh menjejaskan kualiti PdP. Pembangunan formula yang tepat bagi pengiraan nisbah ini penting untuk memastikan pensyarah mencukupi dan memberi tumpuan kepada kualiti pendidikan yang lebih baik. Menurut Rasool et al. (2021), nisbah pensyarah kepada pelajar yang tidak seimbang boleh menjejaskan kualiti pembelajaran serta mengurangkan peluang pelajar untuk mendapat perhatian yang secukupnya. Oleh itu, pelaksanaan formula pengiraan yang jelas dan sesuai perlu dipastikan untuk meningkatkan prestasi akademik dan keberkesanan pengajaran. Pembangunan formula pengiraan nisbah ini bukan sahaja memberi panduan untuk menentukan bilangan pensyarah yang sesuai, tetapi juga memberikan

asas untuk merancang sumber daya manusia yang lebih baik dan berkesan. Kajian perlu dilakukan untuk memastikan formula ini dapat dilaksanakan secara praktikal dalam semua program di institusi TVET dan sesuai dengan keperluan industri.

4.2. Cadangan penambahbaikan terhadap instrumen PENA

Beberapa cangan penambahbaikan terhadap instrument PeNA dapat dibuat, antaranya melibatkan instrument berkaitan latihan berterusan kepada Jawatankuasa Audit Dalam. Latihan ini amat penting untuk memastikan pelaksanaan PeNA lebih efektif dan selaras dengan piawaian. Latihan berkala meningkatkan kefahaman, kemahiran dan keupayaan dalam melaksanakan audit secara objektif, serta memperkukuh penguasaan terhadap prinsip CQI. Skor PeNA wajar dikemas kini berdasarkan latihan yang diterima agar pelaksanaan penaziran lebih cekap dan berkualiti tinggi. Selain itu, pelaksanaan elemen *close the loop* dalam PeNA perlu diberi perhatian. Ia memastikan setiap teguran panel penilai luar ditindaklanjuti secara sistematik melalui penambahbaikan berterusan. Langkah ini membuktikan komitmen institusi terhadap prinsip CQI dan membantu mengekalkan kualiti program yang memenuhi piawaian akreditasi. Pengemaskinian skor PeNA berdasarkan elemen ini dapat meningkatkan keberkesanan sistem jaminan kualiti institusi.

Pengemaskinian maklumat akreditasi di portal web institusi bersama kod MQR dapat meningkatkan ketelusan dan keyakinan awam terhadap institusi. Maklumat seperti sijil akreditasi dan kod pengesahan MQA perlu dipaparkan secara terbuka. Langkah ini memudahkan akses kepada pihak berkepentingan dan menyokong dasar pendidikan tinggi yang telus serta sistem pendidikan yang bertanggungjawab dan berwibawa. Lawatan penandaarasan wajar dimasukkan dalam penyediaan dokumen penilaian sendiri. Melalui lawatan ini, institusi dapat mempelajari amalan terbaik daripada institusi lain dan mengenal pasti jurang pelaksanaan. Ia membantu menambah baik kualiti dokumen sendiri, selaras dengan prinsip CQI. Skor penaziran boleh dipertingkatkan apabila institusi mengamalkan pembelajaran daripada perbandingan praktikal ini secara berterusan.

Item CQI dalam penilaian wajar dipecahkan kepada dua komponen: perancangan dan pelaksanaan. Perancangan perlu dibuktikan melalui dokumentasi rekod rasmi, manakala pelaksanaan dinilai melalui kajian analisa keberkesanan. Pemisahan ini memberi kejelasan dalam pelaksanaan CQI dan memudahkan pemantauan serta penilaian impak secara sistematik. Langkah ini menyokong penambahbaikan berterusan dalam jaminan kualiti akademik institusi. Formula nisbah pensyarah: pelajar perlu diperhalusi dengan mengambil kira saiz institusi, beban tugas, dan keperluan program. Ini penting bagi memastikan pengajaran lebih berkesan dan menyokong pencapaian pembelajaran pelajar, terutama dalam program TVET yang memerlukan pendekatan praktikal. Formula ini juga harus sejajar dengan keperluan akreditasi bagi memastikan keberkesanan PdP dapat dipantau dan ditambah baik secara berterusan.

5. KESIMPULAN

Kajian ini mendapati bahawa keberkesanan instrumen penaziran akademik yang digunakan oleh institusi di bawah JPPKK masih belum mencapai tahap optimum. Walaupun PeNA berfungsi dalam menilai tahap pematuan terhadap beberapa elemen standard akreditasi, dapatan menunjukkan bahawa instrumen sedia ada kurang komprehensif dalam menilai pelaksanaan jaminan kualiti secara menyeluruh, khususnya dalam aspek CQI, pemantauan sistematik dan tindakan susulan. Ketidakkonsistenan pelaksanaan antara institusi turut menjejaskan pencapaian akreditasi yang seimbang, akibat daripada kekangan kefahaman, sumber manusia, dan latihan yang terhad. Sehubungan itu, kajian mencadangkan pembentukan semula instrumen penaziran akademik yang lebih holistik, berstruktur dan seragam bagi semua institusi di bawah JPPKK. Instrumen ini perlu diselaraskan dengan kehendak akreditasi semasa dan dasar pendidikan tinggi negara. Di samping itu, pelaksanaan perlu disokong dengan latihan berterusan, pengukuhan kapasiti staf serta penggunaan sistem digital. Langkah ini diyakini mampu memperkukuh budaya jaminan kualiti dalam institusi TVET dan meningkatkan reputasinya di peringkat nasional dan antarabangsa.

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Future-Ready Learners: Enhancing STEM Literacy with Immersive AR Technologies

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ABSTRAK

This quantitative study investigates the impact of immersive Augmented Reality (AR) technologies on STEM literacy among diploma-level science students at a Malaysian polytechnic. A one-group post-test-only design was employed involving 77 participants who responded to a validated 34-item questionnaire measured on a 5-point Likert scale. The questionnaire covered four constructs of STEM literacy: Concept, Practice, Application, and Attitude. Results indicated high mean scores across all constructs, with the strongest impact observed in STEM Concept ($M = 4.48$), followed by Practice, Application, and Attitude. Strong positive correlations (e.g., $r = 0.937$ between Application and Attitude) suggest that AR not only enhances conceptual understanding but also promotes motivation and practical application. However, the absence of a control group, reliance on self-reported data, and limited session duration present limitations to the generalizability of the findings. Overall, AR demonstrates promising potential as an innovative instructional tool to foster future-ready STEM competencies in technical and vocational education.

Keywords: Augmented reality, STEM literacy, polytechnic education, immersive learning, educational technology

1. INTRODUCTION

With the internet era, the education systems are under more stress to adapt and transfer knowledge that is meaningful in addressing the requirements of the 21st century. One such skill needed is STEM literacy—a synthesized knowledge foundation of science, technology, engineering, and mathematics. STEM literacy is not just memorization of material; it is the ability to apply knowledge in real-world contexts, think critically, solve problems, and communicate effectively (National Academies of Sciences, Engineering, and Medicine, 2021). It is necessary to develop these skills not only for academic achievement but also to prepare students to thrive in a rapidly changing, technology-driven world.

One of the most thrilling new developments in ed-tech is Augmented Reality (AR). AR superimposes digital information such as 3D models, animation, or simulation over real-world environments to create interactive and immersive learning experiences. In STEM education, AR enables students to visualize abstract or difficult-to-conceptualize concepts—such as molecular structures, physical forces, and engineering systems—that are notoriously hard to grasp through traditional teaching approaches (Akçayır & Akçayır, 2022; Chang et al., 2023).

Despite rising research interest, there is substantial literature on the impact of AR on STEM literacy, particularly in technical and vocational environments such as polytechnics. Polytechnics are experiential learning and skill-development oriented, therefore the most relevant environments to examine how experiential technologies such as AR may be leveraged to enhance performance in education. While previous studies have shown AR's potential in augmenting learning results and engagement (Ahmed et al., 2023; Yusof & Halim, 2023), fewer have explored its role in building the broader capabilities that

define STEM literacy—such as reasoning, technological fluency, and collaborative communication (Zhao & Chen, 2021).

This study aims to address this need by examining whether immersive AR technologies can enhance diploma-level science students' STEM literacy at a Malaysian polytechnic. Specifically, it examines the effectiveness of AR-based learning resources in fostering STEM-related skills and probes students' attitudes toward their learning experiences. The AR learning activities were integrated into lessons on Linear Motion, Archimedes' Principle, and Thermal Energy to provide a richer and more interactive learning experience.

The significance of this research is that it coincides with global education priorities—preparing students for an innovation economy, digital literacy, and building lifelong learning skills. As the demand for STEM capabilities grows, education must adapt to bridge the gap between learning and action. By examining AR's pedagogical value, this study adds to the additional work being done to reform pedagogy and develop forward-looking learning in polytechnic education (UNESCO, 2022; Lai et al., 2021).

1.1. Research Objectives

This study aims to explore how immersive Augmented Reality (AR) technologies can enhance STEM literacy among polytechnic students. Specifically:

- i. To evaluate the effectiveness of AR-based instructional materials in enhancing STEM literacy among polytechnic students.
- ii. To assess students' perceptions of their STEM competencies—scientific understanding, problem-solving, technological application, and communication—after engaging with AR-enhanced learning experiences.
- iii. To describe students' comprehension of STEM content after AR instruction, supporting the development of conceptual understanding at lower-order cognitive levels.

2. LITERATURE REVIEW

STEM literacy is a broad set of interconnected skills extending beyond subject knowledge. It is the ability to think critically, solve problems, apply technology efficiently, and communicate effectively in practical contexts. With global economies increasingly reliant on innovation and digitalization, STEM literacy has emerged as an essential skillset for participation in the 21st-century job market (National Academies of Sciences, Engineering, and Medicine, 2021; UNESCO, 2022).

The last few years have seen education technologies play the prime role in enhancing STEM learning, with Special focus being put on Augmented Reality (AR) because it has interactive and immersive qualities. AR contributes to traditional learning by superimposing digital elements—such as animation, simulation, and 3D models—on the physical environment, promoting experiential and contextual learning of students. Multimodal learning process matches constructivist theories of learning as it is focused on learning via active discovery and actual world context.

A number of studies have demonstrated the benefits of AR in improving STEM-related learning outcomes. For instance, Lai, Hwang, and Wang (2021) found that AR significantly improved students' conceptual understanding and learning motivation in science. Chang, Lee, and Tseng (2023) also found improved student performance and engagement when AR was used to support inquiry-based learning in physics. Yusof and Halim (2023) also found increased student curiosity and confidence after experiencing AR in science lessons.

In addition to enhancing motivation and understanding, AR enables the development of valuable STEM practices such as experimentation, hypothesis testing, and modelling. According to Zhao and Chen (2021), AR closes the theoretical-practical gap by enabling students to manipulate variables and observe dynamic systems that would be difficult to represent graphically. AR is therefore particularly critical in polytechnic and vocational education, where applied competence is key.

Despite these promising findings, many existing studies focus narrowly on academic achievement or student interest. There is limited research that explicitly examines AR's contribution to STEM literacy as a multidimensional construct—including scientific reasoning, communication, and real-world application. Ahmed, Karim, and Rahman (2023) emphasize the need for tools and approaches that holistically measure STEM competencies in immersive learning environments.

Moreover, the use of AR in technical and vocational education remains underexplored. Given the hands-on, application-focused nature of these settings, there is strong potential for AR to enhance instructional delivery and improve learning outcomes. As education systems seek to align more closely with the demands of Industry 4.0, understanding how AR can develop future-ready competencies becomes increasingly important.

Accordingly, this study seeks to fill these gaps by investigating how AR-based instructional materials affect students' STEM literacy in a polytechnic context. It contributes to the broader conversation on digital pedagogy by evaluating how immersive technologies can support STEM education in practical, real-world environments.

3. MATERIAL AND METHOD

3.1. Research Design

This study employed a quantitative descriptive research design using a one-group post-test-only approach. The objective was to examine the perceived impact of Augmented Reality (AR)-based instructional materials on students' STEM literacy. The study focused on preliminary evaluation of educational interventions. It had no control group or pre-test since the research aimed at establishing students' perception immediately after they experienced AR-supported learning. A pre-test was not administered, as the purpose was to capture students' immediate reflections after AR engagement without prior exposure bias.

3.2. Participants

The participants were 77 science diploma students of a Malaysian polytechnic. The participants were purposively sampled due to their registration for science and willingness to be involved. All the participants' informed consent was obtained. Voluntary participation, anonymity, and data confidentiality of concern were rigidly upheld in the study.

3.3. Instructional Materials

The AR content was developed using the MyWebAR platform, with interactive 3D models, animations, and embedded video tutorials. Instruction was focused on three core STEM subjects: Linear Motion, Archimedes' Principle, and Thermal Energy. They were chosen due to their conceptual complexity and relevance to the new curriculum. The AR content was accessed by students on mobile devices through scanning QR codes during a 60-minute guided classroom session.

3.4. Research Instrument

To assess the STEM literacy of the students after going through the AR-enhanced learning, the study employed a standardized questionnaire that used the validated tool by Chamrat, Manokarn, and Thammaprateep (2019). The questionnaire was crafted to measure four key aspects of STEM literacy: scientific comprehension (STEM Concept), problem-solving and reasoning (STEM Practice), application of technology (STEM Application), and communication and collaboration (STEM Attitude). It consisted of 34 items, which were scored on a 5-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). The questionnaire was completed immediately following the AR learning session to ensure that the responses captured students' fresh impressions and perceptions regarding the learning process. The internal reliability of the instrument was verified using Cronbach's alpha, and results indicated high

reliability ($\alpha = 0.94$), which was in support of the suitability of the instrument to measure the impact of AR on different dimensions of STEM literacy. The instrument consisted of 34 items: 9 items on STEM Concept, 8 on STEM Practice, 9 on STEM Application, and 8 on STEM Attitude.

3.5. Data Collection and Analysis

Descriptive statistics (mean, standard deviation, and frequency distribution) were used to summarize students' views on the four STEM literacy dimensions. Composite scores were used to identify areas where AR was seen to have the highest impact. Pearson correlation analysis was also used to investigate relationships among the constructs, giving insight into how different STEM literacy components interact in the context of AR learning.

4. RESULT

Descriptive analysis revealed consistently high mean scores across all constructs, reflecting strong agreement among students regarding the positive impact of AR-based instruction. Among the four constructs, STEM Concept received the highest mean score ($M = 4.48$, $SD = 0.62$), indicating that students found AR most beneficial for enhancing conceptual understanding. This was followed closely by STEM Practice ($M = 4.46$, $SD = 0.63$), STEM Application ($M = 4.43$, $SD = 0.64$), and STEM Attitude ($M = 4.41$, $SD = 0.61$). These results suggest that AR was particularly effective in helping students visualize and understand complex scientific ideas while also supporting the development of problem-solving skills, practical application, and collaborative learning attitudes.

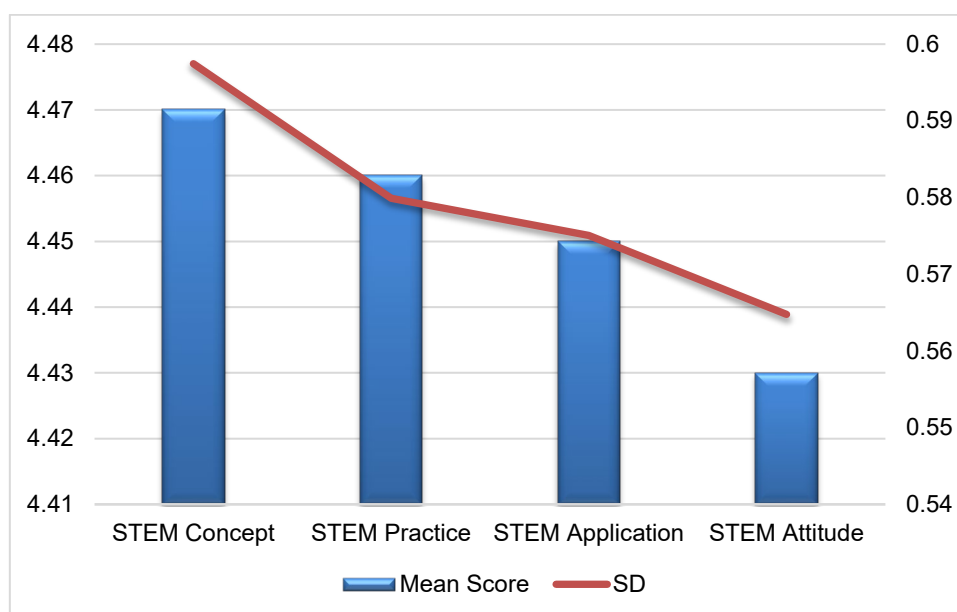


Figure 1: Students' perceived enhancement in STEM literacy constructs after AR-enhanced learning

To better understand item-specific responses, Table 2 summarizes the top and bottom scoring items from the questionnaire. The most highly rated item was, "I can integrate AR into STEM learning activities to better understand content" ($M = 4.53$, $SD = 0.60$), reinforcing AR's role in aiding comprehension. Conversely, the item "AR helps me explore global challenges through STEM perspectives" received the lowest mean score ($M = 4.36$, $SD = 0.65$), pointing to a need for more globally contextualized AR content.

Table 1: Highest and Lowest Rated Questionnaire Items on AR Effectiveness

Statement	Mean	Std. Dev.
I can integrate AR into STEM learning activities to better understand content	4.53	0.60
AR helps me explore global challenges through STEM perspectives	4.36	0.65

To better understand the relationships among the four STEM literacy constructs, a Pearson correlation analysis was conducted. The results showed strong and statistically significant correlations across all

dimensions ($p < 0.01$). The highest correlation was found between STEM Application and STEM Attitude ($r = 0.937$), suggesting that students who perceived AR as useful for practical application were also more motivated and demonstrated more positive attitudes toward STEM learning. Similarly, high correlations were observed between STEM Practice and STEM Application ($r = 0.925$), as well as between STEM Concept and the other constructs (all above $r = 0.86$), further confirming the interconnected nature of STEM literacy skills.

These results collectively indicate that AR-based instruction not only enhances individual competencies but also reinforces the relationships among different aspects of STEM literacy, supporting the use of AR as a holistic educational strategy in polytechnic STEM education.

Table 2. Pearson Correlation Between STEM Literacy Constructs

		Concept	Practice	Application	Attitude
Concept	Pearson Correlation	1	.890**	.886**	.868**
	Sig. (2-tailed)		.000	.000	.000
	N	77	77	77	77
Practice	Pearson Correlation	.890**	1	.925**	.892**
	Sig. (2-tailed)	.000		.000	.000
	N	77	77	77	77
Application	Pearson Correlation	.886**	.925**	1	.937**
	Sig. (2-tailed)	.000	.000		.000
	N	77	77	77	77
Attitude	Pearson Correlation	.868**	.892**	.937**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	77	77	77	77

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

These associations confirm the interrelatedness of STEM literacy and highlight AR's role to re-assert not only knowledge but attitudes and hands-on skill sets. The findings present evidence to substantiate that immersive AR technology brings pedagogical value in an amalgamated manner and holds tremendous potential to advance STEM education in polytechnic settings.

5. DISCUSSION

The findings of this study strongly demonstrate that immersive Augmented Reality (AR) technologies play a significant role in enhancing students' confidence in their STEM competencies. The significant mean scores in all four aspects of STEM Concept, Practice, Application, and Attitude reveal that AR offers a more interactive, immersive, and conceptually rich learning environment. Students reported a strong sense of improved understanding, problem-solving ability, and technological confidence after participating in AR-based science lessons. These outcomes reinforce previous studies that have highlighted the motivational and cognitive benefits of AR in educational settings (Akçayır & Akçayır, 2022; Chang et al., 2023).

The strongest consensus was in the conceptual understanding dimension, indicating that AR works best in allowing students to visualize and comprehend abstract scientific principles. Topics such as Linear Motion and Thermal Energy, which are difficult to explain through traditional means, were better understood through the visual and interactive nature of AR. This is consistent with constructivist learning theories, which emphasize active, experiential learning and the use of real-world contexts to foster deeper understanding.

In addition, the strong positive relationship between STEM Application and STEM Attitude ($r = 0.937$) suggests a strong pedagogical implication: students who see the worth of AR in applying STEM knowledge to practical use are also likely to learn and be inclined to learn about STEM. This is a signal that AR extends beyond content comprehension enhancement; it has potential to spark confidence,

curiosity, and enthusiasm—traits critical in cultivating future lifelong learners and future STEM professionals.

While the general attitude toward AR was extremely positive, the survey also revealed a relative dearth of global contextualization. The least scored item pertained to whether AR might enable students to explore global issues through a STEM perspective. This shows that while AR improves private study and conceptual understanding, its intersection with global themes such as sustainability, innovation ecosystems, or solving real-world challenges has room for improvement. Closing this gap could make AR content more pertinent and richer, encouraging students to consider the broader social implications of STEM.

The results also find application in technical and vocational training. With the skills-oriented, practical focus of polytechnic education, AR offers an ideal platform for bridging the divide between theoretical abstraction and real-world application. It enables the development of graduate students who are ready for the future by incorporating digital literacy, technological adaptability, and collaboration skills into the learning process. As institutions shift to adopt Industry 4.0 standards, the use of AR in STEM education can be at the centre of revolutionizing conventional pedagogical approaches.

By and large, the discussion validates the potential of AR not just as an ancillary tool, but as a revolutionary teaching methodology that can potentially empower genuine STEM literacy. Nevertheless, for that potential to be truly realized, AR content will need to continue evolving—both in terms of depth and contextually applicable implementation.

In answering the first research question, the findings clearly indicate that AR-based instruction enhanced STEM literacy across all four measured dimensions—Concept, Practice, Application, and Attitude. The highest mean score for STEM Concept ($M = 4.48$) demonstrates AR's ability to improve students' understanding of scientific content. Regarding the second research question, students expressed highly positive perceptions of their STEM competencies after experiencing AR. The strong correlation between Application and Attitude ($r = 0.937$) reveals that students not only understood the material better but also felt more confident, motivated, and engaged in STEM learning. These findings affirm that immersive AR technologies can both improve learning outcomes and positively shape students' perceptions, reinforcing AR's role as an effective tool in STEM education.

6. LIMITATIONS

While this research yields dense information regarding the use of AR for enhancing STEM literacy, several limitations must be mentioned. Firstly, the research employed a one-group post-test-only design without a control group, which limits the ability to establish causality. The findings are suggestive of students' attitudes after AR exposure but are not directly comparable with traditional pedagogical methods.

Second, the data collected relied entirely on self-reported responses, which are susceptible to social desirability or enthusiasm for new learning bias. This self-reporting technique may not accurately capture the actual gains in competency.

Third, the study focused on a single polytechnic institution and a relatively small, homogeneous group of science students. As such, the findings may not be generalizable to other educational contexts, disciplines, or levels of technological proficiency.

Additionally, students engaged with the AR content during a single, short session (approximately 60 minutes), limiting the scope for observing long-term retention or skill transfer. Finally, differences in individual students' prior exposure to technology may have influenced their comfort and engagement levels with AR, yet this variable was not controlled for.

Future research should consider experimental or quasi-experimental designs with control groups, longer intervention durations, and triangulated data collection (e.g., performance assessments,

interviews). Expanding to multiple institutions and more diverse student populations would also enhance the generalizability and depth of the findings.

7. CONCLUSION

This study discovers that immersive Augmented Reality (AR) technologies hold vast potential to enhance STEM literacy among polytechnic students. High mean scores across all four constructs of literacy—Concept, Practice, Application, and Attitude—reflect strong students' beliefs in the effectiveness of AR in facilitating both content learning and skill development. Particularly, AR was most successful in fostering conceptual learning, as well as motivating greater motivation, engagement, and technological confidence. The high positive correlations among the STEM literacy facets underscore the interconnectedness of knowledge, practice, application, and attitude in STEM education. These findings validate the relevance of AR as a unified instructional medium that can support multiple facets of learning simultaneously. With interactive and contextually relevant experiences, AR bridges the gap between abstract theory and real-world application—a core necessity of technical and vocational training.

However, the study also highlights the need to enhance the global contextual relevance of AR content. While students responded positively to the technology overall, its potential to connect learning with global challenges and societal issues remains underutilized. Strengthening this aspect could further elevate AR's role in developing critical thinking and global citizenship competencies. With these findings, policymakers and educators are encouraged to incorporate AR into STEM instructional practices to drive future-ready competencies. Further research is recommended to explore the long-term impact of AR on student achievement, its scalability in various learning environments, and its convergence with interdisciplinary and global learning themes. As education continues to advance in sync with technological advancements, AR is a promising vehicle to help redesign the teaching and learning of STEM.

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Visualizing Unity: The Role of Comics in Promoting the Rukun Negara Principles

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ABSTRACT

National unity is fundamental to Malaysia's identity as a multiracial and multi religious country. The Rukun Negara, established in 1970 after the May 13 racial riots, delineates five guiding principles intended to promote unity, patriotism, and common values among residents. Notwithstanding extensive initiatives aimed at fostering unity via legislation and education, modern Malaysian society persists in confronting issues such as racial polarization and diminishing civic values, particularly among the youth. In this setting, comics serve as a potent medium for fostering civic consciousness and social cohesiveness through accessible and compelling story lines. This ongoing study examined how chosen Malaysian comics reflect and convey the values of the Rukun Negara, with a specific emphasis on themes relating to unity. This research utilized qualitative visual content analysis to investigate the visual and linguistic components of comics, aiming to discern representations of national values, including belief in God, devotion to the monarchy and nation, constitutional supremacy, rule of law, and principles of civility and morality. This study aimed to comprehend how comics serve as both amusement and informal educational instruments that reflect national ideology through the analysis of symbolism and character behaviour. The results indicated twenty-seven comic titles that had considerable potential in strengthening civic ideals and fostering unity, particularly among young individuals. Comics, as a creative and culturally pertinent medium of storytelling, can overcome educational and social divides by rendering abstract national concepts more accessible. This study enhances the expanding dialogue on media, identity, and nation-building in mixed cultures such as Malaysia.

Keywords: comics, national unity, national principles, Rukun Negara, visual content analysis

1. INTRODUCTION

National unity in Malaysia is a fundamental cornerstone of the nation's prosperity and stability, considering its distinctive multicultural, multiracial, and multi-religious make-up. Malaysia's social structure is intrinsically heterogeneous, consisting of three principal ethnic groups, Malay, Chinese, and Indian, alongside many Indigenous cultures and others (Suhaimi, 2024). This diversity, however beneficial, also poses obstacles for cohesiveness and integration. Consequently, promoting national unity has been an ongoing emphasis of Malaysian governmental programs, educational frameworks, and national philosophies, like the Rukun Negara. National unity is more than simply peaceful coexistence; it involves cultivating a shared identity and collective purpose among all Malaysians. Initiatives to foster national unity have profound historical origins, especially in the aftermath of the harrowing May 13, 1969, racial riots (Roslan, 2023). This tragedy highlighted the pressing necessity for systematic strategies regarding ethnic relations and national cohesion. In response, the government implemented various long-term policies, including the New Economic Policy (NEP) in 1971 and the Rukun Negara, designed to rectify socio-economic disparities while fostering mutual tolerance and understanding (Esa et al., 2022). Over time, educational initiatives and national service programs were established to unite Malaysians from diverse backgrounds and foster a robust national identity (Awang & Tayeb, 2022).

Education fosters national unity by promoting common values, national history, and civic responsibility. School education frequently serves as the initial venue for students from diverse ethnic backgrounds to engage and acquire knowledge about each other (Bakar et al., 2024). Furthermore, national curricula underscore the significance of cohesion and reverence for diversity. The media, encompassing television, movies, and increasingly comics, may be a potential instrument for shaping conceptions of oneness. When utilized judiciously, media can illuminate common experiences, honour cultural diversity, and challenge assumptions or biases (Mohd Nuri, 2023). With these efforts, national cohesion in Malaysia persists in confronting intricate issues. Factors such as charity, inequitable access to education and economic opportunity, and politically driven ethnic narratives can exacerbate intergroup tensions (Sinar Harian, 2025; Aling, 2024). Sinar Harian (2025) adds that, in the digital age, social media occasionally intensifies these conflicts by disseminating disinformation or provocative content. Additionally, urban-rural disparities and generational splits introduce further intricacy. Confronting these difficulties necessitates both policy-level interventions and grass roots involvement, as well as inclusive narratives and cultural artefacts that promote unity while preserving variety.

In conclusion, national unity in Malaysia is a continuous and evolving process that requires cultivation across generations. Although historical initiatives like the Rukun Negara established a robust foundation, modern strategies must evolve to address present circumstances by fostering open debate, promoting equitable development, and utilizing innovative formats such as comics and visual storytelling. The promotion of togetherness must transcend mere symbolism and be integrated into daily routines, education, and cultural expression. In the absence of a unifying spirit in the country nowadays, it can be reversed and controlled by the implementation of Rukun Negara in a visual aspect. The disrespect of royalty and ethnicity that has been reported before is an example caused by a lack of unity spirit (Amin, 2025; Md. Zain, 2025). Unity as a lived ideal in a plural society can only be sustained by authentic comprehension and reciprocal respect among Malaysians.

1.1. The Rukun Negara (National Principles)

The Rukun Negara, or National Principles, is an essential Malaysian national ideology established on 31 August 1970 (MyGovernment, 2016). MyGovernment is the official portal of the Malaysian government. Founded in reaction to the May 13, 1969 race disturbances, it aimed to promote unity and harmony among Malaysia's varied ethnic, religious, and cultural groups (Muslim, 2021). They add that the Rukun Negara delineates a collective framework of principles designed to direct Malaysian citizens in the establishment of a just, progressive, and united society. Aside from its immediate political context, the Rukun Negara serves as a cornerstone for national identity, civic duty, and a shared ambition for peace and stability (Mohd Nuri, 2023).

The first principle, Belief in God, highlights the pivotal importance of faith in the lives of Malaysian individuals. This concept acknowledges Malaysia's multicultural and multi religious context, asserting that belief in a higher power is vital for moral advancement and national unity. Instead of favouring a particular religion, it advocates for respect for all faiths, fostering spiritual ideals as essential to ethical conduct, mutual comprehension, and community cohesion (Majlis Keselamatan Negara [MKN], 2024). This inclusive strategy corresponds with Malaysia's constitutional assurance of religious freedom while fostering a spiritually anchored populace.

The second and third principles, Loyalty to King and Country and Supremacy of the Constitution, emphasize the significance of fidelity to national sovereignty and constitutional authority (MKN, 2024). Loyalty to the monarchy represents allegiance to Malaysia's political framework and historical heritage, whereas adherence to the Constitution protects democracy, the rule of law, and the rights of citizens (Awang & Tayeb 2022; Mat Ali, 2023). Collectively, these principles foster stability by underscoring the necessity for cohesion within a legitimate and consensual national framework, so averting capricious government and advancing a fair social order.

The fourth and fifth principles, Kedaulatan Undang-undang (Rule of Law) and Kesopanan dan Kesusilaan (Courtesy and Morality), emphasize the ethical and legal underpinnings of Malaysian society (MKN,

2024). The Rule of Law guarantees equitable justice for all citizens, protecting against governmental abuse and promoting societal trust (Muslim, 2021). Simultaneously, the focus on civility and ethics emphasizes the need to promote societal morals, respect for individuals, and healthy interpersonal relations. These ideals bolster legal standards and foster a culture of civility vital for sustaining harmonious coexistence in a diverse society.

In summary, the Rukun Negara functions as an all-encompassing moral and political guide for Malaysia, harmonizing spiritual, civic, legal, and ethical principles. The five principles serve as both historical solutions to previous national crises and as lasting recommendations for contemporary and future generations. By promoting a mutual comprehension of faith, loyalty, constitutional government, legal justice, and social morality, the Rukun Negara perpetuates endeavours aimed at national unity, collective identity, and progressive nation-building. Its significance is essential in confronting modern difficulties inside Malaysia's dynamic society.

1.2. Comics

Comics are a distinctive medium that amalgamates visual artistry and literary narrative to communicate stories, messages, and humour (Dewan Bahasa dan Pustaka, n.d.). They often comprise consecutive panels that depict the evolution of events, augmented by components such as dialogue balloons, subtitles, and icons (Losi et al., 2023). In contrast to conventional text, comics predominantly utilize visual narrative, facilitating multi-faceted communication that encompasses facial expressions, body language, and emotion (Imaizumi et al., 2021). This multi-modal structure improves reader engagement and understanding, rendering comics an ideal medium for both amusement and educational or social commentary purposes.

In addition to their entertainment appeal, comics are acknowledged for their ability to convey intricate social and cultural concerns in an accessible and sympathetic manner. Educational environments may progressively utilize them to enhance literacy, civic consciousness, and ethical growth, especially among younger demographics. In culturally varied societies such as Malaysia, comics provide an inclusive medium for depicting many ethnic identities and societal ideals (Zainuddin & Mahamood, 2018). Comics can serve as informal yet potent instruments for character development, nationhood, and the promotion of unity by including national ideals or moral themes into visually captivating plots.

Comics effectively foster civic values and national identity by distilling abstract notions into tangible, emotionally impactful narratives. They may mirror cultural standards, condemn injustices, or emphasize ideals such as fairness, respect, and harmony, all of which correspond with the fundamental principles of Malaysia's Rukun Negara. Comics can gently exemplify ethical conduct and cultivate empathy through characters, dialogue, and narrative structure. This renders them a significant medium in public campaigns, educational initiatives, and national dialogue, particularly when seeking to foster unity and patriotism within a heterogeneous populace.

2. STATEMENT OF THE PROBLEM

Malaysia is a multi-ethnic and multi religious nation where national unity is essential for preserving social harmony, political stability, and economic advancement. Since achieving independence in 1957, the government has implemented many policies and frameworks, such as the Rukun Negara and the newest Malaysia Madani, to enhance unity among its heterogeneous population. Notwithstanding these endeavours, unity persists as a multifaceted and enduring challenge, especially when the nation undergoes social, economic, and political transformations (Sinar Harian, 2025; Aling, 2024). Malaysia's diverse society underscores the importance of promoting national unity, emphasizing that integration, not assimilation, is essential for sustaining peace and progress. Even so, national unity in Malaysia encounters considerable hurdles. Racial and religious polarization, frequently exacerbated by political discourse and media narratives, can hinder integration efforts. Socio-economic differences between ethnic groups exacerbate sentiments of inequity and distrust. Disparate information sources, especially in the digital era, expose younger generations to polarized perspectives (Sinar Harian, 2025). These facts

demonstrate that, despite enduring efforts, unity in Malaysia is tenuous and necessitates innovative strategies for preservation.

In light of these persistent challenges, there is an urgent necessity to investigate alternate platforms and culturally pertinent channels to enhance unity more effectively. A notable platform is visual storytelling, especially comics, which can overcome linguistic and cultural barriers to communicate shared values (Losi et al., 2023). They add that comics are accessible, captivating, and emotionally impactful, rendering them an optimal medium for civic education and value transmission. Nonetheless, there exists a paucity of scholarly investigation about the representation and potential integration of national ideologies such as Rukun Negara into popular media formats. This disparity necessitates a thorough examination of how comics can function not only as sources of enjoyment but also as instructional and unifying instruments within Malaysia's multicultural context (Zainuddin & Mahamood, 2018).

3. METHODOLOGY

Qualitative research is a methodological approach that aims to investigate and comprehend intricate phenomena using non-numerical data (Khoa et al., 2023). The qualitative approach is more natural, humanized, holistic, and direct from the sources than the quantitative approach (Muzari et al., 2023). This methodology is particularly appropriate for research involving symbolic representations, including those evident in comics, artwork, commercials, or other visual media.

Visual content analysis is a qualitative approach employed to investigate the inherent meanings, motifs, and ideologies present in visual resources (Bell, 2001). This method is a thorough analysis of images, layouts, colour schemes, characters, and narrative components to reveal how they convey particular values or messages. Unlike quantitative content analysis, which measures occurrences or frequencies, qualitative visual analysis emphasizes the interpretive richness of visual signs, encompassing symbolism, cultural references, and narrative techniques. In studies of comics, visual content analysis enables academics to evaluate the interplay between visuals and text in reinforcing societal or national ideologies, such as the values inherent in Rukun Negara.

This study utilized visual content analysis to investigate the representation of the five principles of Rukun Negara in selected Malaysian comics. The study examined both visual aspects (example: character expressions, scenery, iconography) and verbal components (example: conversation, captions) to discern themes about national unity, civic values, and social peace. The study aimed to clarify how comics operate as both entertainment and informal educational instruments that mirror or bolster national ideology by analysing these elements within a cultural framework. This method facilitates an in-depth understanding of how abstract concepts such as unity are conveyed through visual storytelling, which is a comic that is accessible to various Malaysian audiences.

3.1. Research Phase

Below is a research phase that was used in this study, which is considered a data processing tool.

Table 1: Research Phases

Phase	Activity
Phase 1	Collecting existing comic visuals as visual data
Phase 2	Analyzing the visual data using the visual content analysis research method
Phase 3	Determine the appropriate comic visual that conveys the national unity based on Rukun Negara principles

The researchers utilized a collection of comic graphics from the mass production era of printing in Malaysia, spanning from 1980 to 2000. To adhere to this study, they collected a certain newspaper comic from that particular year. The Utusan newspaper was used as one of the visual sources for this comic strip. The study included standalone series or comics without continuations. The research phase began with the collection of comic visuals, which must include a comic strip. This requirement ensured that

the comic would contain numerous visual references, including the text within it. Moreover, the researchers limited the number of comics that are part of the study by choosing only the end-of-month newspaper comics because, based on the data, the payroll usually takes place at the end of the month, and the family may have more money to be used, such as for buying a newspaper for family reading.

The second phase of the analysis process involves using the research method for visual content analysis. This method is enhanced by adapting the theory of iconography to make sure the visual data becomes more valuable and valid. Lastly, a set of comic visuals, such as comic elements, will be identified as a reflection of Rukun Negara, which will be the aim of this paper.

4. RESULT

The researcher had succeeded in collecting 290 newspaper comic visuals as a part of this study. They conducted the analysis and found that 27 comic titles aligned with the visual context of Rukun Negara. The researchers analysed 290 comics from 1980 to 2000, including these 27 titles. The researchers also plotted each comic by its year and month to improve the accuracy of data tracking.

Table 2: Result of the Analysis

Year	Month	Visual References
1980	7	Multiethnic
1981	3	Multiethnic
1982	4	Multiethnic
1982	4	Multiethnic
1982	9	Multiethnic
1984	2	Multiethnic
1984	7	Multiethnic
1984	9	Multiethnic
1986	4	Multiethnic
1987	2	Multiethnic
1987	3	Multiethnic
1987	9	Multiethnic
1988	4	Multiethnic
1992	4	Multiethnic
1992	12	Multiethnic
1993	4	Multiethnic
1993	9	Multiethnic
1994	2	Islamic Practice
1994	4	Multiethnic
1994	5	Multiethnic
1995	3	Multiethnic
1995	12	Multiethnic
1996	2	Multiethnic
1996	4	Multiethnic
1996	12	Multiethnic
1997	2	Multiethnic
2000	3	Multiethnic

Table 2 shows that 26 visuals related to Rukun Negara comply with multi-ethnic visual references. Most of the comics that were analysed for this ongoing study portray the visuals of the Malay ethnic group as their main characters, and they use the Malay language. The researchers also identified the visual representation of Malays by examining both the slang used in the language and the appearance of the characters. However, some of the comics have other ethnicities, like Chinese, which are the comics from July 1980, April 1980, February 1984, July 1984, September 1984, April 1986, December 1992, April 1993, April 1994, February 1996, April 1996, and December 1996. The other multi-ethnic visual references correspond to the representations of various ethnicities such as Indian, Singh, and Christian. Additionally, the multi-ethnic visual references also relate to the overall meaning of Rukun Negara and its final principles, which include courtesy and morality.



Fig. 1: Example of Multi-ethnic Visual

Then, there is a single comic that portrays the visuals of Islamic practice, which is called "Zakat" in the February 1994 comic. "Zakat" is considered an Islamic practice by a Malay community in Malaysia. This visual has fallen into the first principle of Rukun Negara, which is Belief in God. The results of this visual content analysis indicate that the comic published during prime time in Malaysia applied the national principle, or Rukun Negara ideology, which can enhance unity among Malaysians.



Fig. 2: Example of Zakat Visual

5. CONCLUSION

In conclusion, the comic can be a beneficial tool that has huge potential to promote unity among Malaysians. A new model that reflects a Rukun Negara in a visual way can be constructed to make sure future researchers can use it as a reference. Other terms related to unity can also be identified, defined, and discussed further to develop more elements that can cause unity, especially in Malaysia's unique multi-ethnic context.

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Augmented Reality: Revolutionizing the Spark of Learning Motivation

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ABSTRACT

This study investigates the impact of Augmented Reality (AR) on academic performance and motivation in polytechnic-level science education. A one-group quasi-experimental design was conducted involving 61 diploma science students at a Malaysian polytechnic. The study employed a 7-point Likert scale-based Instructional Materials Motivation Survey (IMMS), which measured attention, relevance, confidence, and satisfaction. Students also completed a pre-test and post-test surrounding an AR-enhanced lesson using the MyWebAR platform. The post-test scores ($M = 94.22$, $SD = 6.99$) significantly outperformed pre-test scores ($M = 28.22$, $SD = 13.91$), $p < .001$, indicating improved academic performance. IMMS results revealed high motivation across all dimensions. While the findings affirm the educational benefits of AR, the lack of a control group and possible novelty effect limit generalizability. The study provides a useful baseline for future AR applications in technical education and highlights the need for further research to explore long-term impacts and individual learner differences.

Keywords: Augmented reality, motivation, polytechnic education, science learning, instructional design

1. INTRODUCTION

Augmented Reality (AR) has emerged as a transformative educational technology that overlays digital content onto real-world environments, enabling learners to interact with dynamic, contextualized information in real time. This innovative approach has shown particular promise in science education by enabling the visualization of complex, abstract phenomena such as linear motion, buoyancy, and thermal energy concepts often challenging to grasp through conventional instruction (Ahmed & Hassan, 2020; Tan et al., 2022). In technical and vocational education, particularly within polytechnic institutions, the integration of AR offers unique pedagogical opportunities and challenges. Unlike traditional academic settings, polytechnics prioritize experiential and applied learning. Students in these settings often benefit more from visual, hands-on engagement, especially when dealing with abstract scientific principles. However, most existing studies on AR focus on primary, secondary, or higher education contexts, leaving a notable gap in understanding its isolated effects, particularly on motivation in polytechnic settings.

Grounded in constructivist learning theory, which emphasizes active knowledge construction through interaction and experience, this study explores how AR can scaffold meaningful engagement and conceptual development. Furthermore, the study draws on Self-Determination Theory (SDT) to explain how AR's immersive, autonomous, and competence-driven features may satisfy learners' psychological needs, thereby fostering intrinsic motivation. Although prior research has demonstrated AR's ability to enhance engagement and learning outcomes, few have examined its motivational impact within a one-group quasi-experimental design. This study responds to that gap by evaluating changes in student motivation and academic performance following exposure to an AR-based science lesson in a polytechnic environment.

1.1. Research Objectives

The main objective of this study is to investigate the effects of an Augmented Reality (AR) application on students' academic performance and motivation in polytechnic-level science education. The specific objectives are to:

- i. To assess the effect of an AR application on students' academic achievement in a science course.
- ii. To analyse the impact of AR on students' motivation to learn science.
- iii. To describe students' engagement and perceptions toward AR-based learning.

2. LITERATURE REVIEW

The adoption of Augmented Reality (AR) in educational settings, particularly in STEM disciplines, has gained considerable momentum in recent years. AR's capacity to superimpose interactive digital elements onto the real world allows students to manipulate visualizations and simulations of scientific phenomena that are otherwise abstract or invisible such as molecular interactions, thermal dynamics, or fluid buoyancy (Akçayır & Akçayır, 2020; Qamar et al., 2021). Numerous studies have shown that AR supports improved conceptual understanding and learning performance. For instance, Liang et al. (2023) and Fakhruddin et al. (2022) found that AR-based instruction led to significantly better academic outcomes when compared to traditional teaching. These benefits are often attributed to the active, student-centred nature of AR learning environments, which align closely with constructivist learning theory, wherein learners construct knowledge through contextual and immersive experiences (Hussein et al., 2021).

In addition to academic gains, AR has also been shown to positively influence student motivation. Interactive and immersive elements in AR content tend to attract learners' attention, increase satisfaction, and build confidence (Hsu, 2021; Ibáñez et al., 2020). Through engaging content delivery, AR can reduce cognitive load and improve retention (Chang & Hwang, 2021). This motivational impact is particularly relevant in the context of Self-Determination Theory (SDT), where fulfilling learners' psychological need autonomy, competence, and relatedness can enhance intrinsic motivation. However, existing research often employs experimental-control group designs, leaving a gap in understanding the standalone effects of AR on motivation within one-group quasi-experimental frameworks. Moreover, few studies target polytechnic students, who may differ in cognitive styles, learning needs, and digital readiness compared to students in more traditional academic pathways.

There is also a methodological gap in how studies report outcome many emphasize gains in test scores without establishing baseline motivational data. According to Li et al. (2020), these variations in study design, sample context, and measurement tools complicate cross-study comparisons and hinder the development of generalized instructional frameworks. This study aims to address those gaps by isolating the effects of AR-based learning on both academic performance and student motivation, using validated instruments and a single-group pre-test post-test design within a polytechnic setting. By establishing motivational and performance benchmarks in this context, the study contributes to a clearer understanding of AR's practical and pedagogical value.

3. MATERIAL AND METHODS

3.1. Participants

This study involved 61 diploma-level science students from a Malaysian polytechnic, comprising 50 males and 11 females. Participants were selected using purposive sampling from a course where the targeted science topics were part of the curriculum. Although the sample may not represent the entire polytechnic population, it reflects the typical learner profile for technical science modules at the institution. Out of the 61 students, only 45 completed both the pre-test and post-test assessments. The remaining data were excluded due to absenteeism or incomplete responses, which resulted in a valid sample size of 45 for analysis.

3.2. Research Design

This study utilized a one-group quasi-experimental design incorporating pre-test and post-test assessments. The same group of students was evaluated before and after undergoing an AR-based instructional session. This design enabled measurement of performance and motivational changes within participants. Although a control group would strengthen internal validity, logistical limitations such as the availability of only one intact class and constraints on classroom scheduling made a controlled design impractical. As such, the current approach serves as an important benchmark for future AR-based comparisons, especially in under-researched polytechnic contexts.

3.3. Data Collection Instruments

3.3.1. Pre-test and Post-test

Custom-designed assessments were created by experienced lecturers based on course learning outcomes. The test items were validated by subject matter experts for content relevance and clarity. The instruments measured conceptual understanding of three key science topics: linear motion, Archimedes' principle, and thermal energy. The tests included multiple-choice and short-answer items. While full items are not reported due to space constraints, a sample includes: "Explain the factors affecting buoyant force in a fluid medium."

3.3.2. Instructional Materials Motivation Survey (IMMS)

Motivation was assessed using the 36-item Instructional Materials Motivation Survey (IMMS) developed by Keller (2010), which evaluates four subscales: Attention, Relevance, Confidence, and Satisfaction. All items used the original 7-point Likert format without adaptation, as the language was deemed culturally and linguistically suitable for the participants. Cronbach's alpha coefficients for the subscales ranged from 0.81 to 0.92, indicating high internal consistency.

3.4. AR Design and Implementation

The Augmented Reality (AR) content was developed using the MyWebAR platform to support three core science topics: Linear Motion, Archimedes' Principle, and Thermal Energy. For each topic, the instructional materials included one short educational video, one animated simulation, and one interactive 3D model, all of which were embedded into printed worksheets via QR codes. Students accessed the AR materials using their own mobile devices, enabling them to engage with the content interactively and independently. Prior to implementation, a pilot study was conducted with a small group of students to assess the clarity, technical performance, and usability of the AR materials. Based on the feedback, adjustments were made to improve loading times, interface navigation, and visual clarity. The final version of the AR content functioned smoothly during the main session, with no significant technical issues reported. This structured design aimed to maximize engagement and conceptual understanding by allowing learners to visualize and manipulate abstract scientific concepts in real-time.



Figure 1: Example of Augmented Pages Used in eXploreAR Science

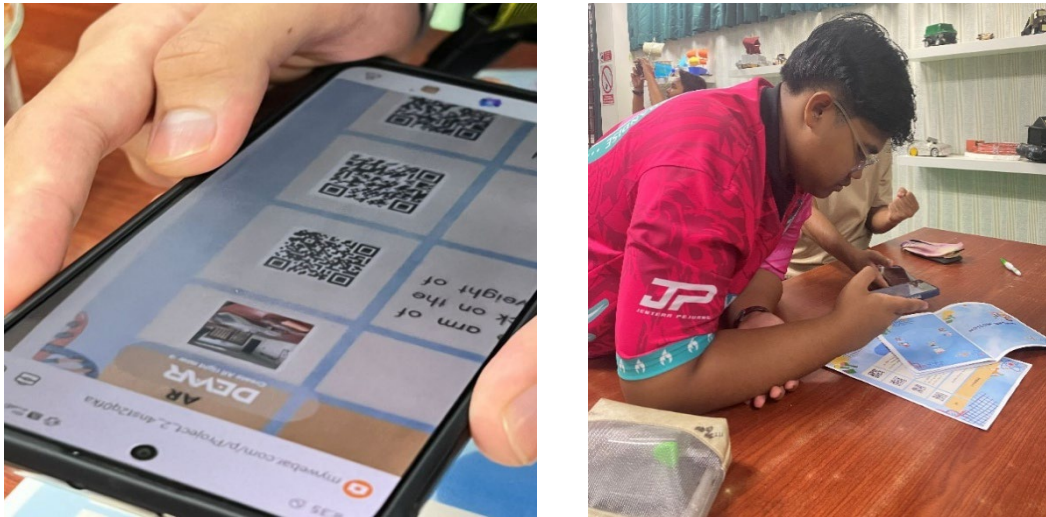


Figure 2: Students using eXploreAR Science

3.5. Procedure

Prior to the study, ethical approval and administrative clearance were obtained from the relevant polytechnic authorities. The participating lecturer was briefed on the study's objectives, procedures, and tools, and was provided with a detailed lesson plan to ensure consistent delivery of the AR-based lesson. The study was conducted in a standard classroom environment. Students first completed a pre-test to assess their baseline understanding of the selected science topics. This was followed by a 60-minute guided lesson using the AR materials, during which students engaged with interactive content through their mobile devices by scanning QR codes embedded in printed worksheets. The lecturer facilitated the session, providing support and clarification as needed to ensure students remained on task. Upon completion of the lesson, students were administered a post-test to measure learning gains, along with the Instructional Materials Motivation Survey (IMMS) to assess their motivational responses to the AR-enhanced instruction.

3.6. Data Analysis

All quantitative data collected from the pre-test, post-test, and IMMS were analysed using SPSS Version 26. Descriptive statistics, including mean and standard deviation, were calculated to summarize students' academic performance and motivation levels. To determine whether the differences between pre-test and post-test scores were statistically significant, a paired samples t-test was conducted. Prior to running the test, the assumption of normality of the difference scores was verified using the Shapiro-Wilk test, confirming that the data met the required conditions. Due to incomplete responses from some participants, only 45 students had valid paired test data, resulting in 44 degrees of freedom for the analysis. The strength of the intervention effect was further examined by calculating Cohen's d, which provides insight into the practical significance of the observed score improvements. Additionally, a Pearson correlation analysis was conducted to explore the relationship between students' pre-test and post-test scores.

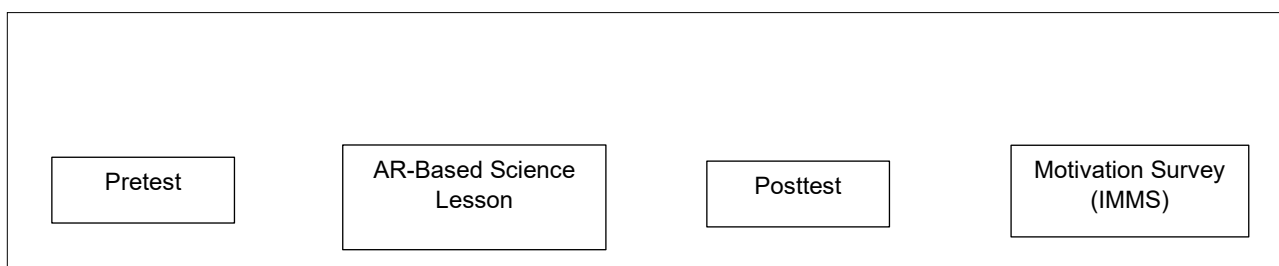


Figure 3: Flowchart of the Experimental Procedure

4. RESULTS

The analysis revealed a significant improvement in students' academic performance following the AR-based lesson. Table 1 presents descriptive statistics for both pre-test and post-test scores, showing a substantial increase in mean scores. The average pre-test score was 28.22 (SD = 13.91), while the post-test average was 94.22 (SD = 6.99), indicating a marked improvement in conceptual understanding of science topics after the AR intervention.

Table 1: Descriptive Statistics of Pre-test and Post-test Scores

	Mean	Std. Deviation	Std. Error Mean
Pre-test	28.2222	13.90534	2.07289
Post test	94.2222	6.98664	1.04151

To explore the relationship between students' baseline and post-intervention performance, a Pearson correlation was conducted (Table 2). The correlation between pre- and post-test scores was weak ($r = .143$) and statistically non-significant ($p = .348$), suggesting that prior knowledge had little predictive influence on post-test outcomes.

Table 2: Correlation Between Pre-test and Post-test Scores

Test	Correlation	Sig.
Pre-test & Post test	.143	.348

Despite the substantial improvement in post-test scores, the correlation between pre- and post-test results was weak ($r = .143$, $p = .348$), indicating a non-significant relationship between students' baseline knowledge and their performance after the AR intervention. This finding suggests that students who began with lower initial understanding were able to benefit from the AR-based instruction just as much as or in some cases, more than those with higher pre-test scores. It may also reflect the levelling effect of AR technology, which provides multisensory, interactive content that supports diverse learning styles. Additionally, the low correlation could point to other influencing factors such as individual motivation, prior exposure to digital tools, or the novelty of the AR experience itself. These variables may have moderated how students engaged with the lesson, potentially diminishing the predictive power of pre-existing knowledge. A paired samples t-test was conducted to determine whether the difference in performance before and after the AR-based lesson was statistically significant. Results showed a significant increase in scores ($t(44) = -30.243$, $p < .001$), with a very large effect size (Cohen's $d = 5.27$), indicating that the AR intervention had a substantial impact on student learning.

Table 3: Paired Sample t-Test Results for Pre-test and Post-test

Paired Differences							
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
			Lower	Upper			
-66.00000	14.63961	2.18234	-70.39823	-61.60177	-30.243	44	.000

Motivational responses were measured using the IMMS across four subscales: Attention, Relevance, Confidence, and Satisfaction. Table 4 summarizes the mean and standard deviation for each dimension. The highest motivation score was in Relevance ($M = 5.36$), followed by Attention ($M = 4.48$), Satisfaction ($M = 4.45$), and Confidence ($M = 4.44$). These results suggest that students found the AR content engaging, applicable, and satisfying.

Table 4: Mean and Standard Deviation of IMMS Dimensions

Dimensions	Mean	Std. Deviation
Attention	4.4795	.52894
Relevance	5.3607	.63647
Confidence	4.4385	.55651
Satisfaction	4.4459	.55184

To further analyse the consistency of responses, Table 5 shows the item-level descriptive statistics for all 18 IMMS items analysed. All items scored between 4.36 and 4.54, indicating consistently high motivation across various aspects of the AR experience.

Table 5: Item-wise Descriptive Statistics for IMMS Survey

Student	Mean	Std. Deviation
S1	4.4426	.64613
S2	4.5246	.59460
S3	4.4918	.59506
S4	4.4590	.64740
S5	4.4754	.62200
S6	4.3607	.68393
S7	4.4754	.64824
S8	4.4918	.62244
S9	4.5410	.59368
S10	4.4098	.66776
S11	4.4262	.64444
S12	4.4426	.64613
S13	4.4754	.62200
S14	4.3607	.63332
S15	4.3607	.68393
S16	4.4754	.64824
S17	4.5246	.64824
S18	4.5082	.59506

The regularity of participant responses is further supported by the consistently high scores across all measures, with means ranging from 4.36 to 4.54 and low standard deviations, suggesting that the training materials were generally well received. The attention component had a marginally better score than the others, indicating that the materials' layout and presentation were very successful at maintaining student interest. The content's connection with learners' objectives and past experiences, which is essential for effective learning, is reflected in the high Relevance score. Despite being somewhat lower, confidence and satisfaction nevertheless show that students felt capable and happy with their development and results.

The statistical outcomes observed in this study align directly with the research objectives. The significant improvement in post-test scores ($M = 94.22$) compared to pre-test scores ($M = 28.22$), supported by a large effect size (Cohen's $d = 5.27$), confirms the effectiveness of the AR intervention in enhancing students' academic performance thus fulfilling the first research objective. Furthermore, the high mean scores across all four IMMS dimensions Attention ($M = 4.48$), Relevance ($M = 5.36$), Confidence ($M = 4.44$), and Satisfaction ($M = 4.45$) indicate that the AR-based lesson successfully stimulated student motivation in multiple facets, addressing the second objective. These findings demonstrate that AR not only facilitates cognitive gains in scientific understanding but also nurtures affective engagement, reinforcing its dual role as both an instructional and motivational tool in polytechnic science education.

5. CONCLUSION

This study affirms the potential of Augmented Reality (AR) to significantly enhance both academic performance and motivation among polytechnic science students. The substantial improvement in post-test scores reflects AR's effectiveness in promoting deeper conceptual understanding, particularly for abstract scientific topics that are traditionally difficult to teach through conventional methods. Furthermore, high scores across all four dimensions of the Instructional Materials Motivation Survey (IMMS) attention, relevance, confidence, and satisfaction underscore the role of AR in creating an engaging and learner-centered environment that fosters sustained interest and motivation. These findings reinforce the value of AR as an innovative instructional tool in technical and vocational education. By bridging the gap between theoretical knowledge and practical application, AR supports not only cognitive learning but also emotional and motivational engagement. Its immersive and

interactive features help boost learners' sense of competence, autonomy, and satisfaction attributes essential for long-term academic growth.

Nonetheless, the study's one-group quasi-experimental design limits the ability to generalize the findings to broader populations. To strengthen the evidence base, future research should incorporate randomized controlled trials and longitudinal studies to explore the long-term effects of AR-based learning on both retention and sustained motivation. Additionally, collecting qualitative feedback from students could yield richer insights into user experiences, emotional responses, and usability challenges. Comparative studies that evaluate AR against other digital learning tools such as virtual reality (VR), gamification platforms, or learning management systems would also help determine the unique contributions and limitations of AR in different educational contexts. In conclusion, Augmented Reality holds strong potential to transform science education by improving conceptual mastery and energizing learners' motivation. When thoughtfully designed and implemented, AR can turn conventional classrooms into dynamic, participatory learning spaces that align with the evolving goals of 21st-century education.

6. LIMITATION

While the findings suggest positive effects of AR-based instruction, several limitations must be acknowledged. First, the absence of a control group limits the ability to isolate the impact of the AR intervention. Second, the short duration of the study may not reflect long-term learning retention or engagement. Additionally, the novelty effect students' excitement toward using new technology may have temporarily enhanced motivation and skewed results. Finally, students' prior exposure to technology or varying digital literacy levels could have influenced their interaction with the AR content and overall learning experience.

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Penggunaan Aplikasi ChatGPT sebagai Alat Pembelajaran yang Efektif: Tinjauan ke atas Pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan

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ABSTRAK

Kajian ini bertujuan meneliti penggunaan aplikasi ChatGPT sebagai alat pembelajaran yang efektif dalam kalangan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan. Penggunaan kecerdasan buatan (AI) dalam pendidikan semakin mendapat perhatian seiring dengan perkembangan Revolusi Industri 4.0, dan ChatGPT merupakan salah satu teknologi yang berpotensi menyokong pembelajaran sendiri serta meningkatkan kefahaman pelajar terhadap kandungan pengajaran. Dalam kajian ini, dua objektif utama telah dikenal pasti, iaitu mengenal pasti tahap pengetahuan pelajar terhadap aplikasi ChatGPT dan menilai keberkesanan penggunaannya dalam menyokong proses pembelajaran harian. Kajian ini menggunakan kaedah kuantitatif yang melibatkan pengedaran borang soal selidik kepada seramai 112 orang responden yang terdiri daripada pelajar semester satu hingga lima. Data dikumpul melalui soal selidik berskala *Likert* 5-mata dan dianalisis menggunakan Microsoft Excel melibatkan statistik deskriptif (min, sisihan piawai) untuk menentukan tahap pengetahuan serta persepsi terhadap keberkesanan aplikasi tersebut. Hasil kajian menunjukkan bahawa tahap pengetahuan dan keberkesanan penggunaan pelajar terhadap ChatGPT adalah tinggi dengan semua nilai min melebihi 4.0 dan mereka menunjukkan kecenderungan yang positif dalam menggunakannya untuk penyediaan tugasan, semakan konsep teknikal, serta mempercepatkan pemahaman topik pembelajaran. Walau bagaimanapun, daripada dapatan hanya 54% responden bersetuju bahawa ChatGPT memberikan jawapan yang tepat menunjukkan terdapat kebimbangan terhadap ketepatan maklumat yang dihasilkan oleh aplikasi ini, yang kadangkala memerlukan semakan lanjut daripada sumber lain yang sahih, sekali gus menunjukkan keperluan untuk memperkukuh tahap literasi maklumat pelajar. Kajian ini menyarankan agar pihak institusi pendidikan tinggi memainkan peranan yang lebih aktif dalam memperkukuh penggunaan teknologi seperti ChatGPT secara etika, terkawal, dan strategik. Sokongan melalui latihan penggunaan, garis panduan etika digital, dan integrasi dalam kurikulum akan membantu pelajar memanfaatkan teknologi ini secara optimum selaras dengan keperluan pembelajaran abad ke-21.

Kata kunci: ChatGPT, pembelajaran berasaskan AI, kejuruteraan, politeknik, teknologi Pendidikan

1. PENGENALAN

Kemajuan teknologi kecerdasan buatan (AI) telah membawa kepada pelbagai inovasi dalam bidang pendidikan. Salah satu inovasi yang semakin mendapat perhatian dalam kalangan pelajar dan tenaga pengajar ialah penggunaan aplikasi ChatGPT, iaitu sebuah model bahasa yang dibangunkan oleh OpenAI. ChatGPT berupaya menjana respon berbentuk teks yang menyerupai pertuturan manusia berdasarkan input yang diterima. Dalam konteks pendidikan, ChatGPT telah digunakan sebagai alat bantu pembelajaran untuk mendapatkan maklumat, menjana idea, menjawab soalan akademik, dan membantu dalam penulisan tugasan. Dalam persekitaran pembelajaran yang semakin mencabar dan berpusatkan pelajar, keberkesanan penggunaan teknologi seperti ChatGPT amat penting untuk diteliti. Hal ini bagi memastikan aplikasi yang digunakan benar-benar memberi nilai tambah kepada proses pembelajaran pelajar. Oleh itu, kajian ini dijalankan untuk meninjau tahap pengetahuan, keberkesanan,

serta kemudahan penggunaan ChatGPT sebagai alat pembelajaran dalam kalangan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan.

1.1. Penyataan Masalah

Perkembangan AI yang pesat, khususnya aplikasi ChatGPT, telah membuka dimensi baharu dalam kaedah pembelajaran dan pengajaran. ChatGPT yang berasaskan pemprosesan bahasa semula jadi (NLP) mampu menjawab soalan, menjelaskan konsep, serta memberi cadangan penyelesaian terhadap pelbagai permasalahan pembelajaran. Walaupun ChatGPT semakin popular digunakan dalam kalangan pelajar institusi pendidikan tinggi, khususnya di Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal Politeknik Ibrahim Sultan, tahap pengetahuan yang sebenar dan keberkesanan penggunaannya sebagai alat pembelajaran belum dapat dipastikan secara menyeluruh. Ada pelajar yang mungkin menggunakan aplikasi ini tanpa memahami batasan atau cara penggunaannya secara berkesan.

Kajian oleh Rahman et al. (2023) menunjukkan bahawa pelajar dalam bidang Pendidikan Teknikal dan Latihan Vokasional (TVET) menunjukkan minat tinggi terhadap penggunaan ChatGPT, namun tahap pengetahuan teknologi dan kemahiran penggunaan AI dalam kalangan pelajar masih rendah. Sementara itu, laporan oleh Kamarudin et al. (2023) mendapati bahawa walaupun pelajar menyedari potensi ChatGPT, masih wujud kebimbangan terhadap ketepatan maklumat, kebergantungan berlebihan, dan isu etika akademik. Tambahan pula, transformasi pendidikan ke arah digitalisasi memerlukan institusi pendidikan tinggi untuk menilai keberkesanan alat sokongan pembelajaran seperti ChatGPT agar pelajar dapat menggunakan teknologi ini secara bertanggungjawab dan efisien. Oleh itu, kajian ini penting untuk mengenal pasti sejauh mana pelajar mengetahui dan menggunakan aplikasi ini serta mengenal pasti keberkesanannya dalam menyokong proses pembelajaran.

1.2. Objektif Kajian

Kajian ini dijalankan bagi mencapai objektif berikut:

- i. Mengetahui tahap pengetahuan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan terhadap penggunaan aplikasi ChatGPT dalam pembelajaran.
- ii. Mengetahui tahap keberkesanan penggunaan ChatGPT sebagai alat pembelajaran yang efektif.

1.3. Persoalan Kajian

Berpandukan kepada objektif kajian yang telah digariskan, kajian ini akan menjawab persoalan-persoalan berikut:

- i. Apakah tahap pengetahuan penggunaan aplikasi ChatGPT dalam kalangan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan?
- ii. Sejauh manakah keberkesanan penggunaan aplikasi ChatGPT dalam menyokong proses pembelajaran pelajar?

1.4. Kepentingan Kajian

Kajian ini dapat memberikan sumbangan kepada beberapa pihak antaranya kepada institusi pendidikan tentang potensi dan cabaran dalam penggunaan ChatGPT dalam proses pembelajaran. Selain itu, dapat membantu pihak institusi merangka dasar atau panduan penggunaan aplikasi AI dalam sistem pembelajaran di politeknik. Dari sudut pensyarah, ia juga dapat membantu pensyarah memberikan maklumat mengenai potensi ChatGPT dalam menyokong pengajaran dan pembelajaran serta merancang kaedah pengajaran yang lebih sesuai dengan keperluan pelajar masa kini. Pihak pelajar juga menyedari tentang kepelbagaian fungsi ChatGPT sebagai alat pembelajaran dan membantu mereka

menggunakannya secara optimum. Manakala bagi pihak penyelidik, dapatan ini boleh dijadikan rujukan berguna dalam mengkaji teknologi AI dalam Pendidikan TVET secara lebih mendalam dan menyeluruh.

2. KAJIAN LITERATUR

2.1. Pengenalan Teknologi ChatGPT

ChatGPT merupakan aplikasi AI yang dibangunkan oleh OpenAI dan mula diperkenalkan secara meluas pada tahun 2022. Ia digunakan untuk pelbagai tujuan seperti menjawab soalan, menyemak fakta, menterjemah teks, dan merancang penulisan. Dalam konteks pendidikan, ChatGPT dilihat sebagai alat yang berpotensi membantu pelajar mendapatkan penjelasan pantas dan sokongan tugasan. Menurut Lim (2023), kecerdasan buatan (AI) kini memainkan peranan penting dalam memperkasa sektor pendidikan melalui penyesuaian pembelajaran, automasi tugasan, serta pemberian maklum balas masa nyata. AI membolehkan pengalaman pembelajaran yang lebih personalisasi, dengan pelajar mampu menerima bimbingan berdasarkan tahap kefahaman mereka. Teknologi AI juga memberi peluang kepada pendidik untuk menyampaikan pengajaran dengan lebih efektif, menggunakan pelbagai aplikasi seperti chatbot, sistem sokongan pintar, dan teknologi pemprosesan bahasa semula jadi (Natural Language Processing, NLP).

2.2. Teknologi ChatGPT dalam Konteks Pendidikan

ChatGPT ialah aplikasi pemprosesan bahasa semula jadi (Natural Language Processing, NLP) yang dibangunkan oleh OpenAI. Aplikasi ini membolehkan pengguna berinteraksi melalui perbualan berasaskan teks dan menerima maklum balas dalam bentuk yang menyerupai respon manusia. Menurut Goh (2023), ChatGPT direka untuk memahami pertanyaan kompleks dan memberikan jawapan yang relevan, menjadikannya sesuai untuk pelajar di peringkat pengajian tinggi. Dalam konteks pendidikan, ChatGPT mampu menjawab soalan akademik, memberi penerangan konsep, membantu menyiapkan tugasan dan menyediakan idea untuk penulisan. Patchara et al. (2021) menyatakan bahawa aplikasi ini sangat berkesan dalam meningkatkan pengetahuan pelajar, terutamanya apabila digunakan untuk pembelajaran sendiri. Hal ini membuktikan bahawa AI seperti ChatGPT boleh menjadi alat sokongan yang berguna kepada pelajar dalam memperoleh maklumat dengan lebih cepat dan mudah.

Menurut Patchara et al. (2021), penggunaan ChatGPT dalam kalangan pelajar kejuruteraan dapat meningkatkan motivasi dan keupayaan mereka memahami subjek yang kompleks. Manakala menurut A. Rahman et al. (2023), pelajar TVET di politeknik menunjukkan minat tinggi terhadap penggunaan ChatGPT kerana ia menyokong penyelesaian masalah secara cepat dan menjimatkan masa. Namun begitu, Mustafa dan Hamzah (2011) mengingatkan bahawa penggunaan teknologi perlulah beretika dan disokong dengan kebolehan menilai maklumat yang diperoleh.

2.3. Tahap Pengetahuan Pelajar terhadap ChatGPT

Tahap pengetahuan merujuk kepada sejauh mana seseorang individu mengetahui dan memahami sesuatu konsep atau aplikasi. Dalam konteks ini, ia merujuk kepada kesedaran dan pemahaman pelajar terhadap kewujudan serta fungsi ChatGPT dalam membantu proses pembelajaran. Berdasarkan kajian oleh Nordin et al. (2023), tahap kesedaran pelajar terhadap penggunaan ChatGPT semakin meningkat, terutamanya dalam kalangan pelajar institusi pengajian tinggi yang terdedah kepada teknologi terkini. Walau bagaimanapun, terdapat perbezaan dari segi tahap penggunaan dan pemahaman fungsi aplikasi tersebut antara pelajar jurusan teknikal dan bukan teknikal.

Kajian yang dijalankan oleh Abu Bakar et al. (2024) mendapati bahawa walaupun ramai pelajar tahu tentang kewujudan ChatGPT, namun tidak semua memahami cara penggunaannya secara optimum, seperti menyemak kesahihan maklumat dan mengaplikasikan jawapan dalam tugasan sebenar. Oleh itu, penting untuk menilai tahap pengetahuan pelajar bagi memastikan mereka bukan sahaja menggunakan aplikasi ini, tetapi menggunakannya dengan cara yang betul dan beretika.

2.4. Keberkesanan ChatGPT sebagai Alat Pembelajaran

Keberkesanan aplikasi ChatGPT sebagai alat pembelajaran dilihat dari pelbagai sudut, antaranya dari segi kemudahan penggunaan, keupayaan menjawab pertanyaan secara tepat dan cepat, serta kebolehan untuk menyesuaikan jawapan mengikut tahap kefahaman pengguna. Lim (2023) menyatakan bahawa penggunaan AI seperti ChatGPT dalam pendidikan telah mencetuskan perubahan inovatif dan meningkatkan penglibatan pelajar dalam pembelajaran secara aktif. Kajian oleh Saad et al. (2024) mendapati bahawa majoriti pelajar bersetuju bahawa ChatGPT membantu mereka memahami sesuatu topik dengan lebih mudah dan meningkatkan motivasi belajar. Selain itu, ChatGPT juga membantu pelajar menyelesaikan tugas dan kerja kursus dengan lebih efisien. Namun begitu, terdapat juga kebimbangan tentang kebergantungan berlebihan terhadap teknologi ini sehingga boleh melemahkan kemahiran berfikir secara kritis. Secara keseluruhan, kajian-kajian lepas oleh Patchara et al. (2021), Foo (2023) dan Saad et al. (2024) menunjukkan bahawa ChatGPT berpotensi menjadi alat pembelajaran yang efektif jika digunakan dengan bijak. Walaupun masih terdapat kekangan dari segi tahap pengetahuan dan etika penggunaan, potensi aplikasi ini dalam menyokong pembelajaran pelajar tidak boleh dinafikan. Justeru, kajian ini dijalankan bagi meninjau secara khusus tahap pengetahuan dan keberkesanan penggunaan ChatGPT dalam kalangan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan, sekaligus mengisi jurang yang belum diteroka secara menyeluruh di peringkat politeknik.

3. METODOLOGI

Kajian ini menggunakan reka bentuk kuantitatif deskriptif dengan pendekatan tinjauan melalui soal selidik. Pendekatan ini membolehkan pengkaji memperoleh maklumat secara langsung daripada pelajar mengenai tahap pengetahuan dan keberkesanan penggunaan ChatGPT dalam pembelajaran mereka. Populasi kajian terdiri daripada pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal, Politeknik Ibrahim Sultan. Seramai 112 pelajar dipilih sebagai sampel kajian secara persampelan rawak berstrata berdasarkan kursus dan semester pelajar.

Instrumen yang digunakan ialah borang soal selidik yang dibangunkan berdasarkan objektif kajian. Soal selidik ini mengandungi empat bahagian. Bahagian pertama terdiri daripada data demografi responden termasuk jantina, jabatan, kursus, semester dan sumber informasi ChatGPT diperolehi. Bahagian kedua mengandungi lima soalan yang berkaitan dengan Pengetahuan ChatGPT dalam Pembelajaran. Bahagian ketiga mengandungi lima soalan yang berkaitan dengan Kemudahgunaan ChatGPT dalam Pembelajaran dan bahagian keempat mengandungi lima soalan yang berkaitan dengan Keberkesanan Penggunaan ChatGPT dalam Pembelajaran. Responden diminta menjawab dengan menyatakan persetujuan mereka terhadap pernyataan yang diberikan menggunakan skala *Likert* 5 mata iaitu daripada 1 (Sangat Tidak Setuju) hingga 5 (Sangat Setuju). Bagi menentukan kebolehpercayaan instrumen soal selidik yang digunakan dalam kajian ini, analisis pekali Alpha Cronbach telah dijalankan ke atas tiga bahagian utama yang merangkumi konstruk Pengetahuan, Kemudahgunaan, dan Keberkesanan Penggunaan aplikasi ChatGPT dalam pembelajaran. Pekali Alpha Cronbach digunakan untuk mengukur konsistensi dalaman bagi setiap set item soal selidik. Jadual 1 menunjukkan nilai Alpha Cronbach bagi setiap konstruk:

Jadual 1: Nilai Alpha Cronbach bagi setiap konstruk

Konstruk	Bilangan Item	Alpha Cronbach	Tafsiran
Pengetahuan	5	0.956	Sangat Baik
Kemudahgunaan	5	0.945	Sangat Baik
Keberkesanan	5	0.927	Sangat Baik

Kesemua nilai Alpha Cronbach melebihi 0.9, menunjukkan tahap kebolehpercayaan yang sangat tinggi. Ini bermakna item-item yang dibangunkan dalam setiap konstruk adalah konsisten serta sesuai digunakan untuk tujuan pengumpulan data dalam kajian ini. Oleh itu, instrumen soal selidik ini dianggap boleh dipercayai untuk menilai tahap pengetahuan dan keberkesanan pelajar terhadap penggunaan aplikasi ChatGPT sebagai alat pembelajaran.

4. DAPATAN KAJIAN

Seramai 112 responden telah terlibat dalam kajian ini. Responden terdiri daripada pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal, Politeknik Ibrahim Sultan yang telah menjawab soal selidik. Tempoh pengumpulan data dijalankan selama dua minggu bagi memberi masa mencukupi kepada pelajar untuk memberikan maklum balas. Data yang dikumpul dan dianalisis menggunakan perisian Microsoft Excel. Statistik deskriptif min dan sisihan piawai digunakan untuk menganalisis data. Dapatan ini dianalisis berdasarkan dua objektif utama kajian, iaitu tahap pengetahuan pelajar mengenai ChatGPT dan tahap keberkesanan penggunaannya sebagai alat pembelajaran.

Jadual 2 menunjukkan analisis demografi responden yang diperoleh daripada 112 orang responden yang menjawab soal selidik. Daripada jumlah keseluruhan responden, seramai 87 orang (77.7%) merupakan pelajar lelaki, manakala 25 orang (22.3%) merupakan pelajar perempuan. Ini menunjukkan majoriti responden dalam kajian ini terdiri daripada pelajar lelaki, selaras dengan dominasi pelajar lelaki dalam bidang kejuruteraan. Dari segi pengkhususan jabatan, seramai 79 orang responden (70.5%) berasal daripada Jabatan Kejuruteraan Elektrik, manakala 33 orang (29.5%) berasal daripada Jabatan Kejuruteraan Mekanikal. Bagi pembahagian mengikut kursus, majoriti responden terdiri daripada pelajar kursus Diploma Kejuruteraan Elektrik dan Elektronik (DEE) iaitu seramai 72 orang (64.3%). Diikuti oleh kursus DTP (19 orang, 17%), DKM (13 orang, 11.6%), DEP (6 orang, 5.4%), manakala DJK dan DEM masing-masing diwakili oleh seorang pelajar (0.9%). Dalam aspek semester pengajian, seramai 42 orang (37.5%) adalah pelajar Semester 1, dan 42 orang (37.5%) juga dari Semester 3. Diikuti oleh 27 orang (24.1%) dari Semester 5, dan hanya 1 orang (0.9%) dari Semester 2. Responden telah diminta menyatakan dari mana mereka mengetahui tentang aplikasi ChatGPT. Majoriti responden memperoleh maklumat mengenai ChatGPT melalui media sosial sebanyak 48 orang (42.9%), diikuti oleh rakan seramai 43 orang (38.4%). Sementara itu, seramai 20 orang (17.9%) mengetahui mengenai ChatGPT melalui pensyarah, dan hanya 1 orang (0.9%) melalui webinar. Corak ini sejajar dengan dapatan Suriani et al. (2022) yang mendapati media sosial sebagai saluran utama pendedahan chatbot dalam kalangan pelajar.

Jadual 2: Analisis demografi responden

Ciri-ciri Demografi		Bilangan
Jantina	Lelaki	87
	Perempuan	25
Jabatan	Kejuruteraan Elektrik	79
	Kejuruteraan Mekanikal	33
Kursus	DEE	72
	DTP	19
	DKM	13
	DEP	6
	DJK	1
	DEM	1
Semester	Tiga	42
	Satu	42
	Lima	27
	Dua	1
Sumber Informasi Mengenai ChatGPT	Media sosial	48
	Rakan	43
	Pensyarah	20
	Webinar	1

Jadual 3 menunjukkan dapatan bagi objektif kajian pertama iaitu tahap pengetahuan pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan terhadap penggunaan aplikasi ChatGPT dalam pembelajaran. Analisis min dan sisihan piawai bagi mengukur tahap pengetahuan responden terhadap ChatGPT menunjukkan skor min yang tinggi. Tahap pengetahuan pelajar terhadap penggunaan ChatGPT berada pada tahap tinggi, dengan semua nilai min melebihi 4.0. Item tertinggi ialah keupayaan menggunakan ChatGPT untuk mendapatkan maklumat pembelajaran (min = 4.42), diikuti dengan kesedaran kewujudan ChatGPT (min = 4.38). Ini menunjukkan majoriti pelajar bukan sahaja sedar akan kewujudan aplikasi ini malah mempunyai tahap pengetahuan yang baik mengenai fungsi dan kegunaan ChatGPT dalam proses pembelajaran mereka. Dapatan ini disokong oleh Nordin et al. (2023) yang menyatakan literasi AI dalam kalangan pelajar meningkat pasca pandemik.

Jadual 3: Analisis tahap pengetahuan pelajar terhadap penggunaan aplikasi ChatGPT dalam pembelajaran

Item	Min	Sisihan Piawai	Tahap
Saya tahu kewujudan ChatGPT	4.38	1.01	Tinggi
Saya boleh menggunakan ChatGPT untuk mendapatkan maklumat pembelajaran	4.42	0.96	Tinggi
Saya mempunyai pengetahuan tentang kepelbagaian fungsi ChatGPT	4.18	1.02	Tinggi
Saya tahu ChatGPT merupakan kaedah baharu dalam memudahkan proses pembelajaran	4.34	0.96	Tinggi
Saya tahu menggunakan ChatGPT dalam mempelbagaikan aktiviti pembelajaran	4.24	0.96	Tinggi

Jadual 4 menunjukkan analisis bagi dapatan objektif kedua iaitu mengenal pasti tahap keberkesanan penggunaan ChatGPT sebagai alat pembelajaran yang efektif. Berdasarkan dapatan responden merasakan penggunaan ChatGPT berkesan dalam menyokong pembelajaran mereka. Nilai min melebihi 4.00 bagi kebanyakan item menunjukkan bahawa responden yakin akan keberkesanan aplikasi ini. Namun, item berkaitan ketepatan jawapan menunjukkan nilai min yang lebih rendah 3.70, yang mencerminkan keperluan untuk kebijaksanaan pengguna dalam menilai jawapan yang diberikan oleh ChatGPT. Fenomena ketidaktepatan turut disorot oleh Saad et al. (2024) yang menekankan kepentingan semakan silang sumber.

Jadual 4: Analisis tahap keberkesanan penggunaan ChatGPT sebagai alat pembelajaran yang efektif

Item	Min	Sisihan Piawai	Tahap
Penggunaan ChatGPT memudahkan menyiapkan tugas	4.13	0.98	Tinggi
ChatGPT memberikan jawapan yang tepat	3.70	1.02	Tinggi
ChatGPT membantu memahami isi kandungan pembelajaran dengan mudah	4.11	1.00	Tinggi
ChatGPT memahami soalan yang ditanya dengan jelas	4.04	0.99	Tinggi
Penggunaan ChatGPT membantu untuk belajar dengan lebih berkesan	4.17	0.96	Tinggi

Secara keseluruhan, dapatan kajian menunjukkan bahawa majoriti responden mempunyai tahap pengetahuan yang baik tentang penggunaan ChatGPT. Aplikasi ini dilihat berkesan dalam menyokong proses pembelajaran, khususnya dalam aspek penyediaan tugas dan pemahaman kandungan. Walau bagaimanapun, ketepatan maklumat yang diperoleh daripada ChatGPT perlu dinilai secara kritis bagi memastikan ketepatan dan kesesuaian dengan konteks pembelajaran.

5. PERBINCANGAN DAN KESIMPULAN

5.1. Perbincangan Dapatan Kajian

5.1.1. Tahap pengetahuan pelajar terhadap penggunaan ChatGPT

Dapatan menunjukkan bahawa tahap pengetahuan pelajar terhadap penggunaan ChatGPT adalah tinggi. Pelajar menunjukkan kefahaman yang jelas tentang kewujudan aplikasi ini serta berkemampuan untuk mengaplikasikannya dalam pembelajaran. Ini menunjukkan bahawa pendedahan kepada teknologi

terkini dalam kalangan pelajar adalah memberangsangkan dan mereka bersedia menerima teknologi baharu dalam proses pembelajaran.

5.1.2. Keberkesanan penggunaan ChatGPT sebagai alat pembelajaran

Keberkesanan penggunaan ChatGPT dalam pembelajaran turut menunjukkan hasil yang positif. Kebanyakan pelajar bersetuju bahawa ChatGPT membantu mereka memahami kandungan pembelajaran, menyelesaikan tugas, dan belajar dengan lebih berkesan. Walau bagaimanapun, terdapat sedikit keraguan terhadap ketepatan jawapan yang diberikan oleh aplikasi ini. Ini menandakan pentingnya literasi digital dan pemikiran kritis dalam kalangan pelajar untuk menilai maklumat yang diperolehi.

6. KESIMPULAN

Kajian ini secara keseluruhannya menunjukkan bahawa aplikasi ChatGPT mendapat sambutan positif daripada pelajar Jabatan Kejuruteraan Elektrik dan Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan. Pelajar mempunyai tahap pengetahuan yang tinggi terhadap ChatGPT dan menggunakannya secara aktif dalam pembelajaran. Dapatan juga menunjukkan bahawa pelajar menganggap ChatGPT sebagai alat yang berkesan dalam membantu mereka memahami kandungan, menyiapkan tugas dan meningkatkan kecekapan pembelajaran. Secara teori, pemerhatian ini menyokong Teori Penggunaan & Kepuasan (U&G) di mana pelajar menggunakan ChatGPT untuk memenuhi keperluan maklumat segera (Jalil, 2024).

Namun begitu, dapatan juga memperlihatkan kebergantungan pada media sosial sebagai sumber maklumat, menimbulkan kebimbangan tentang penyebaran maklumat yang tidak sahih dan beretika seperti dibangkitkan oleh UNESCO (2024). Oleh yang demikian, penggunaannya harus disertai dengan bimbingan yang sesuai agar pelajar tidak terlalu bergantung sepenuhnya kepada teknologi ini dan ketepatan maklumat yang diperolehi daripada ChatGPT perlu dinilai secara berhati-hati oleh pelajar agar tidak berlaku salah faham atau penggunaan maklumat yang tidak tepat. Hal ini penting bagi memastikan pembelajaran yang benar-benar berkualiti dan berasaskan maklumat sahih.

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Keusahawanan Dalam Kalangan Pelajar TVET: Suatu Tinjauan Kualitatif Terhadap Minat, Pendorong dan Kekangan

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ABSTRAK

Keusahawanan semakin diiktiraf sebagai pemangkin utama kepada pertumbuhan ekonomi negara, terutama dalam konteks pendidikan Teknikal dan Vokasional (TVET). Walaupun pelbagai inisiatif telah dilaksanakan bagi menyemai budaya keusahawanan, persoalan masih timbul mengenai tahap minat dan kecenderungan pelajar TVET terhadap bidang ini. Kajian ini bertujuan menilai persepsi dan minat pelajar terhadap bidang keusahawanan serta mengenal pasti faktor-faktor yang mempengaruhi kecenderungan mereka menceburi bidang tersebut. Kajian ini menggunakan pendekatan kajian kes secara kualitatif. Seramai 15 orang pelajar yang aktif dalam Kelab Keusahawanan di Politeknik Port Dickson dipilih sebagai responden. Data dikumpulkan melalui temu bual separa berstruktur secara berkumpulan dan dianalisis menggunakan kaedah analisis kandungan secara deduktif berdasarkan tema-tema yang telah ditetapkan. Tema utama merangkumi persepsi pelajar terhadap keusahawanan serta faktor pendorong dan penghalang dalam penglibatan mereka. Hasil kajian mendapati bahawa pelajar mempunyai persepsi yang positif terhadap keusahawanan, melihatnya sebagai peluang menjana pendapatan, membina kerjaya bebas, serta memberi impak sosial. Walau bagaimanapun, kekangan seperti kekurangan pendedahan praktikal, bimbingan yang terhad, serta kebimbangan terhadap risiko kewangan turut dikenal pasti. Faktor sokongan institusi, latar belakang keluarga, dan penyertaan dalam program keusahawanan turut mempengaruhi kecenderungan pelajar. Kajian mencadangkan agar institusi TVET menyediakan lebih banyak peluang pembelajaran berasaskan pengalaman dan memperkukuh bimbingan keusahawanan bersama usahawan berjaya. Usaha ini diyakini mampu meningkatkan keyakinan serta kesediaan pelajar untuk melibatkan diri dalam bidang keusahawanan secara aktif dan mampan.

Kata kunci: TVET, keusahawanan, persepsi pelajar, pendidikan politeknik

1. PENGENALAN

Bidang keusahawanan semakin mendapat perhatian sebagai salah satu jalan kerjaya yang penting dalam usaha memacu pertumbuhan ekonomi dan pembangunan sosial, terutamanya dalam konteks negara membangun. Di Malaysia, sektor pendidikan Teknikal dan Vokasional (TVET) dilihat sebagai platform utama untuk melahirkan tenaga kerja mahir dan berinovasi. Pelan Induk Pendidikan TVET 2021-2025 yang diperkenalkan oleh kerajaan Malaysia bertujuan untuk meningkatkan penyertaan pelajar dalam bidang yang bukan sahaja melengkapkan mereka dengan kemahiran teknikal, tetapi juga memupuk daya keusahawanan yang penting dalam menghadapi cabaran dunia pekerjaan yang semakin kompetitif (KPM, 2021).

Dalam konteks pelajar TVET pula, keusahawanan merupakan salah satu laluan kerjaya alternatif selain pekerjaan dalam sektor industri. Walau bagaimanapun, persoalan timbul mengenai persepsi dan minat pelajar TVET terhadap bidang keusahawanan. Banyak kajian terdahulu menunjukkan bahawa walaupun terdapat sokongan dari segi program keusahawanan, minat pelajar terhadap bidang ini masih rendah (Rahim et al., 2020). Kajian Norasmah Othman & Farhana Ishak (2019) mendapati bahawa minat pelajar terhadap keusahawanan dipengaruhi oleh pelbagai faktor termasuk latar belakang keluarga, persekitaran pembelajaran, dan pendedahan kepada bimbingan keusahawanan.

Selain itu, faktor-faktor yang mempengaruhi kecenderungan pelajar TVET untuk menceburi bidang keusahawanan adalah kompleks dan melibatkan aspek dalaman dan luaran. Kajian oleh Fayolle dan Gailly (2020) menekankan bahawa selain minat peribadi, sokongan institusi, seperti program keusahawanan di politeknik dan universiti, memainkan peranan penting dalam membentuk sikap positif terhadap keusahawanan. Sementara itu, kajian tempatan yang dijalankan oleh Mohamad et al. (2021) juga menegaskan bahawa faktor persekitaran seperti bimbingan oleh pensyarah, kemudahan yang disediakan oleh institusi, serta peluang pendedahan kepada industri turut menyumbang kepada peningkatan kecenderungan pelajar untuk menceburi bidang keusahawanan.

Walaupun banya kajian lepas yang mengkaji tentang minat, dorongan dan kecenderungan pelajar terhadap bidang keusahawanan, namun kajian-kajian tersebut masih kurang memberi fokus secara mendalam terhadap pengalaman pelajar TVET di institusi tertentu seperti Politeknik Port Dickson, khususnya dari perspektif kualitatif. Oleh itu, kajian ini dijalankan secara kualitatif untuk menilai persepsi dan minat pelajar TVET di Politeknik Port Dickson (PPD) terhadap keusahawanan. Kajian ini juga bertujuan mengenal pasti faktor-faktor yang mempengaruhi atau menghalang mereka daripada menceburi bidang ini.

2. SOROTAN KAJIAN

2.1. Keperluan Keusahawanan dalam Kalangan Pelajar TVET

Pendidikan Teknikal dan Latihan Vokasional (TVET) di Malaysia telah lama dikenal pasti sebagai salah satu komponen penting dalam pembangunan modal insan dan ekonomi negara. Pelajar yang dilatih melalui program TVET diberikan kemahiran teknikal dan praktikal yang bersesuaian dengan keperluan industri. Namun demikian, walaupun TVET telah berjaya melahirkan graduan yang berkemahiran tinggi dalam bidang teknikal, mereka masih menghadapi cabaran besar untuk menceburi bidang keusahawanan (Abdullah et al., 2021). Kajian menunjukkan bahawa kebanyakan graduan TVET lebih cenderung untuk mencari pekerjaan berbanding memulakan perniagaan sendiri, walaupun kerajaan dan pelbagai institusi menawarkan sokongan untuk menggalakkan keusahawanan (Kamaruddin & Omar, 2020).

Kajian juga mendapati minat graduan TVET dalam bidang keusahawanan masih di tahap yang rendah (Rahim et al., 2020). Ini menimbulkan persoalan mengenai sejauh mana program TVET dan sokongan keusahawanan dalam pendidikan mampu menarik minat pelajar untuk menjadi usahawan. Dalam usaha mencapai sasaran peningkatan penyertaan belia dalam keusahawanan, adalah penting untuk mengenal pasti faktor-faktor yang mendorong atau menghalang pelajar TVET daripada menceburi bidang ini (Mohamad et al., 2021). Keusahawanan kini diiktiraf sebagai satu aspek penting dalam pembangunan ekonomi, terutamanya dalam konteks negara membangun seperti Malaysia. Dalam era globalisasi dan revolusi industri 4.0, pelajar TVET perlu dilengkapi dengan kemahiran keusahawanan untuk bersaing dalam pasaran kerja yang semakin kompetitif (Khalid & Rahman, 2021). Keperluan untuk menggalakkan pelajar TVET menceburi bidang keusahawanan adalah penting bukan sahaja untuk meningkatkan kemahiran individu tetapi juga untuk menyumbang kepada pertumbuhan ekonomi negara.

2.2. Kecenderungan Pelajar TVET dalam Bidang Keusahawanan

Salah satu isu yang ketara dalam kalangan pelajar TVET adalah kekurangan minat terhadap keusahawanan walaupun terdapat pelbagai inisiatif dan program yang disediakan oleh kerajaan dan institusi pendidikan (Aziz & Zainal, 2019). Pelajar TVET sering melihat keusahawanan sebagai pilihan yang berisiko berbanding pekerjaan tetap, dan mereka lebih cenderung mencari pekerjaan selepas tamat pengajian. Menurut kajian oleh Norasmah Othman dan Farhana Ishak (2019), walaupun pelajar TVET memiliki kemahiran teknikal yang tinggi, mereka tidak mempunyai keyakinan atau pendedahan yang mencukupi mengenai keusahawanan. Kajian mendapati bahawa ramai pelajar TVET merasakan mereka tidak mempunyai kemahiran yang mencukupi untuk menjadi usahawan, walaupun mereka mempunyai kemahiran teknikal yang kuat (Yusof & Ibrahim, 2021). Persepsi ini adalah hasil daripada kurangnya latihan keusahawanan yang berstruktur dan kurangnya pengalaman dalam pengurusan

perniagaan, yang menghalang mereka daripada melihat diri mereka sebagai usahawan yang berpotensi. Menurut Aziz et al. (2022), faktor-faktor seperti kekurangan mentor, kurangnya akses kepada program bimbingan, dan kurangnya contoh teladan dalam kalangan usahawan berjaya juga turut menyumbang kepada masalah ini. Hal ini menimbulkan keperluan untuk memahami lebih lanjut faktor-faktor yang mempengaruhi minat dan persepsi mereka terhadap bidang ini.

2.3. Faktor-faktor yang Mempengaruhi Kecenderungan Pelajar TVET Menceburi Keusahawanan

Kajian terdahulu menunjukkan bahawa pelbagai faktor mempengaruhi kecenderungan pelajar untuk menjadi usahawan. Antaranya ialah sokongan keluarga, pengalaman keusahawanan dalam keluarga, dan pendedahan kepada aktiviti keusahawanan dalam kurikulum pendidikan (Fayolle & Gailly, 2020). Kajian oleh Ahmad et al. (2021) mendapati bahawa pelajar yang mempunyai latar belakang keluarga usahawan lebih cenderung untuk menunjukkan minat dalam bidang ini. Selain itu, persekitaran pendidikan yang menyediakan kursus dan latihan keusahawanan juga memainkan peranan penting dalam membentuk persepsi dan minat pelajar (Mohamad et al., 2021). Namun begitu, kekurangan modal, kurang keyakinan diri, dan ketidakstabilan ekonomi adalah antara cabaran utama yang sering dihadapi oleh pelajar TVET yang berminat untuk menjadi usahawan (Rahim et al., 2020). Menurut kajian oleh Nordin et al. (2021), pelajar TVET juga sering kali mempunyai persepsi bahawa keusahawanan adalah pilihan kerjaya yang tidak stabil dan berisiko tinggi, terutamanya dalam situasi ekonomi yang tidak menentu. Faktor ini menjadikan mereka lebih cenderung untuk memilih laluan kerjaya yang lebih selamat seperti bekerja di syarikat-syarikat besar atau kerajaan, berbanding menjalankan perniagaan sendiri.

2.4. Peranan Program Pendidikan dan Sokongan Institusi

Program keusahawanan yang ditawarkan di politeknik dan kolej TVET memainkan peranan penting dalam meningkatkan kesedaran dan minat pelajar terhadap bidang keusahawanan (Aziz & Zainal, 2019). Kajian oleh Yusof et al. (2021) menunjukkan bahawa sokongan daripada pensyarah dan program keusahawanan yang ditawarkan oleh institusi dapat memberikan pelajar motivasi tambahan untuk menceburi bidang keusahawanan. Namun, kajian lain mendapati bahawa program-program tersebut masih kurang efektif dalam memupuk keyakinan pelajar untuk menceburi bidang keusahawanan (Nor et al., 2020). Penyelidikan oleh Rahim et al. (2020) menunjukkan bahawa pelajar TVET memerlukan lebih banyak pendedahan kepada situasi keusahawanan sebenar, seperti projek berasaskan industri dan interaksi dengan usahawan berjaya, untuk meningkatkan keyakinan mereka terhadap prospek keusahawanan.

Pendidikan keusahawanan yang berkesan perlu merangkumi bukan sahaja teori tetapi juga pengalaman praktikal. Menurut kajian oleh Mustafa et al. (2021), institusi TVET yang menawarkan program keusahawanan yang berstruktur dan berterusan mampu meningkatkan minat pelajar dalam bidang ini. Pelajar TVET perlu didedahkan kepada pelbagai aspek keusahawanan seperti pengurusan perniagaan, pemasaran, kewangan, serta pembangunan produk. Hal ini dapat membantu mereka memahami realiti perniagaan dengan lebih mendalam dan seterusnya meningkatkan keyakinan mereka untuk memulakan perniagaan selepas tamat pengajian (Rahim et al., 2020). Pendidikan keusahawanan yang berjaya tidak hanya fokus kepada aspek teknikal perniagaan tetapi juga melatih pelajar dalam pembangunan kemahiran insaniah seperti kreativiti, inovasi, penyelesaian masalah, dan pengurusan risiko. Dalam kajian yang dijalankan oleh Ghani et al. (2021), pendidikan yang memupuk kemahiran ini dikaitkan dengan peningkatan kesediaan pelajar TVET untuk melibatkan diri dalam dunia keusahawanan yang mencabar.

3. METODOLOGI KAJIAN

Kajian ini dijalankan menggunakan pendekatan kualitatif dengan matlamat untuk memahami secara mendalam bagaimana pelajar Politeknik Port Dickson (PPD) melihat bidang keusahawanan, serta mengenal pasti faktor-faktor yang mempengaruhi kecenderungan mereka untuk menceburi bidang tersebut. Sebelum temu bual, persetujuan termaklum diperoleh secara lisan dan bertulis daripada

semua peserta. Penyelidik juga memberi jaminan bahawa identiti dan maklumat peserta akan dirahsiakan sepenuhnya dan hanya digunakan untuk tujuan akademik. Ini adalah untuk memberikan keyakinan kepada pelajar supaya memberi jawapan yang jujur dan tidak berat sebelah.

3.1. Reka Bentuk Kajian

Reka bentuk kajian ini berbentuk kajian kes, dengan memberi tumpuan kepada kumpulan pelajar di bawah kelab keusahawanan dari pelbagai program di Politeknik Port Dickson. Kajian ini menggunakan kaedah temubual separuh berstruktur, di mana penyelidik menyediakan senarai soalan berdasarkan dua tema utama kajian: iaitu persepsi pelajar terhadap keusahawanan dan faktor-faktor pendorong serta halangan dalam menceburi bidang ini. Reka bentuk ini membolehkan penyelidik menjalankan perbualan yang fleksibel tetapi masih berpandukan objektif kajian.

3.2. Sampel Kajian

Sampel kajian terdiri daripada 15 orang pelajar yang berdaftar di bawah Kelab Keusahawanan di Politeknik Port Dickson. Pemilihan dibuat secara persampelan bertujuan (*purposive sampling*) berdasarkan kriteria seperti pernah menyertai program keusahawanan atau menunjukkan minat terhadap bidang ini. Jumlah ini dianggap mencukupi kerana data yang diperoleh telah mencapai ketepuan (data saturation), selari dengan saranan Creswell (2019) bahawa kajian kualitatif mementingkan kedalaman maklumat berbanding bilangan responden.

3.3. Kaedah Pengumpulan Data

Data dikumpul melalui temu bual separa berstruktur. Kaedah ini membolehkan penyelidik untuk menanyakan soalan-soalan utama yang telah dirancang, namun masih memberi ruang kepada peserta untuk memberi jawapan yang mendalam dan berkongsi pengalaman mereka secara bebas. Data dikumpulkan melalui sesi temubual bersemuka yang dijalankan secara berkumpulan di mana terdapat 3 kumpulan iaitu seramai 5 orang setiap kumpulan. Temubual berlangsung selama kira-kira 20 hingga 30 minit setiap kumpulan. Sesi dijalankan dalam suasana santai dan tidak terlalu formal supaya responden lebih selesa berkongsi pandangan dan pengalaman mereka. Temu bual direkodkan dan transkrip disediakan untuk analisis lanjut.

3.4. Kaedah Analisis Data

Data yang diperoleh daripada temu bual dianalisis menggunakan kaedah analisis tematik seperti yang dicadangkan oleh Braun dan Clarke (2021). Bagi memastikan ketekalan dan kejelasan dalam proses analisis pula, pendekatan Miles dan Huberman (1994) turut digunakan. Setiap transkrip dibaca berulang kali dan dikodkan berdasarkan tema utama kajian. Kod-kod awal ini kemudian dikumpulkan dan dianalisis untuk mengenal pasti corak pemikiran yang berulang. Validasi dilakukan melalui semakan silang bersama rakan penyelidik bagi memastikan kebolehpercayaan. Tema seperti persepsi terhadap keusahawanan, minat dan cabaran dikaji dengan pendekatan deduktif, berpandukan objektif kajian.

4. ANALISIS DAPATAN DAN PERBINCANGAN KAJIAN

Kajian ini melibatkan seramai 15 orang pelajar dari Politeknik Port Dickson yang dipilih secara bertujuan berdasarkan keterlibatan mereka dalam aktiviti keusahawanan atau minat terhadap bidang tersebut. Daripada jumlah tersebut, 9 orang merupakan pelajar lelaki dari Jabatan Kejuruteraan Mekanikal manakala 6 orang lagi adalah pelajar Perempuan dari Jabatan Perdagangan dengan julat umur antara 19 hingga 20 tahun. Menariknya, sebahagian daripada mereka mempunyai pengalaman awal dalam dunia keusahawanan, seperti menjalankan perniagaan secara kecil-kecilan melalui platform dalam talian, menyertai program keusahawanan anjuran institusi, atau membantu perniagaan keluarga. Kepelbagaian latar belakang ini memberikan dimensi yang lebih luas dalam memahami persepsi dan kecenderungan pelajar TVET terhadap bidang keusahawanan.

4.1. Persepsi Pelajar Terhadap Bidang Keusahawanan

Jadual 1 menunjukkan maklumbalas pelajar berkenaan dengan persepsi terhadap bidang keusahawanan. Hasil temubual menunjukkan bahawa majoriti pelajar mempunyai pandangan yang positif dan terbuka terhadap konsep keusahawanan. Bagi mereka, keusahawanan bukan sekadar satu bentuk pekerjaan alternatif, malah dianggap sebagai jalan untuk membina kehidupan yang lebih bebas dan berdikari. Ramai yang mengaitkan keusahawanan dengan kebolehan menjana pendapatan sendiri tanpa perlu bergantung kepada majikan atau pekerjaan tetap.

Beberapa pelajar turut menyatakan bahawa mereka melihat bidang ini sebagai satu ruang untuk mengekspresikan kreativiti dan melahirkan idea baharu dalam bentuk produk atau perkhidmatan yang memberi nilai kepada masyarakat. Dalam erti kata lain, mereka tidak sekadar mahu 'menjual', tetapi mahu membina sesuatu yang berbeza dan bermakna. Selain itu, sebilangan pelajar menggambarkan keusahawanan sebagai satu kerjaya yang mencabar tetapi menyeronokkan. Mereka tertarik dengan elemen risiko dan cabaran yang hadir bersama keusahawanan kerana ia memberikan kepuasan peribadi apabila sesuatu perniagaan itu berjaya dibangunkan dari peringkat permulaan.

Terdapat juga pelajar yang menyifatkan keusahawanan sebagai salah satu cara untuk mencapai kestabilan kewangan dan meningkatkan taraf ekonomi keluarga. Dalam konteks ini, mereka melihat keusahawanan bukan hanya memberi manfaat kepada diri sendiri, tetapi juga berpotensi memberi kesan kepada pembangunan masyarakat dan negara. Secara keseluruhannya, persepsi pelajar terhadap keusahawanan boleh disimpulkan sebagai matang dan menyeluruh. Mereka tidak lagi melihat keusahawanan sebagai satu pilihan kerjaya yang 'terpaksa' atau 'akhir', sebaliknya sebagai satu jalan hidup yang memerlukan komitmen, usaha dan semangat untuk terus belajar serta berinovasi.

Jadual 1: Maklumbalas pelajar berkenaan dengan persepsi terhadap bidang keusahawanan

Subtema	Dapatan	Petikan Responden
Menjana pendapatan & berdikari	Pelajar melihat keusahawanan sebagai satu kaedah untuk menjana pendapatan sendiri dan menjadi lebih berdikari.	"Saya boleh cari duit sendiri dan tak perlu kerja bawah orang." R15 "Pada saya bisnes buka peluang buat duit sendiri, jadi bos sendiri." R10 "Boleh jana pendapatan sendiri, tak bergantung pada orang lain." R4
Kreativiti & inovasi	Pelajar menganggap keusahawanan sebagai ruang untuk berinovasi dan melahirkan idea-idea baharu.	"Buat bisnes dengan idea fresh dan ada something extra." R2 "Jalankan bisnes cara sendiri, tambah sikit kelainan." R7 "Berniaga tapi bagi nampak lain dari yang lain, baru power." R15
Kerjaya mencabar tetapi menarik	Kerjaya keusahawanan dianggap mencabar namun memberi peluang yang menarik serta mencabar diri.	"Kerjaya yang memang mencabar, tapi seronok juga." R6 "Kerjaya yang tough, tapi penuh dengan kepuasan." R9 "Kerjaya yang agak mencabar tetapi saya yakin ia seronok sebab boleh buat banyak duit" R3

4.2. Faktor Pendorong dan Halangan

Jadual 2 menunjukkan maklumbalas pelajar berkenaan dengan faktor-faktor yang mendorong pelajar menceburi bidang keusahawanan dan cabaran atau halangan yang ditempuhi. Dapatan kajian mendapati antara pendorong utama yang dikenal pasti ialah minat untuk berdikari, keinginan menjana pendapatan sendiri, serta pengaruh positif daripada keluarga dan rakan yang terlibat dalam bidang perniagaan. Pelajar yang mempunyai latar belakang keluarga berniaga lebih yakin dan cenderung melihat keusahawanan sebagai sesuatu yang realistik dan berdaya saing. Walau bagaimanapun, terdapat beberapa halangan utama yang mengekang potensi keusahawanan dalam kalangan pelajar. Antara yang paling dominan ialah ketakutan terhadap kegagalan, kurangnya keyakinan diri, dan kurangnya latihan

praktikal atau mentor untuk membimbing mereka secara langsung. Pelajar juga menyuarakan kebimbangan bahawa mereka kurang pengetahuan dalam aspek teknikal pengurusan perniagaan seperti pemasaran, pengurusan modal dan risiko, serta dokumentasi perniagaan. Kekangan ini menimbulkan keraguan terhadap keupayaan diri untuk mengendalikan perniagaan dengan berkesan.

Jadual 2: Maklumbalas pelajar berkenaan faktor pendorong dan halangan dalam menceburi bidang keusahawanan

Subtema	Dapatan	Petikan Responden
Minat dan sokongan keluarga	Faktor dalaman seperti minat serta sokongan dari keluarga memainkan peranan penting.	"Keluarga saya memang ada bisnes yang dijalankan sendiri." R3 "Kawan-kawan saya ramai yang berniaga, keluarga saya pun ada bisnes sendiri." R10 "Minat memang minat sebab keluarga saya ramai yang berniaga." R4
Takut gagal dan kekurangan latihan	Halangan yang ketara termasuk rasa takut gagal dan kurangnya latihan praktikal.	"Risau juga kalau bisnes tak menjadi." R9 "Ada la rasa takut perniagaan ni tak dapat pergi jauh." R3 "Perasaan takut sangat kalau gagal tu ada, risau nanti malu semua orang tahu." R6 "Risau tak untung sebab modal dah keluar..nanti sia-sia pula" R4
Sukar dapat mentor	Ketiadaan mentor atau orang yang boleh membimbing menjadi salah satu kekangan utama.	"Susah nak cari mentor yang boleh bimbing." R3 "Saya tiada mentor. Susah la nak cari" R8 "Mentor yang nak bagi bimbingan susah nak jumpa." R12 "Nak cari mentor yang betul-betul boleh bimbing, memang susah." R14

5. KESIMPULAN

Secara keseluruhannya, dapatan kajian ini menunjukkan bahawa majoriti pelajar mempunyai tanggapan yang positif terhadap keusahawanan dan melihatnya bukan sekadar sebagai alternatif kepada kerjaya tetap, tetapi sebagai laluan untuk membina masa depan yang lebih berdikari, kreatif, dan bermakna. Walau bagaimanapun, terdapat jurang yang ketara antara minat dan kesediaan sebenar pelajar untuk menceburi bidang ini. Kebimbangan terhadap risiko kewangan, kurangnya keyakinan diri, kekangan pendedahan praktikal serta ketiadaan bimbingan daripada mentor merupakan antara faktor utama yang membantutkan potensi keusahawanan mereka. Dalam masa yang sama, faktor sokongan keluarga, penyertaan dalam program kelab keusahawanan serta latar belakang persekitaran pembelajaran turut memainkan peranan penting dalam membentuk kecenderungan pelajar.

Oleh itu, kajian ini menggariskan keperluan mendesak untuk merapatkan jurang antara teori dan amalan dalam pendidikan keusahawanan di institusi TVET. Justeru, dicadangkan agar institusi menyediakan lebih banyak platform pembelajaran berasaskan pengalaman seperti projek perniagaan sebenar, program inkubator pelajar, serta sistem bimbingan berstruktur yang melibatkan pensyarah dan usahawan alumni. Pendekatan ini bukan sahaja dapat memperkukuh kemahiran keusahawanan, malah dapat meningkatkan keyakinan dan kesediaan pelajar untuk menjadi agen perubahan dalam pembangunan ekonomi negara.

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Etika Penggunaan ChatGPT dalam Penyediaan Tugas Kursus Pengajian Islam: Kajian di Politeknik METrO Johor Bahru

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ABSTRAK

Perkembangan pesat teknologi kecerdasan buatan (*Artificial Intelligence, AI*) seperti ChatGPT telah mengubah secara signifikan cara pelajar mengakses maklumat serta menyelesaikan tugas akademik. Walaupun teknologi ini memberikan kemudahan dalam penyediaan tugas, ia turut menimbulkan cabaran serius berkaitan etika dan integriti akademik, khususnya apabila pelajar berisiko bergantung sepenuhnya kepada alat tersebut tanpa menggunakan pemikiran sendiri. Kajian ini bertujuan untuk mengenal pasti tahap kefahaman, kesedaran, dan kesediaan pelajar Politeknik METrO Johor Bahru (PMJB) terhadap etika penggunaan ChatGPT dalam konteks penyediaan tugas kursus Pengajian Islam. Kaedah penyelidikan kuantitatif digunakan dengan pengedaran soal selidik kepada 73 orang pelajar yang mengikuti kursus tersebut. Data yang diperoleh dianalisis menggunakan perisian IBM SPSS versi 29 secara statistik deskriptif dan inferensi melalui ujian korelasi Pearson. Dapatan kajian menunjukkan bahawa tahap kefahaman ($\text{min}=4.15$), kesedaran ($\text{min}=4.17$), dan kesediaan ($\text{min}=4.34$) pelajar terhadap penggunaan ChatGPT berada pada tahap tinggi. Ujian korelasi mendapati terdapat hubungan yang signifikan antara kefahaman dengan kesedaran ($r = 0.456, p = 0.000$), kefahaman dengan kesediaan ($r = 0.418, p = 0.000$), serta kesedaran dengan kesediaan ($r = 0.308, p = 0.008$). Ini menunjukkan bahawa ketiga-tiga aspek (kefahaman, kesedaran dan kesediaan) saling mempengaruhi antara satu sama lain. Berdasarkan tahap kefahaman, kesedaran, dan kesediaan pelajar yang tinggi terhadap penggunaan ChatGPT, kajian ini mencadangkan pensyarah menggalakkan penggunaan teknologi ini secara bertanggungjawab sebagai alat bantu sahaja. Penekanan perlu diberikan kepada aspek etika supaya pelajar terus mengasah kemahiran berfikir kritis dan menghasilkan karya asli, seterusnya mengekalkan integriti akademik. Kajian lanjutan yang dicadangkan adalah faktor yang mempengaruhi etika penggunaan ChatGPT dalam penyediaan tugas akademik pelajar.

Kata kunci: Etika akademik, ChatGPT, Pengajian Islam, kefahaman, kesedaran, kesediaan

1. PENGENALAN

Perkembangan teknologi kecerdasan buatan (*Artificial Intelligence, AI*) telah membuka pelbagai peluang dalam bidang pendidikan, terutamanya dalam membantu pelajar menyiapkan tugas dan memahami konsep pembelajaran dengan lebih mudah dan efisien (Rahman et al., 2022). Salah satu teknologi AI yang semakin popular ialah ChatGPT, yang mampu menjana teks secara automatik berdasarkan *input* pengguna (Ismail & Harun, 2023). Dalam konteks pendidikan di Institusi Pengajian Tinggi (IPT), penggunaan ChatGPT dalam penyediaan tugas semakin meluas dan memberi kesan kepada proses pembelajaran (Zainuddin, 2023).

Namun begitu, kemudahan ini turut membawa cabaran dari segi etika dan integriti akademik. Kajian oleh Abdullah dan Kamal (2021) menegaskan bahawa penggunaan teknologi tanpa kawalan dan kesedaran etika boleh mengundang pelanggaran seperti plagiarisme, penghasilan tugas yang tidak asli serta penyalahgunaan sumber digital. Dalam konteks Pengajian Islam, yang menekankan nilai kejujuran dan tanggungjawab, isu etika ini menjadi lebih kritikal (Halim & Aziz, 2020). Pelajar perlu memahami batasan dan amalan beretika ketika menggunakan alat seperti ChatGPT agar tidak menjejaskan integriti akademik mereka (Nor & Ahmad, 2022).

Kajian lepas jelas menunjukkan penekanan diberikan kepada kepentingan integriti akademik dalam kalangan pelajar politeknik dan universiti, termasuk cabaran yang dihadapi dalam era digital (Mohd Saad et al., 2021; Salleh & Mansor, 2022). Walaupun begitu, kajian khusus mengenai etika penggunaan ChatGPT dalam konteks Pengajian Islam di politeknik masih terhad dan kurang mendapat perhatian (Rahim et al., 2023). Justeru, kajian ini dijalankan bertujuan untuk mengenal pasti tahap kefahaman, kesedaran dan kesediaan pelajar Politeknik METrO Johor Bahru terhadap etika penggunaan ChatGPT dalam penyediaan tugas kursus Pengajian Islam.

1.1. Objektif Kajian

- i. Menenal pasti tahap kefahaman pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- ii. Menenal pasti tahap kesedaran pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- iii. Menenal pasti tahap kesediaan pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- iv. Menenal pasti sama ada terdapat hubungan yang signifikan antara kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT.

1.2. Persoalan Kajian

- i. Apakah tahap kefahaman pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- ii. Apakah tahap kesedaran pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- iii. Apakah tahap kesediaan pelajar terhadap etika dan integriti akademik penggunaan ChatGPT.
- iv. Adakah terdapat hubungan yang signifikan antara aspek kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT.

1.3. Hipotesis Kajian

- i. Ho1 Tidak terdapat hubungan yang signifikan antara aspek kefahaman dan kesedaran pelajar terhadap etika penggunaan ChatGPT.
- ii. Ho2 Tidak terdapat hubungan yang signifikan antara aspek kefahaman dan kesediaan pelajar terhadap etika penggunaan ChatGPT.
- iii. Ho3 Tidak terdapat hubungan yang signifikan antara aspek kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT.

2. SOROTAN KAJIAN

2.1. Etika dan Integriti Akademik

Kajian lepas jelas menegaskan kepentingan integriti akademik dalam kalangan pelajar sebagai asas utama dalam memastikan kredibiliti dan kualiti pendidikan tinggi (Abdullah & Kamal, 2021; Mohd Saad et al., 2021). Integriti akademik melibatkan kejujuran, tanggungjawab, dan kepatuhan kepada prinsip etika dalam melaksanakan tugas akademik (Salleh & Mansor, 2022). Dalam era digital, cabaran seperti plagiarisme dan penyalahgunaan teknologi semakin meningkat, menjadikan kesedaran tentang integriti akademik lebih kritikal (Rahman et al., 2022).

2.2. Etika Penggunaan ChatGPT dalam Penyediaan Tugas Akademik

Teknologi kecerdasan buatan (AI) seperti ChatGPT telah merevolusikan cara pelajar mendapatkan maklumat dan menyiapkan tugas (Ismail & Harun, 2023). Walaupun teknologi ini memudahkan proses pembelajaran, ia juga berpotensi membawa risiko pelanggaran etika jika digunakan tanpa kawalan yang betul (Rahim et al., 2023). Kajian menunjukkan bahawa penggunaan AI yang tidak beretika boleh menyebabkan ketidakjujuran akademik seperti plagiarisme dan pemalsuan karya ilmiah (Nor & Ahmad, 2022).

Dalam konteks Pendidikan Islam, nilai kejujuran dan integriti adalah teras utama dalam pembelajaran (Halim & Aziz, 2020). Oleh itu, penggunaan ChatGPT perlu dibuat dengan penuh tanggungjawab dan kesedaran terhadap etika supaya tidak melanggar prinsip-prinsip Islam dan norma akademik (Nor & Ahmad, 2022). Penemuan kajian Ismail & Sulaiman (2023) menunjukkan penggunaan ChatGPT tanpa panduan menyebabkan salah tafsir kandungan. Kajian etika penggunaan ChatGPT, terutamanya dalam konteks kursus Pengajian Islam masih lagi terhad, sekaligus menuntut kajian lanjutan yang lebih menyeluruh (Rahim et al., 2023).

2.3. Kesedaran, Kefahaman dan Kesediaan Pelajar Terhadap Penggunaan ChatGPT

Kefahaman pelajar terhadap etika penggunaan teknologi seperti ChatGPT adalah penting bagi memastikan penggunaan dilaksanakan dengan bertanggungjawab dan mematuhi prinsip integriti akademik (Nor & Ahmad, 2022; Ismail & Harun, 2023). Walaupun sebahagian pelajar menunjukkan kefahaman yang baik, terdapat juga yang kurang jelas mengenai batasan penggunaan AI, yang boleh menjejaskan kejujuran akademik. Kesedaran pelajar mengenai implikasi pelanggaran etika turut memainkan peranan penting dalam memupuk sikap bertanggungjawab (Abdullah & Kamal, 2021). Namun, kajian menunjukkan bahawa tahap kesedaran ini masih perlu dipertingkatkan, khususnya dalam kalangan pelajar politeknik (Rahim et al., 2023). Kesediaan pelajar pula dipengaruhi oleh pendedahan dan sokongan institusi; pelajar yang mendapat bimbingan lebih bersedia mengamalkan etika dalam penggunaan ChatGPT (Salleh & Mansor, 2022; Mohd Saad et al., 2021). Kajian lepas juga mendapati hubungan positif antara kefahaman, kesedaran, dan kesediaan pelajar-pelajar yang memahami dan menyedari kepentingan etika, cenderung lebih bersedia untuk mematuhi prinsip integriti akademik (Nor & Ahmad, 2022). Oleh itu, pendidikan dan latihan berterusan mengenai etika digital adalah penting bagi memperkukuh ketiga-tiga aspek ini dalam kalangan pelajar.

3. METODOLOGI KAJIAN

3.1. Populasi dan Sampel

Populasi kajian terdiri daripada 120 orang pelajar yang mengikuti kursus Pengajian Islam di PMJB. Sampel kajian melibatkan 73 orang pelajar yang dipilih secara rawak (Krejcie & Morgan, 1970). Pemilihan sampel secara rawak ini bertujuan untuk memastikan sampel mewakili populasi dengan tepat.

3.2. Instrumen Kajian

Soal selidik digunakan sebagai instrumen kajian untuk menilai tahap kefahaman, kesedaran, serta kesediaan pelajar dalam menerapkan etika penggunaan ChatGPT ketika menyediakan tugas Pengajian Islam. Terdapat empat (4) bahagian di dalam soal selidik. Bahagian A merujuk kepada item demografi responden iaitu jantina dan program. Bahagian B, C dan D pula merujuk kepada item (B) kefahaman pelajar terhadap etika penggunaan ChatGPT, item (C) kesedaran pelajar terhadap etika penggunaan ChatGPT manakala item (D) kesediaan pelajar terhadap etika penggunaan ChatGPT. Setiap Bahagian B, C dan D mengandungi 5 item soalan seperti Jadual 1. Setiap bahagian instrumen soal selidik terdiri daripada lima (5) item yang diukur menggunakan skala Likert lima mata. Instrumen ini telah disemak oleh pakar bidang untuk memastikan kesahihan dan kebolehpercayaan data yang diperoleh.

Jadual 1: Soalan soal selidik bahagian B sehingga bahagian D

Bahagian		Soalan
B	Kefahaman terhadap etika penggunaan ChatGPT	B1 Saya sedar menggunakan ChatGPT tanpa rujukan adalah tidak beretika
		B2 Saya sedar menggunakan ChatGPT sepenuhnya boleh merosakkan integriti tugas
		B3 Saya sedar tugas harus mengandungi usaha sendiri walaupun menggunakan ChatGPT
		B4 Saya perlu mengaku penggunaan ChatGPT dalam tugas saya
		B5 Saya sedar penyalahgunaan ChatGPT boleh menjejaskan pembelajaran saya

Bahagian		Soalan
C	Kesedaran terhadap etika penggunaan ChatGPT	C1 Saya faham prinsip etika penggunaan ChatGPT dalam tugas
		C2 Saya faham garis panduan penggunaan ChatGPT dalam tugas
		C3 Saya faham penggunaan ChatGPT secara tidak beretika melanggar integriti akademik
		C4 Saya faham pentingnya pengiktirafan sumber apabila menggunakan ChatGPT
		C5 Saya faham keperluan menggunakan ChatGPT secara bertanggungjawab
D	Kesediaan terhadap etika penggunaan ChatGPT	D1 Saya bersedia menggunakan ChatGPT secara beretika dalam menyiapkan tugas Pengajian Islam
		D2 Saya bersedia mengaku jika menggunakan ChatGPT dalam tugas saya
		D3 Saya bersedia mematuhi garis panduan etika ketika menggunakan ChatGPT
		D4 Saya bersedia belajar dan memahami etika penggunaan ChatGPT dalam tugas
		D5 Saya bersedia menerima akibat jika melanggar etika penggunaan ChatGPT

3.3. Pengumpulan Data dan Penganalisan Data

Kaedah pengumpulan data menggunakan soal selidik. Data kuantitatif dikumpul melalui soal selidik dalam talian menggunakan *google form* yang diedarkan kepada 73 orang pelajar yang mengambil kursus Pengajian Islam di PMJB. Data kuantitatif dalam kajian ini telah dianalisis dengan menggunakan perisian IBM SPSS Versi 29 dengan kaedah statistik deskriptif. Manakala statistik inferensi ditentukan dengan menggunakan analisis korelasi Pearson koefisien. Jadual 2 menunjukkan interpretasi skor min yang digunakan dalam kajian ini berpandukan kepada Rowntree (1981).

Jadual 2: Interpretasi skor min

Skor Min	Tahap
1.00 hingga 2.33	Rendah
2.34 hingga 3.66	Sederhana
3.67 hingga 5.00	Tinggi

4. DAPATAN KAJIAN

Taburan responden kajian terdiri daripada pelajar yang mengambil kursus Pengajian Islam seperti Jadual 3. Dapatan kajian menunjukkan seramai 62 orang responden (84.9%) merupakan pelajar lelaki, manakala 11 orang (15.07%) adalah pelajar perempuan. Majoriti responden, iaitu seramai 52 orang (71.2%), terdiri daripada pelajar program DLS, manakala selebihnya, iaitu 21 orang (28.8%) merupakan pelajar program DEN. Kepelbagaian dari segi program pengajian dan jantina ini membolehkan data kajian diperolehi secara lebih menyeluruh dan mewakili populasi pelajar yang mengambil kursus Pengajian Islam di PMJB.

Jadual 3: Latar belakang responden

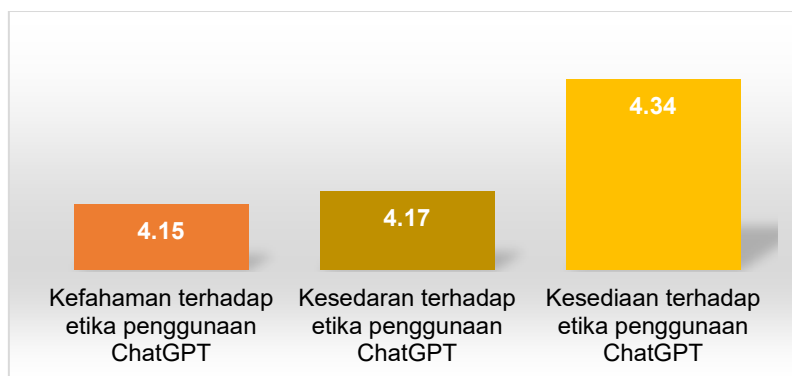
Program pengajian	Lelaki	Perempuan	Jumlah
Diploma Keusahawanan (DEN)	20	1	21
Diploma Pengurusan Logistik dan Rantaian Bekalan (DLS)	42	10	52
Jumlah	62	11	73

Jadual 3 menunjukkan dapatan min dan sisihan piawai bagi tiga faktor utama dalam kajian ini. Faktor kesediaan terhadap etika penggunaan ChatGPT mencatatkan min tertinggi ($M=4.34$, $SP=.554$). Ini diikuti oleh faktor kesedaran ($M=4.17$, $SP=.611$). Sementara itu, faktor kefahaman terhadap etika penggunaan ChatGPT mencatatkan ($M=4.15$, $SP=.643$) seperti jadual 4 di bawah. Dapatan ini menunjukkan bahawa skor min untuk faktor kefahaman, kesedaran dan kesediaan terhadap etika penggunaan ChatGPT dalam kalangan pelajar yang mengambil kursus Pengajian Islam di PMJB adalah tinggi ($M=4.22$, $SP=.602$).

Jadual 4: Dapatan min dan sisihan piawai kajian

Faktor-faktor	Min	Sisihan piawai	Tahap
Kefahaman terhadap etika penggunaan ChatGPT	4.15	.643	Tinggi
Kesedaran terhadap etika penggunaan ChatGPT	4.17	.611	Tinggi
Kesediaan terhadap etika penggunaan ChatGPT	4.34	.554	Tinggi
Keseluruhan	4.22	.602	Tinggi

Rajah 1 menunjukkan perbandingan min skor bagi kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT. Ketiga-tiga nilai berada pada tahap tinggi, menunjukkan bahawa pelajar bukan sahaja memahami dan sedar, malah bersedia untuk mengaplikasikan etika dalam penggunaan ChatGPT. Dapatan ini menggambarkan sikap positif pelajar terhadap penggunaan teknologi secara beretika dalam penyediaan tugas Pengajian Islam.



Rajah 1: Min skor bagi kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT

Dalam kajian ini, hubungan antara kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT dianalisis menggunakan analisis korelasi Pearson dengan kaedah dua hujung (two-tailed). Analisis ini bertujuan menilai kekuatan serta arah hubungan antara konstruk yang dikaji. Tahap signifikan yang ditetapkan bagi menentukan penerimaan atau penolakan hipotesis nol ialah pada aras 0.01. Sekiranya nilai signifikan (p-value) adalah kurang daripada 0.01, maka hubungan tersebut dianggap signifikan dari segi statistik.

Jadual 5: Dapatan analisis korelasi antara kefahaman, kesedaran dan kesediaan pelajar terhadap etika penggunaan ChatGPT

Pemboleh ubah	Nilai korelasi Pearson (r)	Nilai signifikan (p)	Interpretasi hubungan
Kefahaman dan kesedaran	0.456	0.000	Sederhana, signifikan
Kefahaman dan kesediaan	0.418	0.000	Sederhana, signifikan
Kesedaran dan kesediaan	0.308	0.008	Lemah, signifikan

Jadual 5 menunjukkan terdapat hubungan yang signifikan antara kefahaman dengan kesedaran, kefahaman dengan kesediaan, serta kesedaran dengan kesediaan pelajar. Dapatan analisis menunjukkan hubungan yang signifikan antara kefahaman dan kesedaran pelajar ($r = 0.456$, $p = 0.000$) dan hipotesis nol H_{01} ditolak. Ini menunjukkan bahawa pelajar yang memahami etika penggunaan ChatGPT turut memiliki tahap kesedaran yang lebih tinggi terhadap tanggungjawab dan implikasi etika dalam penggunaannya. Dapatan ini menekankan bahawa aspek kefahaman memainkan peranan penting dalam membentuk kesedaran etika pelajar.

Dapatan kajian juga menunjukkan hubungan antara kefahaman dengan kesediaan pelajar adalah signifikan ($r = 0.418$ dan nilai $p = 0.000$) dan nol H_{02} ditolak. Ini menunjukkan bahawa semakin tinggi tahap kefahaman pelajar terhadap etika penggunaan ChatGPT, semakin tinggi juga kesediaan mereka untuk mengamalkan teknologi tersebut secara beretika. Dapatan ini menandakan bahawa pemahaman yang mendalam terhadap prinsip etika dapat mendorong pelajar untuk lebih bersedia mematuhi garis panduan penggunaan ChatGPT dalam tugas akademik.

Sementara itu, hubungan antara kesedaran dan kesediaan pelajar berada pada tahap lemah tetapi masih signifikan ($r = 0.308$ dan $p = 0.008$) dan nol H_0 3 ditolak. Walaupun kekuatan hubungan ini lebih rendah berbanding pasangan sebelumnya, ia menunjukkan bahawa pelajar yang lebih sedar tentang etika penggunaan ChatGPT cenderung lebih bersedia mematuhi prinsip etika tersebut. Dapatan ini menegaskan bahawa kesedaran terhadap tanggungjawab moral dan akademik memainkan peranan penting dalam meningkatkan kesediaan pelajar untuk beretika dalam penggunaan teknologi kecerdasan buatan.

5. PERBINCANGAN

5.1. Tahap Kefahaman Pelajar Terhadap Etika Penggunaan ChatGPT

Dapatan menunjukkan tahap kefahaman pelajar terhadap etika penggunaan ChatGPT berada pada tahap tinggi ($M=4.15$). Hal ini menunjukkan bahawa pelajar mempunyai asas pengetahuan yang kukuh berkaitan penggunaan teknologi secara beretika, khususnya dalam konteks pendidikan Islam. Penemuan ini disokong oleh kajian Mohd Fadzil dan Azizah (2019) yang mendapati bahawa tahap kefahaman pelajar terhadap prinsip etika digital sangat mempengaruhi kemampuan mereka menilai sesuatu tindakan sebagai betul atau salah dalam persekitaran digital. Kefahaman ini juga berkait rapat dengan pendekatan pengajaran yang menekankan literasi digital dalam kalangan pelajar, sebagaimana dibincangkan oleh Hashim et al. (2021) yang menyatakan bahawa penguasaan kefahaman etika digital membantu pelajar membuat keputusan yang lebih bertanggungjawab apabila berinteraksi dengan teknologi pintar.

5.2. Tahap Kesedaran Pelajar Terhadap Etika Penggunaan ChatGPT

Tahap kesedaran pelajar juga didapati tinggi ($M=4.17$), menunjukkan bahawa mereka peka terhadap implikasi moral dan akademik sekiranya ChatGPT disalahgunakan. Kajian oleh Norlina et al. (2021) menyatakan bahawa kesedaran terhadap etika digital menjadi kunci utama dalam mengekang salah laku akademik seperti plagiarisme, penyalahgunaan AI, dan pencabulan hak cipta. Tambahan lagi, kajian Razak dan Halim (2020) menekankan bahawa kesedaran etika yang tinggi membentuk kawalan sendiri dalam kalangan pelajar apabila berhadapan dengan godaan teknologi yang mudah diakses. Kesedaran ini turut dilihat sebagai hasil daripada pendedahan pelajar terhadap nilai-nilai agama dan pendidikan moral dalam silibus Pengajian Islam. Ini menunjukkan bahawa pemupukan nilai etika secara konsisten semasa proses pengajaran dan pembelajaran (PdP) mempunyai kesan terhadap pembentukan sikap pelajar terhadap teknologi.

5.3. Tahap Kesediaan Pelajar Terhadap Etika Penggunaan ChatGPT

Tahap kesediaan pelajar untuk mengaplikasikan etika dalam penggunaan ChatGPT berada pada tahap tinggi ($M=4.34$). Ini membuktikan pelajar bukan sahaja memahami dan sedar, malah benar-benar bersedia untuk bertindak secara beretika apabila menggunakan alat ini dalam tugas. Kajian oleh Nor Azimah (2020) menyokong dapatan ini, mendapati bahawa pelajar yang mempunyai asas nilai yang kukuh lebih cenderung mematuhi garis panduan akademik, meskipun tiada pemantauan langsung daripada pensyarah. Tambahan itu, pengaruh rakan sebaya dan norma akademik juga memberi kesan kepada kesediaan pelajar, seperti yang dinyatakan dalam kajian Latiff et al. (2022), di mana pelajar lebih cenderung berkelakuan etika apabila berada dalam persekitaran yang menyokong amalan tersebut.

5.4. Hubungan antara Kefahaman, Kesedaran dan Kesediaan

Hubungan yang signifikan ini membuktikan bahawa kefahaman mendalam terhadap prinsip etika digital mendorong kepada kesedaran yang tinggi dan seterusnya membentuk kesediaan untuk bertindak secara beretika. Ini selaras dengan dapatan Rahman et al. (2022) yang menyatakan bahawa pemahaman terhadap nilai etika merupakan asas kepada pembentukan sikap dan perlakuan pelajar terhadap teknologi. Walaupun hubungan antara kesedaran dan kesediaan berada pada tahap lemah, ia masih signifikan. Kemungkinan ini berlaku disebabkan oleh faktor luaran seperti tekanan akademik, pengaruh media sosial, atau kurangnya bimbingan berterusan, seperti yang dibincangkan oleh Hassan et al.

(2021). Oleh itu, penting untuk institusi pendidikan menyediakan sistem sokongan yang menyeluruh, termasuk pemantauan, modul pendidikan, dan latihan etika yang bersifat berterusan.

6. RUMUSAN

Kajian ini menunjukkan bahawa pelajar kursus Pengajian Islam di PMJB mempunyai tahap kefahaman, kesedaran, dan kesediaan yang tinggi terhadap etika penggunaan ChatGPT. Hubungan signifikan antara ketiga-tiga faktor ini membuktikan bahawa kefahaman etika digital memainkan peranan penting dalam membentuk kesedaran moral dan kesediaan pelajar untuk menggunakan teknologi secara bertanggungjawab. Dapatan ini menggariskan keperluan untuk mengintegrasikan pendidikan etika digital dalam kurikulum, bagi melahirkan pelajar yang bukan sahaja celik teknologi, tetapi juga berintegriti dalam penggunaannya. Institusi pendidikan perlu menyediakan modul khusus dan latihan berterusan bagi memupuk nilai etika dalam kalangan pelajar. Selain itu, pendekatan pedagogi perlu memberi tumpuan kepada pemahaman prinsip etika, agar pelajar dapat menginternalisasikan nilai tersebut dan mengelakkan penyalahgunaan teknologi. Secara keseluruhan, pelaksanaan pendidikan etika digital yang sistematik adalah penting dalam melahirkan graduan yang cemerlang dan beretika selaras dengan perkembangan teknologi masa kini.

7. IMPLIKASI DAN CADANGAN

Dapatan ini memberi implikasi penting kepada pihak pentadbiran dan pendidik di institusi pengajian tinggi, terutamanya dalam merangka dasar penggunaan teknologi AI secara bertanggungjawab. Kajian ini mencadangkan:

- i. Pengintegrasian modul etika digital ke dalam kurikulum secara menyeluruh, merentas semua kursus, bukan hanya dalam subjek khusus.
- ii. Latihan berkala kepada pensyarah mengenai pendekatan menilai pelajar berdasarkan proses pemikiran, bukannya semata-mata hasil akhir tugas.
- iii. Penerapan nilai agama dan moral dalam konteks digital, agar pelajar bukan sahaja memahami etika tetapi menjadikannya sebagai budaya dalam pembelajaran.

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Penggunaan Twitter Sebagai Medium Digital untuk Penyebaran Budaya Puisi dalam Kalangan Masyarakat Malaysia: Suatu Kajian Kualitatif Tindakan Refleksi Kendiri

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ABSTRAK

Kajian ini merupakan kajian kualitatif yang bertujuan untuk meneliti penggunaan platform *Twitter* sebagai medium digital dalam penyebaran budaya puisi dalam kalangan masyarakat Malaysia. Pada tahun 2023, platform *Twitter* telah menjalani penjenamaan semula yang dikenali sebagai *X*. Dalam konteks penulisan ini, istilah *X* digunakan oleh penyelidik. Reka bentuk kajian ini berbentuk tindakan reflektif sendiri, manakala kaedah pengumpulan data adalah melalui analisis dokumen terhadap pelbagai tweet puisi di *X* menggunakan pensampelan bertujuan. Beberapa tanda pagar seperti #puisi7kata dan #Puisidarurat digunakan sebagai indikator kepada gerakan puisi aktif yang berlaku di ruang media sosial tersebut. Kajian ini memberi tumpuan kepada tiga aspek utama, iaitu fungsi *X* sebagai ruang apresiasi sastra, kesannya terhadap budaya dan komuniti penikmat puisi, dan refleksi peribadi penyelidik sebagai penggiat sastra digital. Hasil dapatan menunjukkan bahawa kandungan puisi yang pendek, padat dan sarat dengan emosi berjaya menarik perhatian pengguna *X*, lalu membina interaksi sosial yang menyumbang kepada penyebaran puisi secara lebih meluas. Penulisan ini turut menyentuh aspek etika seperti keperluan memberikan kredit kepada pemilik asal karya dan penggunaan tangkapan layar yang bertanggungjawab. Refleksi penyelidik mendapati bahawa walaupun terdapat cabaran seperti capaian terhad atau kurangnya interaksi, pengalaman ini menyemai kesedaran akan tanggungjawab berkarya dan kepentingan memartabatkan bahasa Melayu dalam era digital. Kesimpulannya, *X* bukan sekadar medium penyebaran karya, malah menjadi wahana digital yang berpotensi memperkukuh budaya puisi. Kajian ini mencadangkan agar penyelidikan lanjutan menggunakan Model Kajian Tindakan seperti CRASP atau Kemmis & McTaggart dijalankan bagi menilai impak jangka panjang media sosial terhadap kelangsungan kesusasteraan Melayu dalam komuniti tempatan.

Kata kunci: Twitter, X, puisi digital, tindakan reflektif sendiri

1. PENDAHULUAN

Puisi merupakan ekspresi jiwa seseorang yang disampaikan melalui medium bahasa dalam satu ruang teks yang tersusun. Ia bukan sahaja menjadi saluran luahan perasaan, malah turut mencerminkan perkembangan jiwa dan pemikiran penulisnya. Justeru, puisi seharusnya berfungsi bukan hanya sebagai hiburan sastra semata-mata, tetapi juga sebagai medium penyampaian ilmu, nilai murni, serta wadah pendidikan yang efektif. Seiring dengan arus teknologi serba pantas masa kini, puisi turut mengalami perubahan dari segi kaedah penyebaran. Menurut Prof. Madya Dr. Awang Azman Awang Pawi, "Puisi kini turut dikongsikan menerusi medium media sosial seperti *Facebook*, *Twitter*, *Instagram*, *Youtube*, *blog* dan portal serta aplikasi telefon pintar *WhatsApp* dan *Telegram* oleh pemuisi" (Bernama, 2021). Perkembangan positif ini memperlihatkan bahawa dengan segala kemudahan digital yang tersedia, para penulis puisi mempunyai lebih banyak ruang untuk berkarya dan berkongsi karya mereka tanpa bergantung kepada saluran konvensional seperti kolum sastra di media cetak arus perdana.

Berdasarkan kepada laporan Digital 2025, menunjukkan pada awal tahun 2025, terdapat 34.9 juta pengguna internet di Malaysia, yang mewakili 97.7% daripada jumlah penduduk negara ini. Selain itu,

terdapat 43.3 juta sambungan mudah alih aktif, bersamaan dengan 121% daripada jumlah penduduk, menunjukkan bahawa ramai individu memiliki lebih daripada satu sambungan mudah alih (Kemp, 2025). Malahan, dari segi penggunaan media sosial, Malaysia mencatatkan 25.1 juta identiti pengguna media sosial pada Januari 2025, iaitu bersamaan dengan 70.2% daripada jumlah penduduk. Statistik ini menjelaskan bahawa media sosial memainkan peranan penting dalam kehidupan seharian rakyat Malaysia, termasuk dalam aspek komunikasi, hiburan, dan penyebaran maklumat (Kemp, 2025). Data yang diperoleh ini memperlihatkan dengan nyata peranan signifikan yang dimainkan oleh media digital dan media sosial dalam kehidupan harian rakyat Malaysia.

Jadual 1: Purata Min dan Sisihan Piawai Penggunaan Media Sosial oleh Pelajar UNIMAS Mengikut Platfom

Kategori	Item	Twitter	Facebook	Instagram	TikTok
		Min (SD)	Min (SD)	Min (SD)	Min (SD)
Dokumentasi Kendiri	Merakam aktiviti harian	3.92 (1.11)	3.73 (1.13)	2.71 (1.28)	3.53 (1.29)
	Merakam apa yang dipelajari	3.70 (1.24)	3.51 (1.30)	3.06 (1.32)	3.34 (1.34)
	Merakam tempat yang dilawati	3.98 (1.08)	3.60 (1.29)	2.65 (1.27)	3.63 (1.28)
Berkongsi Maklumat	Berkongsi maklumat	3.37 (1.45)	2.79 (1.40)	2.53 (1.29)	2.87 (1.40)
	Berkongsi informasi	3.32 (1.42)	3.02 (1.41)	2.49 (1.27)	2.81 (1.42)
	Berhubung dengan individu yang minat sama	3.29 (1.38)	2.83 (1.39)	2.23 (1.14)	2.89 (1.42)
Interaksi Sosial	Berhubung individu baru	3.44 (1.47)	2.95 (1.45)	2.54 (1.32)	3.06 (1.51)
	Mudah digunakan	2.88 (1.49)	2.42 (1.35)	2.00 (1.07)	2.24 (1.29)
Kemudahan	Mengakses platfom	2.91 (1.44)	2.43 (1.27)	2.15 (1.10)	2.36 (1.29)

Nota: Min = Purata; SD = Sisihan Piawai

Sumber: Siti Haslina Hussin & Nur Hazwani Abu Bakar (2023)

Siti Haslina Hussin, dan Nur Hazwani Abu Bakar (2023), menyatakan bahawa Twitter adalah antara platfom yang digunakan oleh pelajar UNIMAS untuk motivasi ekspresi diri melalui media sosial sebagaimana pada paparan Jadual 1.

Meskipun dapatan kajian yang digunakan adalah berdasarkan sampel pelajar UNIMAS, ia tetap boleh dijadikan gambaran awal yang bersifat empirikal tentang kecenderungan penggunaan media sosial dalam kalangan masyarakat Malaysia. Dapatan ini memaparkan motivasi dan corak penggunaan Twitter yang sangat sesuai, khususnya dalam memenuhi keperluan ekspresi sendiri yang berkait rapat dengan penyebaran puisi dan kandungan sastera. Sehubungan itu, Twitter berpotensi menjadi platfom efektif bagi penyebaran budaya puisi, khususnya dalam kalangan generasi muda, agar puisi terus relevan dan seiring dengan arus perkembangan teknologi semasa. Objektif penulisan kajian ini, adalah untuk membincangkan secara ringkas mengenai platfom Twitter, mengupas peranannya dalam penyebaran maklumat, serta berkongsi refleksi penulis berkenaan penggunaan Twitter sebagai medium penulisan dan penyebaran puisi.

Walaupun banyak kajian yang meneliti penggunaan media sosial seperti TikTok, Instagram dan Facebook, tetapi kajian yang secara khusus meneliti terhadap Twitter sebagai medium untuk penyebaran budaya puisi dalam kalangan masyarakat Malaysia masih terhad. Justeru, penulis berharap agar kajian ini dapat membuka ruang kepada para pengkarya untuk terus berkarya dan memanfaatkan platfom Twitter sebagai medium partisipatif dalam usaha melestarikan puisi dalam masyarakat.

2. SOROTAN LITERATUR

Pada ruangan ini, penulis membahagikan sorotan kajian kepada tiga subtopik yang selari dengan objektif kajian ini, iaitu fungsi dan ciri utama Twitter, peranan Twitter dalam penyebaran puisi, serta kepentingan elemen refleksi dalam kajian kualitatif.

2.1. Fungsi dan Ciri Utama Twitter

Menurut Alhabash dan Ma (2017) Twitter mula bertapak pada tahun 2006 sebagai laman mikroblog yang memberi kemudahan kepada pengguna berkongsi maklumat secara masa nyata (real-time). Pada tahun 2023, platform Twitter telah menjalani penjenamaan semula yang dikenali sebagai X. Selain itu, ia mempunyai ciri-ciri utama antaranya:

- a. Had aksara
Bilangan had aksara telah meningkat daripada 140 aksara kepada 280 aksara. Ini membolehkan pengguna menyampaikan mesej yang ringkas dan padat.
- b. Tanda pagar (hashtag)
Kemudahan ini dapat memudahkan penjejakan topik dan perbincangan tertentu.
- c. Twit semula (retweet) dan Petikan Twit (Quote Tweet)
Kemudahan untuk membolehkan penyebaran semula kandungan dengan atau tanpa ulasan tambahan.
- d. Sohor kini (Trending)
Ia menunjukkan topik yang sedang hangat dibincangkan secara global atau mengikut lokasi.
- e. Jalur (Thread)
Kemudahan untuk membolehkan pengguna membuat rangkaian cerita atau berita.

2.2. Peranan X dalam Penyebaran Puisi

Ciri-ciri ini menjadikan X sebagai platform yang sesuai untuk penyebaran maklumat dan perbincangan awam. Selain itu, platform ini digunakan secara meluas terutamanya dalam menyebarkan berita dan maklumat. Apabila menerima maklumat, pengguna boleh memberi maklum balas terhadap mesej yang disampaikan dengan twit mesej yang mampu mewujudkan fenomena sohor kini dan tular. Malahan, X dikenali sebagai 'dewan perdebatan' kerana membolehkan pengguna membincangkan sesuatu isu sama ada isu tempatan atau antarabangsa.

Menurut Kemp (2024), terdapat 5.71 juta pengguna X di Malaysia. Sebagai perbandingan, pada tahun 2022, beliau melaporkan 4.40 juta pengguna. Peningkatan sebanyak 1.31 juta pengguna dalam tempoh dua tahun ini mencerminkan pertumbuhan signifikan platform ini dalam kalangan masyarakat Malaysia. Justeru, penulis dan penggiat sastera menjadi platform ini untuk menyebarkan puisi kepada khalayak yang lebih luas. Dengan ciri-ciri seperti had aksara yang mendorong penulisan ringkas dan padat, serta kemudahan seperti tanda pagar dan jalur, X memudahkan penyebaran puisi secara cepat dan meluas.

Gerakan *eSastera-On-Twitter* di Malaysia telah memainkan peranan penting dalam memasyarakatkan karya sastera Melayu melalui medium digital iaitu bermula pada tahun 2012, khususnya puisi, dengan menyediakan platform terbuka untuk penerbitan dan penyebaran karya (Abu Bakar, 2016). Malahan penggunaan tanda pagar digunakan dalam gerakan puisi seperti #Puisidarurat yang dianjurkan oleh Bilik Penyair dan Gerak Malaysia pada 17 Julai 2021. Inisiatif ini telah berjaya mengumpulkan lebih 700 pengguna media sosial untuk berkongsi puisi berkaitan isu semasa ketika itu iaitu serangan pandemik (Hamizul, 2021). Menurut pemerhatian penulis melalui twit bertarikh 8 Januari 2025 oleh akaun @PuteriSrimaya, yang memuat naik satu hantaran puisi tanpa tajuk telah menerima 35 komen, 283 suka dan 57 twit semula. Respon ini menggambarkan bahawa puisi berkenaan mendapat sambutan positif daripada audiens, contoh menunjukkan bahawa puisi tersebut mendapat sambutan positif daripada komuniti X. Situasi ini memperlihatkan potensi platform ini sebagai medium yang menghidupkan budaya apresiasi puisi dalam talian. Melaluinya, penggiat sastera bukan sahaja dapat berkongsi karya secara meluas, malah dapat berinteraksi secara langsung dengan audiens. Tambahan pula, X berupaya menjadi alat efektif dalam usaha melestarikan budaya puisi, khususnya dalam kalangan generasi muda yang lebih dekat dengan media sosial. Ini sekali gus memastikan kesinambungan tradisi puisi terus relevan dalam era digital.

2.3. Kepentingan Elemen Refleksi dalam Kajian Kualitatif

Penyelidikan kualitatif memerlukan penyelidik untuk sentiasa melakukan refleksi, iaitu berfikir dan menilai diri sendiri sebelum dan semasa proses penyelidikan dijalankan (Sutton & Austin, 2015). Tujuan

refleksi ini adalah untuk memberikan konteks dan pemahaman yang lebih jelas kepada pembaca mengenai proses dan hasil kajian. Tambahan pula, menurut Drozdowski dan Dominey-Howes (2015) refleksi adalah proses kesedaran sendiri yang berterusan terhadap peranan penyelidik dan konteks kajian, sekaligus membolehkan penilaian kritikal terhadap posisi penyelidik dalam hubungan dengan peserta. Selain itu refleksi merujuk kepada proses seseorang berhenti sejenak untuk menilai dan merenung kembali rutin harian serta pengalaman yang dilaluinya. Semasa proses ini, individu menilai tindakan dan keputusan secara kritikal untuk membentuk pandangan baharu yang lebih bermakna. Manakala Imam Al-Ghazali pula menggunakan istilah muhasabah iaitu penilaian sendiri bagi menilai perbuatan atau tindakan secara batiniah untuk membentuk pandangan dan keputusan yang lebih tepat, iaitu ia juga boleh diaplikasikan dalam konteks penyelidikan sebagai pemurnian intelektual dan spiritual (A. Shukor et al., 2023).

Kajian *scoping review* oleh Karcher et al.(2024) pula meneliti 55 artikel daripada pelbagai disiplin yang menggunakan amalan refleksi dan refleksiviti dalam kajian kualitatif bertopik sensitif. Dapatan kajian menunjukkan ramai penyelidik kurang bersedia dan kekurangan latihan dalam mengamalkan refleksi sendiri secara efektif. Penulisan jurnal reflektif, sesi *debriefing*, dan sokongan rakan sebaya dikenal pasti sebagai strategi utama untuk mengurus tekanan emosi sepanjang proses penyelidikan. Selain itu, kajian ini menegaskan bahawa refleksi hendaklah diamalkan secara proaktif sepanjang proses penyelidikan, bukan hanya selepas mengalami kesan negatif. Pendekatan ini bukan sahaja memelihara kesejahteraan penyelidik tetapi juga meningkatkan kredibiliti dan kualiti dapatan kajian secara keseluruhan.

Oleh itu, integrasi elemen refleksi dalam kajian kualitatif adalah amat penting bagi memastikan proses penyelidikan menjadi lebih jujur, telus, dan bermakna. Dalam konteks penyelidikan kualitatif, refleksi berperanan memperdalam kefahaman terhadap pengalaman penyelidik sendiri, mengenal pasti andaian tersirat, dan menyesuaikan pendekatan kajian dengan lebih jujur dan telus. Justeru, elemen refleksi dalam penyelidikan bukan sekadar satu analisis akademik, tetapi juga merupakan pemurnian intelektual dan spiritual yang memperkukuh kredibiliti dapatan serta memanusiaikan proses penyelidikan.

3. METODOLOGI

Metodologi kajian adalah kaedah dan teknik yang digunakan oleh penyelidik untuk menjawab persoalan kajian agar mencapai objektif yang telah ditetapkannya. Penulis menggunakan infografik pada Rajah 1 untuk menerangkan elemen-elemen yang perlu ada di dalam ruangan ini. Kajian ini berasaskan pendekatan kualitatif dengan penekanan terhadap elemen reflektif dan dokumentasi kepustakaan.



Rajah 1: Infografik elemen-elemen di dalam penulisan metodologi
 Sumber: *Statistic, Econometrics, Data Analysis and Coding, (2024)*

3.1. Reka Bentuk Kajian

Menurut Creswell (2009), penyelidikan kualitatif merupakan kaedah yang digunakan untuk meneroka dan memahami makna yang diberikan oleh individu atau kumpulan terhadap sesuatu masalah sosial atau pengalaman manusia. Tujuan utama kaedah ini adalah untuk memperoleh pemahaman yang

mendalam dan terperinci berdasarkan pengalaman langsung peserta. Sementara itu, McKernan menekankan bahawa kajian tindakan ialah satu bentuk penyelesaian masalah secara reflektif sendiri oleh penyelidik, yang membolehkannya memahami dengan lebih baik dan menangani masalah-masalah mendesak dalam konteks sosial penulis (Amalina, 2015). Oleh itu, rekabentuk kajian ini menggunakan kaedah kajian kualitatif tindakan reflektif sendiri, kerana ia lebih bersifat individu dan tidak melibatkan interaksi secara langsung bersama-sama komuniti sastera (seperti temubual atau kolaborasi terus).

3.2. Kaedah Pengumpulan Data

Zaleha (2009) menjelaskan bahawa kajian kepustakaan merujuk kepada segala usaha yang dilakukan oleh penyelidik untuk menghimpun maklumat yang sesuai dengan topik atau isu kajian. Maklumat ini boleh diperolehi daripada buku-buku ilmiah, laporan penyelidikan, artikel akademik, tesis dan disertasi, dokumen rasmi, buku tahunan, ensiklopedia serta sumber-sumber bertulis sama ada bercetak mahupun elektronik. Justeru, penulis memilih kaedah kepustakaan sebagai strategi pengumpulan data bagi membolehkan penulisan ini mengulas dapatan kajian terdahulu, menyumbang dari aspek teori dan metodologi, serta memperdalam kefahaman pengkaji tentang topik ini. Selain itu, penulis turut mendokumentasikan pemerhatian sendiri terhadap twit di X yang berkaitan dengan puisi dan gerakan sastera digital.

Malah, penulis turut mendokumentasikan pemerhatian terhadap beberapa kandungan X yang berkaitan dengan puisi dan gerakan sastera digital. Pemilihan tanda pagar dalam kajian ini dibuat berdasarkan konteks budaya dan topikal, selaras dengan penyebaran puisi dalam kalangan masyarakat Malaysia di platform X. Pendekatan ini seiring dengan cadangan Murthy (2012) dan Bruns & Burgess (2015) yang menekankan kepentingan pemilihan tanda pagar kerana pemilihan tanda pagar yang sesuai bukan sahaja mewujudkan komuniti maya, tetapi turut menyebarkan kandungan secara lebih berkesan berdasarkan tema dan nilai budaya. Di samping itu, kekerapan penggunaan tanda pagar turut diambil kira sebagai faktor sokongan untuk memastikan data yang dikumpul mewakili interaksi yang aktif dan sesuai.

3.3. Strategi Sampel

Kajian kualitatif ini bersifat tindakan reflektif sendiri dan tidak melibatkan interaksi langsung dengan responden. Justeru, menurut Merriam (2009) dalam kajian kualitatif, kaedah pensampelan bertujuan (*purposive sampling*) lebih sesuai, iaitu pemilihan sumber data yang paling berpotensi memberi pemahaman mendalam terhadap isu yang dikaji. Maka, penulis memilih pelbagai twit dari platform X yang berkait langsung dengan objektif penyelidikan. Pemilihan dibuat berdasarkan tanda pagar yang relevan seperti #puisi7kata dan #Puisidarurat serta kandungan twit yang memperlihatkan penyebaran budaya puisi dalam kalangan masyarakat Malaysia. Sebanyak 30 twit telah dikumpul, namun analisis tertumpu kepada enam twit sebagai contoh untuk memperincikan dapatan kajian.

Keputusan kajian hanya merujuk kepada data terpilih dan tidak mewakili keseluruhan populasi pengguna X. Dapatan ini mencerminkan kumpulan data tertentu yang dikaji secara mendalam. Kajian reflektif sendiri memfokuskan kepada pemahaman terhadap proses pemikiran dan pengalaman individu (Finlay, 2008), bukan generalisasi statistik. Oleh itu, pemilihan data dalam kajian ini lebih menekankan aspek kualiti dan keaslian (Tracy, 2010). Menurut Schön (1983), refleksi sendiri melibatkan pencerahan terhadap pengalaman untuk menghasilkan pengetahuan bermakna. Sehubungan itu, pemilihan beberapa data terpilih sebagai ilustrasi dalam laporan kajian adalah sesuai (Merriam & Tisdell, 2015), kerana ia membantu menjelaskan tema atau isu utama secara lebih fokus. Menurut Malterud et al. (2016), semakin tinggi *information power* yang dimiliki oleh data, iaitu semakin kaya, relevan dan spesifik terhadap objektif kajian, maka semakin sedikit sampel yang diperlukan oleh penyelidik. Oleh itu, penggunaan enam twit utama dalam kajian ini adalah memadai memandangkan setiap satunya mempunyai *information power* yang tinggi dan mewakili dapatan utama yang telah dikenalpasti dalam keseluruhan 30 twit.

3.4. Analisis Data

Kajian ini menggunakan kaedah analisis dokumen untuk meneliti bahan-bahan terpilih secara sistematik. Pendekatan tematik deskriptif digunakan bagi mengenal pasti pola, tema dan makna yang terkandung dalam kandungan teks. Analisis ini turut merangkumi interpretasi terhadap respons pengguna X terhadap puisi yang dikongsikan oleh penulis, bagi memahami makna dan reaksi sosial yang terbentuk daripada interaksi tersebut. Antara tema yang dikenal pasti termasuklah reaksi audiens dan penggunaan tanda pagar tertentu. Beberapa contoh twit dipilih sebagai ilustrasi kes bagi menjelaskan dapatan.

3.5. Pertimbangan Etika

Walaupun penyelidikan ini tidak melibatkan data peribadi responden atau temu bual, pertimbangan etika tetap diberi perhatian. Setiap tangkap layar yang digunakan dalam kajian ini telah disemak agar tidak mendedahkan identiti pengguna secara langsung. Nama pengguna, gambar profil, dan maklumat sensitif lain dikaburkan atau diubah suai. Selain itu, twit yang dipetik merupakan kandungan umum yang telah diterbitkan secara terbuka di X. Sumber asal turut dinyatakan sebagai tanda penghargaan kepada pemilik karya.

3.6. Bentuk Pembentangan Data

Dapatan akan dipersembahkan dalam bentuk naratif, disokong dengan petikan twit, tangkap layar visual, serta grafik sokongan seperti carta atau model konsep. Penyampaian data ini bertujuan memberi gambaran yang lebih konkrit tentang dinamik penyebaran puisi dalam ekosistem X di Malaysia.

4. KEPUTUSAN DAN PERBINCANGAN

Ruangan ini membincangkan hasil dapatan kajian berdasarkan analisis dokumentasi dan refleksi peribadi penulis terhadap penggunaan platform X dalam penyebaran puisi. Penghuraian ini dilihat kepada tiga komponen utama yang seiring dengan objektif kajian, iaitu:

4.1. Peranan X dalam Penyebaran Puisi

X berfungsi bukan sahaja sebagai saluran komunikasi sosial, tetapi juga sebagai medium ekspresi kreatif. Berdasarkan pemerhatian penulis, ramai penyair dan peminat puisi menggunakan X untuk berkongsi karya mereka secara segera, ringkas dan terbuka kepada umum. Ciri seperti had aksara, tanda pagar, dan ruangan balas menjadikan interaksi dengan audiens lebih aktif dan langsung. Gerakan seperti #Puisidarurat juga menunjukkan wujudnya solidariti kesusasteraan digital di kalangan pengguna.



Sumber: @indahgemaladewi, (2016)

(a)



Sumber: X #pui7kata, (2024)

(b)

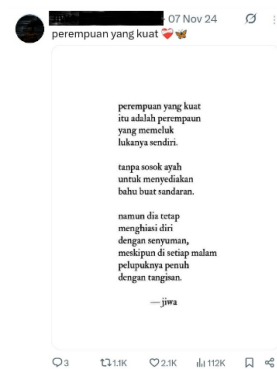
Rajah 2: Tangkap layar penggunaan tanda pagar

Penulis mendapati bahawa pengguna *X* sama ada pemuisi amatir atau profesional akan menggunakan tanda pagar seperti #Puisi, #AntologiUYTTP, dan #puisi7kata untuk menyebarkan karya secara terbuka dan tersusun. Contoh twit dalam Rajah 2(a), @indahgemaladewi, (2016) menunjukkan puisi daripada Wani Ardy yang disertakan dengan elemen visual, serta mendapat interaksi pengguna iaitu 15 suka dan 22 twit semula. Ini memperlihatkan potensi puisi untuk menarik minat meskipun dalam ruang digital yang pantas dan terhad. Sementara itu, Rajah 2(b) menunjukkan akaun #puisi7kata yang membentuk komuniti sastera digital dalam mempopularkan bentuk puisi ringkas. Penggunaan simbol @ sebagai penanda identiti penulis, serta konsistensi tanda pagar menjadikan gerakan ini inklusif dan berstruktur. Ia bukan sahaja menampilkan karya, tetapi turut membina jaringan komuniti dan ruang penghargaan sesama pengguna. Kedua-dua contoh ini mewakili dua pendekatan dalam penyebaran budaya puisi di laman *X* iaitu satu, secara individu yang spontan, dan satu lagi melalui gerakan kolektif yang berasaskan tanda pagar.

Menurut Pöschko (2011), penggunaan tanda pagar di media sosial seperti *X* berperanan penting dalam meningkatkan capaian dan keterlibatan pengguna. Tanda pagar memudahkan pengkategorian kandungan serta pembentukan komuniti maya yang berkongsi minat sama, termasuk dalam penyebaran budaya puisi. Ini sejajar dengan pemerhatian penulis bahawa gerakan seperti #puisi7kata berhasil merapatkan penyair dan pembaca dalam satu ruang digital yang interaktif dan kreatif. Kesannya, penyebaran puisi di *X* bukan sahaja memperluas capaian pembaca, malah menyemarakkan kembali minat terhadap kesusasteraan dalam bentuk yang segar dan kontemporari. Kenyataan ini turut disokong oleh pandangan Sasterawan Negara, Datuk Dr. Zurinah Hassan, yang menyatakan bahawa melalui media sosial, beliau kini dapat melihat sendiri siapa yang membaca karyanya, sesuatu yang sukar diperoleh ketika karyanya hanya diterbitkan dalam bentuk buku. Beliau menyebut, "Sekarang saya lihat mereka (anak muda) dapat bawa semula karya yang diminati masyarakat di media sosial. Saya berterima kasih kepada internet sebab saya boleh tahu siapa yang baca." (Selangorkini, 2021).

4.2. Kesan Penyebaran Budaya Puisi di *X* Terhadap Masyarakat Malaysia

Merujuk kepada Rajah 3(a), penggunaan *X* sebagai medium penyebaran budaya puisi memberi kesan signifikan terhadap masyarakat, khususnya dalam menyebarkan nilai empati serta kesedaran emosi. Sebagai contoh, twit oleh Jiwa (2024) yang mengangkat tema ketabahan seorang wanita telah meraih lebih daripada 2,000 tanda suka dan 112,000 tontonan. Hal ini membuktikan bahawa puisi yang sarat dengan emosi dan kejujuran mampu menyentuh hati audiens serta mendapat sambutan meluas. Puisi yang bersifat pendek, padat, dan dipersembahkan dengan visual estetik menjadikannya mudah dikongsi, sekaligus mencipta rangkaian interaksi sosial yang memperluaskan capaian karya ke khalayak lebih luas. Oleh itu, *X* bukan sahaja berfungsi sebagai ruang ekspresi, malah sebagai wahana budaya yang menyemai nilai kemanusiaan secara digital. Ini sejajar dengan dapatan Karcher et al. (2024) yang menyatakan bahawa keterbukaan emosi dalam komunikasi digital berpotensi menjadi agen perubahan sosial. Jelaslah bahawa platform *X* mampu memberi kesan positif terhadap masyarakat Malaysia dalam usaha membudayakan puisi selari dengan kemajuan teknologi.



Sumber: Jiwa, (2024)
(a)



Sumber: @SeniPuisi, (2014)
(b)

Rajah 3: Kesan penyebaran budaya puisi dalam masyarakat

Rajah 3(b) menunjukkan tweet daripada akaun X rasmi @SeniPuisi, sebuah platform aktif yang mempromosikan dan menyebarkan karya puisi di media sosial. Penggunaan tanda @ pada tweet tersebut menandakan identiti pemilik karya, sekaligus memberikan penghargaan kepada penulis asal dan mengukuhkan keberkesanan penyebaran puisi melalui platform digital. Komitmen @SeniPuisi terbukti melalui usaha menyebarkan dan melestarikan budaya puisi di X, walaupun tweet ini tidak melibatkan interaksi seperti komen, tanda pagar, suka, atau tweet semula. Selain itu, penulis turut mendokumentasikan pemerhatian terhadap respons audiens di akaun individu dan komuniti seperti yang ditunjukkan dalam Jadual 2. Perbandingan antara akaun peribadi individu iaitu @MustaqimJiwa dan akaun komuniti yang menggunakan tanda pagar #puisi7kata.

Jadual 2: Perbandingan Respon antara akaun Individu dan Komuniti

Tarikh	Akaun / Hashtag	Teks Ringkas Puisi	Tema	Suka	Tweet Semula	Komen	Tontonan
24 Nov. 2024	@MustaqimJiwa (individu)	Perempuan yang kuat	Emosi	2.1k	1.1k	3	112.1k
21 Jun. 25	#puisi7kata (komuniti)	Sesakit inikah cinta bermandi dusta?	Emosi	3	1	0	78
21 Jun. 25	#puisi7kata (komuniti)	Cinta berbalas dusta..	Emosi	3	0	0	81

Jadual 2 menunjukkan bahawa respons terhadap puisi dari akaun individu (@MustaqimJiwa) jauh lebih tinggi berbanding akaun komuniti (#puisi7kata). Tweet daripada @MustaqimJiwa mencatatkan 2.1k suka dan 112.1k tinjauan, berbanding hanya 3 suka dan kurang 100 tinjauan untuk tweet komuniti. Hal ini menunjukkan bahawa penyampaian puisi secara peribadi dengan elemen visual dan naratif yang emosional lebih berkesan dalam menarik keterlibatan pengguna. Sementara itu, akaun komuniti lebih bersifat fungsi penyebaran, tetapi tidak menjana interaksi tinggi. Ini memperlihatkan bahawa bentuk penyampaian puisi ini sama ada bersifat individu atau kolektif masih memberi kesan langsung terhadap sambutan khalayak di platform digital.

4.3. Refleksi Peribadi Penulis Sebagai Penyelidik dan Pengguna Platform

Sebagai pemilik akaun X puisi, penyelidik menyedari bahawa peranannya bukan hanya berkongsi karya, tetapi turut membuka ruang apresiasi puisi kepada audiens. Medium ini membolehkan penyelidik menyampaikan ekspresi sastera dalam bentuk yang ringkas namun bermakna. Selain itu ia menjadi penyambung antara penulis dan audiens yang pelbagai latar. Sebagaimana diujikan oleh Zizi Papacharissi (2010), media digital seperti X mencipta ruang penting untuk ekspresi emosi dan identiti. Ia menjadi saluran penyampaian naratif peribadi dan budaya, sekaligus membentuk "sfere peribadi" dalam konteks demokrasi digital. Sehubungan itu, X membolehkan penulis berkongsi puisi dengan cara yang mudah difahami oleh audiens, tanpa mengorbankan nilai estetika atau makna. Ia membuktikan bahawa puisi tetap relevan dalam ekosistem digital yang pantas dan interaktif. Namun begitu, penyelidik turut berdepan cabaran dari segi respons audiens. Tidak semua tweet mendapat perhatian dalam bentuk suka atau tweet semula seperti pada Rajah 4(a). Ini menuntut ketekunan dan keikhlasan penyelidik untuk terus menyebarkan karya, tanpa bergantung kepada pengesahan sosial. Konsistensi dalam berkarya menjadi satu bentuk komitmen terhadap kelestarian puisi.



(a)



(b)



(c)

Rajah 4: Tangkap layar akaun X penulis sebagai refleksi sendiri

Meskipun sistem boleh memberikan pengiktirafan automatik, tetapi tindakan manusia secara sedar dan sukarela memberi penghargaan “manual” kepada pencipta asal kandungan adalah lebih bernilai secara emosional dan sosial (Monroy-Hernández et. al. ,2015). Sehubungan itu, penyelidik semakin peka terhadap isu etika dalam pemilikan karya. Walaupun ada twit yang pendek dan kelihatan umum, penyelidik tetap mengambil langkah untuk mengekalkan kredit kepada penulis asal sebagai satu bentuk penghormatan dan integriti dalam penyebaran sastera digital seperti pada Rajah 4(b). Salah satu momen penting dalam penyelidikan ini ialah apabila twit puisi penyelidik dipaparkan semula oleh akaun rasmi #puisi7kata seperti pada Rajah 4(c). Pengalaman ini memberi kesedaran bahawa platform digital seperti *X* mampu menghubungkan karya dengan komuniti pembaca secara lebih luas dan spontan. Paparan tersebut bukan sahaja menjadi bentuk pengiktirafan, malah menyuntik motivasi untuk terus berkarya dan berkongsi puisi. Ia membuktikan bahawa penyebaran puisi secara digital boleh membina jaringan apresiasi dan memupuk minat masyarakat terhadap sastera. Sebagai penyelidik, mendapati tindakan reflektif melalui pengalaman ini telah memperkukuh kefahaman penyelidik tentang peranan aktif media sosial dalam melestarikan budaya puisi secara kontemporari.

Penglibatan dalam penyebaran puisi juga membuka ruang emosi yang mendalam. Setiap twit dipilih atau dihasilkan berdasarkan perasaan empati, kenangan atau keprihatinan terhadap isu semasa. Ini menjadikan proses penulisan dan kurasi puisi bukan sekadar rutin, tetapi satu bentuk penghayatan nilai kemanusiaan. Akhirnya, refleksi sendiri ini mendorong penyelidik mengenal potensi diri dan persepsi masyarakat terhadap puisi. Interaksi yang terhasil melalui twit membina kefahaman lebih luas tentang kepekaan sosial, minat pembaca, dan keperluan menyesuaikan penyampaian puisi dalam konteks digital masa kini.

5. KESIMPULAN

Penulisan ini telah membuka ruang pemahaman yang lebih luas tentang bagaimana platform *X* dimanfaatkan sebagai medium digital dalam menyebarkan budaya puisi dalam kalangan masyarakat Malaysia. Tinjauan terhadap penggunaan tanda pagar, bentuk interaksi pengguna, serta wujudnya gerakan puisi dalam talian menunjukkan bahawa *X* mampu berfungsi sebagai ruang apresiasi sastera yang dinamik, terbuka dan inklusif. Peranannya bukan sahaja terhad kepada penyebaran teks, malah turut membentuk komuniti kreatif yang saling menyokong serta memperkaya makna dan nilai karya.

Refleksi sendiri penyelidik mendapati bahawa keterlibatan secara langsung dalam penulisan dan penyebaran puisi digital memberi impak terhadap kesedaran diri, nilai etika dalam berkarya, dan tanggungjawab terhadap bahasa dalam era teknologi. Pengalaman ini memperlihatkan bahawa teknologi bukanlah ancaman kepada warisan sastera, sebaliknya boleh menjadi jambatan kukuh ke arah pemartabatan puisi Melayu dalam bentuk yang segar dan mudah diakses. Walaupun media sosial sering mendorong gaya bahasa bebas dan tidak formal, penulis berpendirian bahawa mengekalkan keindahan dan ketepatan bahasa dalam penulisan puisi digital adalah satu bentuk perjuangan intelektual yang wajar diteruskan oleh setiap pengguna *X*. Oleh itu, penulisan ini diharap dapat membuka jalan kepada lebih banyak kajian bersifat tindakan yang meneroka potensi sebenar platform digital dalam mengembangkan sastera. Cadangan untuk penyelidikan akan datang termasuklah penggunaan model Kajian Tindakan seperti CRASP atau Kemmis & McTaggart bagi menilai secara sistematik keberkesanan platform seperti *X* dalam memupuk, mendidik dan memperluas budaya puisi dalam komuniti sastera tempatan. Penulis berharap agar kajian ini dapat menjadi rujukan awal kepada penggiat, pendidik dan penyelidik dalam melihat masa depan puisi bukan sekadar di atas kertas, tetapi juga dalam ruang digital yang hidup dan berkembang.

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Hubungan antara Pembelajaran Matematik Kejuruteraan dan Kesedaran Teknologi Hijau dalam Kalangan Pelajar Politeknik

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ABSTRAK

Kesedaran terhadap teknologi hijau semakin penting dalam dunia kejuruteraan hari ini. Dalam konteks pendidikan politeknik, pelajar bukan sahaja perlu menguasai kemahiran teknikal, tetapi juga mempunyai kepekaan terhadap isu kelestarian. Kajian ini dijalankan untuk mengenal pasti hubungan antara pembelajaran Matematik Kejuruteraan dan tahap kesedaran pelajar terhadap teknologi hijau di Politeknik Port Dickson. Kajian ini dilaksanakan menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan di mana sampel kajian seramai 295 orang pelajar telah dipilih menggunakan kaedah pensampelan rawak mudah. Instrumen kajian berbentuk soal selidik berstruktur yang disesuaikan daripada kajian terdahulu, dan data dianalisis menggunakan perisian SPSS versi 29. Dapatan kajian menunjukkan bahawa tahap kesedaran pelajar adalah tinggi secara keseluruhan (min = 4.06). Selain itu, analisis korelasi Pearson menunjukkan terdapat hubungan positif yang signifikan antara pembelajaran Matematik Kejuruteraan dan kesedaran terhadap teknologi hijau ($r = 0.683$, $p < 0.001$). Ini menunjukkan bahawa subjek Matematik Kejuruteraan berpotensi untuk menjadi saluran penting dalam membina kesedaran pelajar terhadap isu alam sekitar khususnya apabila disampaikan secara kontekstual dan berkait rapat dengan dunia sebenar. Oleh itu, pengajaran dalam subjek teknikal disarankan agar disepadukan dengan elemen kelestarian dan penggunaan teknologi digital secara lebih meluas supaya mesej hijau dapat sampai dengan lebih berkesan dan relevan kepada pelajar.

Kata kunci: Matematik kejuruteraan, teknologi hijau, kesedaran alam sekitar, pelajar politeknik, pendidikan TVET

1. PENGENALAN

Dalam era yang semakin menekankan kelestarian alam sekitar, peranan institusi pendidikan tinggi bukan sekadar menyampaikan ilmu teknikal semata-mata, tetapi turut merangkumi usaha membentuk kesedaran dan tanggungjawab terhadap alam sekitar. Bagi pelajar kejuruteraan, pendedahan kepada konsep teknologi hijau bukan lagi satu pilihan, sebaliknya satu keperluan yang perlu diintegrasikan dalam pembelajaran harian. Ini selari dengan matlamat Pendidikan untuk Pembangunan Lestari (Education for Sustainable Development, ESD) yang menekankan penglibatan aktif pelajar dalam memahami dan mengaplikasikan nilai kelestarian dalam bidang masing-masing (UNESCO, 2020). Pendekatan berasaskan platform digital telah menjadi sebahagian daripada amalan pengajaran dan pembelajaran (PdP) harian di mana ianya bukan sekadar untuk menyampaikan kandungan subjek, tetapi juga untuk menggalakkan pelajar berfikir secara kritikal tentang isu-isu semasa seperti perubahan iklim, kecekapan tenaga, dan pengurusan sumber. Namun, persoalan timbul: sejauh manakah pendekatan ini benar-benar membantu pelajar membina kesedaran terhadap konsep teknologi hijau yang berkait rapat dengan dunia kejuruteraan sebenar?

Kajian terdahulu menunjukkan bahawa pendekatan digital mampu meningkatkan penglibatan pelajar dan memperkukuh pemahaman mereka terhadap isu kelestarian apabila disampaikan dalam bentuk yang interaktif dan menarik (Abdullah & Ismail, 2021; Mylonas et al., 2019). Aktiviti seperti kuiz maya, video animasi berkaitan tenaga boleh baharu (renewable energy), dan simulasi aplikasi pintar telah menunjukkan kesan positif terhadap motivasi dan minat pelajar terhadap topik teknologi hijau. Namun,

masih terdapat jurang dalam memahami bagaimana bahan digital ini diterima oleh pelajar politeknik, khususnya dalam subjek teknikal. Tambahan pula, kebanyakan kajian memfokuskan kepada kesan pembelajaran dari sudut kognitif semata-mata, tanpa memberi perhatian khusus kepada pembentukan sikap dan minat terhadap kelestarian. Dalam konteks ini, kajian ini dijalankan untuk mengenal pasti tahap kesedaran pelajar Politeknik Port Dickson terhadap konsep teknologi hijau dan meneliti hubungan antara pembelajaran Matematik Kejuruteraan dengan kesedaran pelajar terhadap teknologi hijau. Pemahaman terhadap hubungan ini penting bagi membantu pihak institusi mengenal pasti potensi subjek teknikal seperti Matematik Kejuruteraan dalam menyampaikan nilai-nilai kelestarian. Dapatan kajian juga boleh digunakan sebagai asas penambahbaikan dalam pendekatan pengajaran yang lebih kontekstual dan berfokuskan kepada pembangunan pelajar yang lebih lestari dan bertanggungjawab terhadap alam sekitar.

2. SOROTAN KAJIAN

2.1. Fungsinya dan Ciri Utama Twitter

Kesedaran terhadap kelestarian alam sekitar atau lebih dikenali sebagai kesedaran hijau semakin menjadi agenda penting dalam sektor pendidikan, khususnya di institusi latihan teknikal dan vokasional (TVET). Istilah ini merangkumi pemahaman pelajar tentang isu alam sekitar, sikap terhadap amalan lestari, dan keterlibatan dalam tindakan yang menyokong pembangunan mampan. Namun begitu, beberapa dapatan kajian mutakhir menunjukkan bahawa walaupun tahap pengetahuan dan kesedaran pelajar berada pada tahap yang memuaskan, penerapan nilai dan amalan hijau dalam kehidupan seharian masih belum konsisten. Dapatan kajian oleh Abd Rahman dan Abdul Rahman (2024) yang dilaksanakan di Politeknik Sultan Azlan Shah mendapati bahawa pelajar mempunyai sikap yang positif dan memahami konsep asas teknologi hijau. Namun demikian, pengamalan terhadap prinsip-prinsip kelestarian dalam konteks pembelajaran, pengurusan sisa, dan penggunaan tenaga masih berada pada tahap sederhana. Dapatan ini menunjukkan kewujudan jurang yang signifikan antara kesedaran kognitif dan perlakuan sebenar dalam kalangan pelajar.

Kajian oleh Shani et al. (2021) di Politeknik Mukah turut mengesahkan fenomena yang sama. Walaupun pelajar jurusan perdagangan menunjukkan tahap kesedaran yang tinggi terhadap kepentingan pemeliharaan alam sekitar, hanya sebilangan kecil yang benar-benar mengaplikasikan amalan hijau secara konsisten, seperti kitar semula atau pengurangan penggunaan bahan plastik. Ini memberi gambaran bahawa kesedaran semata-mata tidak mencukupi untuk mendorong perubahan tingkah laku lestari, terutamanya dalam kalangan pelajar muda yang terdedah kepada pelbagai pengaruh gaya hidup moden. Dalam konteks yang lebih luas, Mahat et al. (2024) menekankan bahawa pendidikan untuk pembangunan lestari (Education for Sustainable Development, ESD) di institusi TVET Malaysia memerlukan pendekatan yang lebih dinamik, holistik dan kontekstual. Mereka mencadangkan penggunaan teknologi sebagai pemangkin perubahan, namun menyatakan bahawa penyelidikan empirikal tentang keberkesanan penggunaan alat digital dalam pendidikan kelestarian masih terhad. Oleh itu, terdapat keperluan mendesak untuk meneroka bagaimana pendekatan digital seperti penggunaan aplikasi, kuiz interaktif, sistem pengurusan pembelajaran (Learning Management System, LMS), atau e-book dapat berfungsi sebagai medium yang lebih efektif untuk memperkukuh kesedaran dan amalan hijau dalam kalangan pelajar politeknik.

2.2. Penggunaan Platform Digital Sebagai Alat Pendidikan Hijau

Penggunaan teknologi digital sebagai alat pendidikan hijau semakin mendapat perhatian dalam kalangan pengkaji khususnya kerana potensinya dalam meningkatkan kemahiran, kesedaran dan motivasi pelajar terhadap isu kelestarian alam. Pendekatan ini tidak hanya melibatkan penyampaian kandungan secara digital, tetapi juga penerapan metodologi interaktif seperti gamifikasi dan penggunaan peranti pintar (IoT). Kajian oleh Paganelli et al. (2019) dan Mylonas et al. (2019) menunjukkan bahawa integrasi teknologi Internet of Things (IoT) dalam persekitaran bilik darjah khususnya apabila digabungkan dengan pendekatan gamifikasi, berpotensi besar dalam meningkatkan kesedaran pelajar terhadap isu penjimatan tenaga. Melalui pendekatan ini, pelajar tidak hanya memperoleh maklumat secara pasif, malah mereka turut dilibatkan secara aktif dalam pemantauan

penggunaan tenaga sebenar di sekitar mereka. Data yang direkodkan secara langsung oleh sistem IoT memberi peluang kepada pelajar untuk menyedari kesan penggunaan tenaga harian mereka, sekali gus membina kesedaran yang lebih mendalam terhadap kelestarian alam sekitar. Pendekatan ini terbukti mampu mendorong perubahan tingkah laku secara positif di mana pelajar menunjukkan kecenderungan untuk mengambil tindakan konkrit seperti mematikan lampu apabila tidak digunakan dan mengurangkan pergantungan kepada peralatan elektrik yang tidak perlu. Ini membuktikan bahawa penggunaan teknologi secara bijak dalam pendidikan bukan sahaja memperkukuhkan pembelajaran kognitif, tetapi juga menyumbang kepada pembentukan nilai dan sikap yang lebih lestari dalam kalangan pelajar.

Kajian oleh Sánchez-Rodríguez et al. (2023) menekankan potensi teknologi realiti maya (VR) dan realiti terimbuh (AR) dalam membentuk pengalaman pembelajaran yang mendalam dan berkesan, khususnya dalam konteks pendidikan alam sekitar. Melalui pendekatan berasaskan simulasi dan interaksi visual yang seakan nyata, pelajar bukan sahaja terdedah kepada maklumat, malah turut 'mengalami' situasi sebenar berkaitan isu-isu alam sekitar secara maya. Pengalaman yang dirasakan secara langsung melalui teknologi ini dilaporkan berupaya merangsang empati dalam kalangan pelajar terhadap permasalahan alam sekitar, di samping meningkatkan kesedaran mereka terhadap tanggungjawab bersama dalam menjaga kelestarian bumi. Keupayaan VR dan AR untuk mencipta situasi pembelajaran yang lebih dekat dengan realiti menyumbang kepada pembinaan kefahaman yang lebih mendalam dan berpanjangan. Ini menunjukkan bahawa integrasi teknologi imersif dalam pendidikan bukan sekadar menarik minat pelajar, tetapi juga membina kesedaran yang menyeluruh dari segi kognitif dan afektif.

2.3. Persepsi dan Penerimaan Pelajar terhadap Platform Digital

Penerimaan dan persepsi pelajar terhadap platform digital merupakan elemen kritikal yang menentukan kejayaan pelaksanaan teknologi dalam pendidikan, khususnya dalam menyampaikan mesej kelestarian dan kesedaran hijau. Dalam era digital ini, pelajar bukan sahaja bertindak sebagai penerima maklumat, tetapi juga sebagai pengguna aktif yang memilih dan menilai sendiri keberkesanan sesuatu pendekatan pembelajaran. Kajian oleh Peters et al. (2023) menekankan bahawa daya tarikan sesuatu platform digital sangat dipengaruhi oleh reka bentuk antaramuka, kebolehgunaan, dan tahap interaktiviti bahan pembelajaran yang disediakan. Sekiranya kandungan disampaikan dalam bentuk yang membosankan, atau terlalu kompleks tanpa panduan visual yang sesuai, pelajar cenderung untuk hilang minat dan tidak mencapai objektif pembelajaran yang diharapkan. Justeru, dalam konteks pendidikan hijau, reka bentuk bahan digital yang menarik, mudah diakses dan menyentuh nilai kehidupan harian pelajar menjadi faktor utama dalam membentuk sikap positif terhadap amalan kelestarian.

Menurut Mylonas et al. (2019) mendapati bahawa bahan pembelajaran berbentuk infografik, video pendek dan borang refleksi digital mampu merangsang minat dan memupuk kefahaman mendalam dalam kalangan pelajar terhadap isu-isu berkaitan alam sekitar. Ini menunjukkan bahawa pelajar lebih cenderung mengadaptasi dan memahami konsep kelestarian apabila ia disampaikan melalui pendekatan visual dan aplikasi praktikal. Ini selari dengan dapatan kajian oleh Rahman et al. (2018) yang menunjukkan bahawa pendekatan gamifikasi dan kuiz interaktif seperti Kahoot dan Quizizz berjaya meningkatkan tahap keterlibatan serta memperkukuh pemahaman pelajar politeknik terhadap topik yang kompleks.

Selain itu, kajian oleh Chong et al. (2025) yang menggunakan teknologi realiti maya dalam bentuk permainan escape room interaktif bagi menyampaikan mesej pengurusan sisa makanan membuktikan bahawa kaedah yang menyentuh emosi dan empati pelajar mempunyai potensi besar dalam mempengaruhi niat tingkah laku mesra alam. Pengalaman yang imersif dan bersifat 'hands-on' ternyata mampu membina hubungan yang lebih mendalam antara pelajar dan isu-isu alam sekitar, berbanding kaedah tradisional berasaskan teks atau ceramah semata-mata.

3. METODOLOGI

3.1. Reka Bentuk Kajian

Kajian ini menggunakan reka bentuk kuantitatif yang dijalankan secara deskriptif dan inferensi. Tinjauan kuantitatif ini sesuai digunakan apabila penyelidik ingin mendapatkan gambaran menyeluruh mengenai tahap kesedaran pelajar terhadap teknologi hijau serta mengkaji hubungan antara pembelajaran Matematik Kejuruteraan dengan kesedaran tersebut. Di samping itu, pendekatan ini juga membantu menghasilkan data berbentuk numerik yang boleh dianalisis secara deskriptif dan korelasi Pearson.

3.2. Sampel Kajian

Populasi kajian terdiri daripada 1,195 orang pelajar yang mendaftar kursus Matematik Kejuruteraan bagi sesi II 2024/2025 di Politeknik Port Dickson. Daripada jumlah ini, 295 orang pelajar telah dipilih sebagai sampel kajian menggunakan kaedah pensampelan rawak mudah. Saiz sampel ini ditentukan berdasarkan panduan Krejcie dan Morgan (1970), yang mencadangkan bahawa bagi populasi seramai 1,200, saiz sampel yang mencukupi ialah sekitar 291 orang. Pemilihan Politeknik Port Dickson sebagai lokasi kajian pula dibuat berdasarkan beberapa pertimbangan praktikal dan akademik. Pertama, ia merupakan institusi TVET yang menawarkan program-program kejuruteraan yang berkait rapat dengan topik teknologi hijau. Kedua, penyelidik berkhidmat di institusi ini, sekali gus memudahkan proses pengumpulan data melalui hubungan langsung dengan pelajar dan pensyarah serta memastikan pelaksanaan kajian berjalan lancar dan beretika.

3.3. Kaedah Pengumpulan Data

Instrumen kajian yang digunakan dalam penyelidikan ini ialah borang soal selidik berstruktur yang diadaptasi daripada kajian-kajian terdahulu dan disesuaikan mengikut konteks pelajar politeknik. Soal selidik ini terdiri daripada tiga bahagian utama, iaitu:

- a. Bahagian A: Maklumat demografi pelajar
- b. Bahagian B: Item mengukur tahap kesedaran terhadap teknologi hijau
- c. Bahagian C: Item berkaitan pembelajaran Matematik Kejuruteraan dan teknologi hijau

3.4. Kaedah Analisis Data

Data yang dikumpul dianalisis menggunakan perisian *Statistical Package for the Social Sciences* (SPSS) versi 29. Bagi menjawab objektif 1, iaitu mengenal pasti tahap kesedaran pelajar terhadap teknologi hijau, analisis statistik deskriptif seperti min dan sisihan piawai digunakan. Bagi Objektif 2, iaitu mengenal pasti hubungan antara pembelajaran Matematik Kejuruteraan dan kesedaran terhadap teknologi hijau, ujian Korelasi Pearson digunakan untuk mengukur kekuatan dan arah hubungan antara kedua-dua pemboleh ubah. Kaedah analisis yang digunakan membolehkan dapatan kajian digambarkan dengan jelas, tepat dan boleh dijadikan asas cadangan untuk penambahbaikan dalam pendekatan pengajaran subjek teknikal di politeknik.

4. ANALISIS DAPATAN DAN PERBINCANGAN KAJIAN

4.1. Analisis Demografik

Jadual 1 menunjukkan peratus responden yang terdiri daripada 295 orang pelajar di mana 23.1% dari Jabatan Kejuruteraan Awam(JKA), 52.5% dari Jabatan Kejuruteraan Elektrik(JKE) dan 24.4% dari Jabatan Kejuruteraan Mekanikal(JKM). Daripada jumlah responden, majoriti responden adalah pelajar lelaki iaitu sebanyak 67.1%, manakala pelajar perempuan merangkumi 32.9%. Apabila diteliti tahap celik IT dalam kalangan responden, didapati sebahagian besar pelajar berada pada tahap sederhana iaitu sebanyak 64.7%. Seramai 31.9% pula menunjukkan tahap celik IT yang tinggi, manakala hanya 3.4% responden berada pada tahap rendah. Dapatan ini menunjukkan bahawa secara umumnya, pelajar mempunyai kemahiran asas dalam menggunakan teknologi maklumat dan komunikasi. Ini merupakan

satu indikator positif kerana tahap celik IT yang memadai dapat menyokong kefahaman serta penerokaan pelajar terhadap maklumat berkaitan teknologi hijau secara dalam talian. Tambahan pula, 100% responden didapati pernah mendengar tentang teknologi hijau.

Jadual 1. Analisis Demografik

Demografik	Kriteria	Peratus
Jabatan	JKA	23.1
	JKE	52.5
	JKM	24.4
Jantina	Lelaki	67.1
	Perempuan	32.9
Pernah Dengar Teknologi Hijau	Ya	100
	Tidak	0
Tahap Celik IT	Rendah	3.4
	Sederhana	64.7
	Tinggi	31.9

4.2. Tahap Kesedaran Terhadap Teknologi Hijau

Bagi menjawab objektif kajian, analisis kajian dilakukan dengan menggunakan kaedah deskriptif skor min dan sisihan piawai. Pengukuran dibuat berdasarkan kepada julat skor min yang dicadangkan oleh Baharom dan Saat (2009), di mana nilai min antara 1.00 hingga 1.49 ditafsirkan sebagai sangat rendah, 1.50 hingga 2.49 sebagai rendah, 2.50 hingga 3.49 sebagai sederhana, 3.50 hingga 4.49 sebagai tinggi, dan 4.50 hingga 5.00 sebagai sangat tinggi. Jadual 2 menunjukkan bahawa pelajar Politeknik Port Dickson secara umumnya mempunyai tahap kesedaran yang tinggi terhadap teknologi hijau. Item yang mencatatkan nilai min tertinggi ialah "*Saya tahu maksud teknologi hijau*" (min = 4.47), yang menggambarkan bahawa pelajar telah terdedah kepada maklumat asas mengenai teknologi hijau, sama ada melalui pengajaran formal, media digital atau kempen kesedaran awam. Ini sejajar dengan penemuan oleh Aldalalah dan Ababneh (2022) yang menyatakan bahawa pendedahan terhadap kandungan digital dapat meningkatkan literasi alam sekitar dalam kalangan pelajar institusi tinggi.

Namun begitu, item yang mencatatkan nilai min paling rendah ialah "*Saya mengurangkan penggunaan plastik dalam kehidupan seharian*" (min = 3.74). Walaupun masih berada dalam julat tahap kesedaran yang tinggi, pernyataan ini menunjukkan bahawa terdapat jurang antara kesedaran teori dan amalan sebenar dalam kehidupan seharian pelajar. Hal ini turut disokong oleh kajian Chien et al. (2020) yang mendapati bahawa meskipun pelajar menunjukkan tahap kesedaran alam sekitar yang tinggi, amalan pro-alam sekitar seperti mengurangkan penggunaan plastik masih rendah kerana kurangnya sokongan persekitaran dan kekangan gaya hidup.

Selain itu, nilai sisihan piawai bagi semua item berada dalam lingkungan 0.64 hingga 0.87, yang menunjukkan variasi sederhana dalam respon pelajar. Ini menggambarkan bahawa walaupun majoriti pelajar menunjukkan kesedaran yang positif, terdapat juga sebahagian kecil pelajar yang masih kurang peka atau belum mengamalkan teknologi hijau secara konsisten. Kajian oleh Leelavathi et al. (2020) turut melaporkan hasil serupa, di mana wujud kepelbagaian dalam tahap penghayatan kelestarian dalam kalangan pelajar politeknik walaupun pendedahan kepada maklumat adalah hampir sama.

Secara keseluruhan, dapatan ini mengukuhkan rasional kajian ini dijalankan. Ia memberi isyarat bahawa meskipun pelajar telah memiliki asas pengetahuan tentang teknologi hijau, usaha yang lebih menyeluruh masih diperlukan untuk mengubah kesedaran tersebut kepada tindakan dan amalan lestari. Ini termasuk integrasi pendidikan kelestarian dalam subjek seperti Matematik Kejuruteraan melalui penggunaan platform digital yang lebih interaktif, seperti yang dicadangkan oleh Kamarudin et al. (2021) dalam konteks politeknik.

Jadual 2. Tahap Kesedaran Terhadap Teknologi Hijau

Pernyataan	Min	Sisihan Piawai	Interpretasi
Saya tahu maksud teknologi hijau	4.47	0.64	Tinggi
Saya sedar bahawa teknologi hijau penting dalam kehidupan moden.	4.31	0.65	Tinggi
Saya faham bagaimana penggunaan tenaga boleh diperbaharui boleh memelihara alam sekitar.	4.03	0.79	Tinggi
Saya mengambil kira aspek kelestarian dalam membuat keputusan harian.	3.87	0.85	Tinggi
Saya menyokong penggunaan produk mesra alam.	4.05	0.67	Tinggi
Saya peka terhadap isu perubahan iklim dan pemanasan global.	4.18	0.66	Tinggi
Saya mempraktikkan pengasingan sisa dan kitar semula.	3.87	0.87	Tinggi
Saya cuba menjimatkan penggunaan elektrik dan air setiap hari.	4.07	0.81	Tinggi
Saya mengurangkan penggunaan plastik dalam kehidupan seharian.	3.74	0.86	Tinggi
Saya faham bahawa generasi muda perlu bertanggungjawab terhadap kelestarian alam sekitar	4.02	0.74	Tinggi
Purata	4.06		Tinggi

4.3. Hubungan Antara Pembelajaran Matematik Kejuruteraan Dan Kesedaran Pelajar Terhadap Teknologi Hijau

Analisis korelasi Pearson telah dijalankan bagi mengenal pasti hubungan antara tahap pembelajaran Matematik Kejuruteraan dan tahap kesedaran pelajar terhadap teknologi hijau. Ianya ditafsirkan berdasarkan garis panduan oleh Cohen (1988), yang mengelaskan kekuatan hubungan seperti berikut: sangat lemah (0.00–0.19), lemah (0.20–0.39), sederhana (0.40–0.59), kuat (0.60–0.79), dan sangat kuat (0.80–1.00). Hasil analisis seperti dalam jadual 3 menunjukkan nilai pekali korelasi Pearson (r) = 0.683 dengan nilai $p < 0.001$, yang menunjukkan bahawa terdapat hubungan yang kuat, positif dan signifikan antara pembelajaran Matematik Kejuruteraan dan kesedaran pelajar terhadap teknologi hijau. Dapatan ini menggambarkan bahawa walaupun Matematik Kejuruteraan sering dianggap sebagai subjek teknikal yang abstrak, ia sebenarnya boleh menjadi saluran berkesan untuk memupuk pemikiran analitik dan kesedaran terhadap penyelesaian lestari.

Jadual 3: Hubungan Antara Pembelajaran Matematik Kejuruteraan Dan Kesedaran Pelajar Terhadap Teknologi Hijau

Hubungan	Nilai Signifikan	Pekali Kolerasi
Pembelajaran Matematik Kejuruteraan dan Kesedaran Pelajar Terhadap Teknologi Hijau	7.09×10^{-42}	0.683

Dapatan ini selari dengan kajian oleh Zulkifli et al. (2021) yang menyatakan bahawa penerapan elemen hijau dalam subjek STEM mampu meningkatkan kesedaran pelajar terhadap isu kelestarian, termasuk dalam subjek matematik. Malah, kajian oleh Chang & Pascua (2017) menunjukkan bahawa pendekatan pengajaran bersepadu antara disiplin teknikal dan kesedaran alam sekitar telah memberi impak positif terhadap kematangan ekologi pelajar kejuruteraan. Kajian ini juga menyokong pandangan oleh Rashid & Aziz (2020) yang menekankan keperluan untuk mentransformasikan kurikulum teknikal di politeknik supaya lebih bersifat “*green-conscious*”. Dengan menyisipkan elemen-elemen seperti analisis penggunaan tenaga, pemodelan sistem lestari atau konsep pengurangan sisa dalam pengajaran matematik kejuruteraan, pelajar akan lebih mudah mengaitkan pembelajaran mereka dengan realiti alam sekitar.

5. KESIMPULAN

Hasil daripada kajian yang dijalankan didapati bahawa tahap kesedaran pelajar terhadap konsep teknologi hijau adalah tinggi. Pelajar secara umumnya memahami kepentingan teknologi hijau dan menyokong penggunaannya meskipun pengetahuan mereka terhadap dasar-dasar kerajaan serta penglibatan langsung dalam aktiviti berkaitan masih boleh dipertingkatkan. Ini menunjukkan wujudnya kesedaran asas yang kukuh, tetapi masih memerlukan pengukuhan dari segi pendedahan dan penglibatan praktikal. Oleh itu, sistem pemantauan tingkah laku hijau, contohnya melalui aplikasi pelaporan atau refleksi harian boleh dibangunkan bagi menggalakkan perubahan berterusan. Kajian ini juga mendapati terdapat hubungan yang signifikan dan kuat antara pembelajaran Matematik Kejuruteraan dan tahap kesedaran terhadap teknologi hijau ($r = 0.683$, $p < 0.001$). Ini memberi petunjuk bahawa subjek yang dianggap teknikal seperti Matematik Kejuruteraan berpotensi besar untuk menyemai nilai kelestarian dan kesedaran alam sekitar apabila dikaitkan dengan konteks dunia sebenar. Oleh itu, penggunaan ebook, simulasi, kuiz maya, video pendek, dan gamifikasi perlu dipertingkatkan dalam PdP Matematik Kejuruteraan bagi menarik minat pelajar serta menyampaikan mesej kelestarian dengan lebih efektif. Kesimpulannya, kajian ini menunjukkan bahawa walaupun Matematik Kejuruteraan dilihat sebagai satu bidang teknikal dan abstrak, ia sebenarnya mempunyai keupayaan besar untuk menyokong pembangunan kesedaran terhadap teknologi hijau dalam kalangan pelajar politeknik. Dengan pendekatan pedagogi yang lebih kontekstual, inklusif dan berpaksikan kelestarian, pendidikan kejuruteraan masa hadapan boleh melahirkan bukan sahaja jurutera yang bijak mengira, tetapi juga insan yang peka dan bertanggungjawab terhadap alam sekitar.

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AI-Based Analysis of Programme Learning Outcomes for Enhancing Student Performance in Polytechnics

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ABSTRACT

This study investigates the application of artificial intelligence (AI) techniques, specifically linear regression, Random Forest, and Deep Learning, to enhance the analysis of Program Learning Outcomes (PLOs) among polytechnic students. The primary objective is to provide a more precise and insightful interpretation of student performance metrics by employing these advanced machine learning algorithms. The study categorises students into clusters based on their interests and performance levels, enabling educators to offer targeted guidance and personalised advice, thereby improving student learning outcomes. Linear Regression helps predict future student performance based on historical data, while Random Forest classifiers group students and identify key success factors. Deep Learning captures complex patterns in the data, offering more accurate predictions. The results were promising: Deep Learning achieved the highest prediction accuracy at 93%, followed by Random Forest (90%), Decision Tree (84%), and Linear Regression (78%). The findings show that AI-driven analysis significantly improves the understanding and utilisation of PLO data. This enables educators to tailor their teaching strategies to better meet the individual needs of students. Continuous monitoring and adaptive learning modules boost student engagement and academic achievement. Integrating AI into educational practices is a promising step forward for polytechnic institutions. This approach enhances performance predictions and helps create personalised learning plans, catering to diverse student needs. Ultimately, the study advocates for utilising AI to create a more effective and responsive educational environment, ensuring that students are well-prepared for their future careers.

Keywords: AI data analysis, Program Learning Outcome, machine learning algorithm, talent development, polytechnic students

1. INTRODUCTION

Artificial intelligence (AI) is rapidly transforming various sectors, and education is no exception. In polytechnic institutions, where hands-on technical skills are crucial, AI offers exciting possibilities to enhance the analysis of Program Learning Outcomes (PLOs) and support talent development. This paper explores how AI algorithms like Linear Regression, Random Forest, and Deep Learning can be used to analyze PLO data more effectively. Despite the promising benefits of AI in education, there are still challenges in effectively analysing and utilising PLO data to enhance student outcomes. Traditional methods often fall short in providing the detailed insights needed to tailor educational strategies to individual student needs (Yağcı, 2022). This gap highlights the need for advanced AI techniques that can provide more precise and actionable insights into student performance metrics. For instance, K-Means clustering has been demonstrated to effectively identify student learning patterns (Sultan Alalawi et al., 2023), while decision tree models can predict academic performance and employability with high accuracy (David Kolo et al., 2015). Another approach is deep learning, which further enhances the predictive capabilities by capturing complex patterns in data (Tien et al., 2022).

The primary objective of this research is to provide a clearer and more insightful understanding of student performance metrics by utilising advanced machine learning techniques. By grouping students into clusters based on their interests and performance levels, educators can offer more personalised guidance and advice, which can significantly improve learning outcomes. This approach not only deepens our understanding of PLO data but also helps in crafting more effective educational strategies and interventions. The findings of this study demonstrate that AI-driven analysis can significantly enhance the utilisation of PLO data, providing educators with valuable insights into student performance and enabling them to tailor their teaching methods to meet the diverse needs of their students. As polytechnic institutions work to prepare students for the modern workforce, integrating AI techniques into educational practices represents a promising step forward.

1.1. Theoretical Framework

In the context of Outcome-Based Education (OBE), Program Learning Outcomes (PLOs) serve as critical indicators of student achievement and curriculum effectiveness. For polytechnic institutions, which emphasize technical and vocational competencies, the accurate analysis of PLOs is essential to ensure students are equipped with industry-relevant skills. However, traditional methods of evaluating PLOs are often manual, subjective, and limited in their ability to provide predictive insights into student performance. Integrating artificial intelligence (AI) techniques in educational analysis has shown promising results in enhancing the understanding and utilisation of Program Learning Outcomes (PLOs) to improve student talent development and employability.

Recent advancements in Artificial Intelligence (AI) have opened new avenues for enhancing educational evaluation. AI techniques such as Natural Language Processing (NLP), particularly machine learning algorithms, have demonstrated significant potential in educational data mining and academic performance prediction. For example, (Zaki et al., 2022) developed an NLP-based system to automate the mapping of Course Learning Outcomes (CLOs) to PLOs, making curriculum evaluation more accurate and efficient. Similarly, (Bao & Liu, 2024) introduced a fuzzy clustering technique to evaluate student learning outcomes, showing the potential of AI to predict performance with impressive accuracy. Similarly, (Pusporini & Nurdianto, 2024) explored the use of AI in outcome-based curriculum development, highlighting its role in continuous improvement and data-driven decision-making. The application of psychometric indicators such as difficulty, discrimination, and generality, as proposed by (Martinez-Plumed & Hernandez-Orallo, 2020) provides a framework for evaluating both the quality of learning outcomes and student performance. These indicators can help educators better understand how students engage with different learning tasks. These ideas can be adapted to evaluate student performance across PLOs in a more meaningful way.

In addition, (McNeil, 2011) used Bloom's Taxonomy to identify outcome indicators, providing a structured approach to assessing learning goals. (Mageed Hag Elamin, 2024) proposed a framework for mapping and weighting CLOs in engineering programs, which could be very useful for polytechnic settings. (Mulyono et al., 2024) emphasised the importance of evaluating PLOs as part of curriculum review, and Sloane et al. (2024) highlighted the need for continuous improvement in learning outcomes. Meanwhile, Masong and Barillo (2022) explored the employability of technical-vocational graduates, which highlights that PLOs should reflect real-world job readiness. Despite these valuable contributions, a gap remains in applying AI specifically in polytechnic education. Most studies focus on general or university-level contexts and don't fully consider the unique needs of polytechnic students, who often come from diverse backgrounds and follow more hands-on, skill-based learning paths. Moreover, few studies use real-time student data to predict performance and guide teaching strategies.

This study aims to fill the gap by utilising linear regression, Random Forest, and Deep Learning to analyse PLO data and predict student performance. By grouping students based on their interests and academic profiles, the research aims to provide educators with clearer insights into how students are performing and what type of support they require. The goal is to create a more personalised and responsive learning environment—one where teaching strategies are tailored to individual needs, and students are better prepared for their future careers. Ultimately, integrating AI into PLO analysis represents a

transformative step toward data-informed educational practices in polytechnics. It supports continuous improvement in teaching strategies, fosters student engagement, and ensures that graduates are better prepared for their professional careers.

2. METHOD

2.1. Research Purpose and Significance

The purpose of this research is to analyse the relationship between Program Learning Outcomes (PLOs) and talent development among polytechnic students using AI techniques. The significance lies in providing educators with tools to better understand student performance and tailor educational strategies to individual needs, thereby enhancing learning outcomes and employability.

2.2. Research Population and Sample

The research population consists of polytechnic students from various departments. The sample includes students from the Electrical Engineering and Mathematics, Science & Computer departments, selected using stratified random sampling to ensure representation of different performance levels.

2.3. Research Method

This study employs a quantitative research design, utilizing existing PLO data from polytechnic students over the previous three semesters. The data includes grades, attendance, and participation in academic and extracurricular activities. Three AI techniques—Linear Regression, Random Forest, and Deep Learning—are used to analyse the data.

2.4. Data Collection and Analysis

Linear Regression models are trained using historical data to predict future performance metrics. Random Forest classifiers categorise students based on performance levels and identify key success factors. Deep Learning models capture complex patterns in the data, providing more accurate predictions. K-Means clustering groups students based on interests and performance levels, enabling targeted guidance.

2.5. Evaluation Metrics

The effectiveness of the AI techniques will be assessed using various evaluation metrics: Prediction Accuracy: Measures the accuracy of the predictions made by the linear regression and deep learning models. Classification Performance: Evaluate the performance of the Random Forest classifier using metrics like precision, recall, and F1-score. Cluster Quality: Assess the quality of the clusters formed using K-Means clustering.

2.6. Implementation and Validation

The AI models will be implemented using Python and popular machine learning libraries such as scikit-learn and TensorFlow. The models will be validated using cross-validation techniques to ensure their robustness and reliability. Additionally, the results will be compared with traditional methods to highlight the improvements brought by AI-driven analysis.

2.7. Ethical Considerations

The study will adhere to ethical guidelines for data analysis. Student data will be anonymised to protect privacy, and informed consent will be obtained from participants. The research will also ensure that the AI models are used responsibly and do not lead to biased or unfair outcomes.

3. FINDINGS

Based on the collected data, the analysis reveals that students with high achievements in PLO001, PLO006, and PLO008 show potential for higher achievements in the upcoming semester. Students with moderate achievements in PLO 009 and PLO 010 are likely to require additional academic interventions to enhance their performance. Students with low achievements in PLO002 and PLO005 may face learning challenges and require extra guidance.

3.1. Visualisation of Predicted Semester Achievements

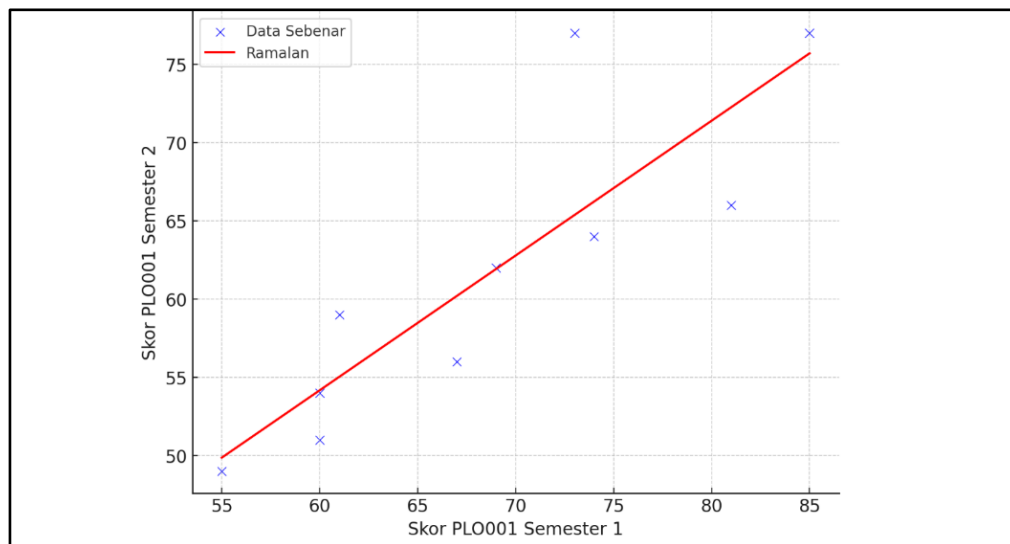


Fig 1: Relationship between Current PLO Scores and Predicted Semester Achievements

3.2. Accuracy of Prediction Models

Table 1: Comparison of AI Models in Predicting Student Academic Achievements

AI Model	Accuracy (%)
Linear Regression	78%
Decision Tree	84%
Random Forest	90%
Deep Learning	93%

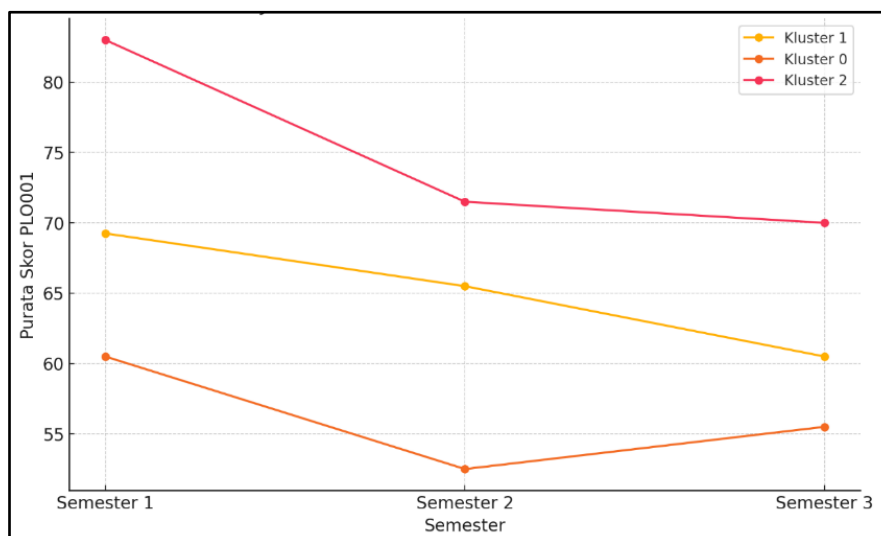


Fig 2: Results of AI Models in Predicting Student Academic Achievements

3.3. Analysis of Factors Affecting Talent Development

Besides the relationship between academic achievements and employability, this study also identifies several factors impacting student talent development. Which is shown in Table 4.2.

Table 2: List of Factors Affecting Talent Development

Factor	Potential Talent
Critical Thinking Skills	Students excelling in PLOs related to critical thinking perform better in final projects and industrial training.
Communication Skills	Students who are actively involved in extracurricular activities and group projects tend to score higher in PLOs related to communication.
Industrial Training Participation	Students with early industrial training experience show significant improvement in their academic achievements.
Persistence in Learning	Students with high attendance records and active class participation show steady improvement in PLO scores from semester to semester.

3.4. Student Performance Patterns Over Several Semesters

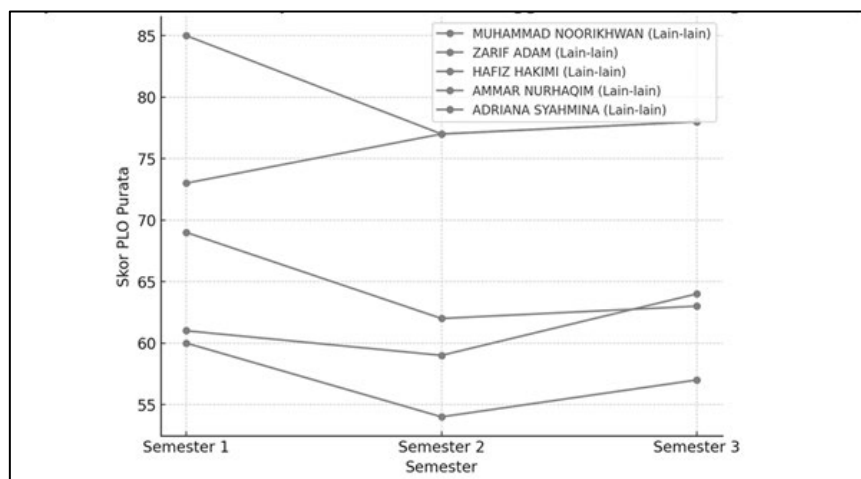


Fig 3: Student Performance Patterns from Semester 1 to Semester 4

The study finds that students who score high in foundational PLOs like PLO1 (Critical Thinking) and PLO3 (Communication Skills) in early semesters show more consistent improvement in subsequent semesters compared to those starting with low scores. Based on student performance patterns from Semester 1 to Semester 3, students are grouped into several performance clusters to better understand their academic development patterns.

Table 3: Student Grouping Based on Performance

Cluster	Characteristics	Involved Students	Recommendations
Cluster A: Stable Improvement	Consistent performance improvement from Semester 1 to Semester 3.	Muhammad Noorikhwan, Ammar Nurhaqim	Provide academic challenges like research or innovative projects.
Cluster B: Temporary Decline	Scores decline in Semester 2 but improve again in Semester 3.	Zarif Adam	Additional guidance and close monitoring in Semester 2 to prevent decline.
Cluster C: Gradual Growth	Moderate improvement without drastic changes in performance.	Hafiz Hakimi, Adriana Syahmina	Encourage participation in academic activities and additional training.
Cluster D: Inconsistent Performance	Scores fluctuate without clear patterns, showing variations in achievements.	Not available	Close monitoring, identify factors causing instability.
Cluster E: Stagnant/Declining Performance	No significant improvement or continuous decline.	Not available	Immediate intervention with guidance, support classes, and additional motivation.

3.5. Cluster Analysis

Students in Cluster A (Stable Improvement) can serve as models for understanding effective learning strategies. Students in Cluster B (Temporary Decline) require closer monitoring to prevent recurring performance drops. Students in Cluster C (Gradual Growth) indicate a need for deeper academic guidance. Students in Clusters D & E need to be identified based on additional data to determine appropriate intervention approaches. Figure 3.4 shows the chart comparing the performance of clusters across PLO 1 to PLO 12.

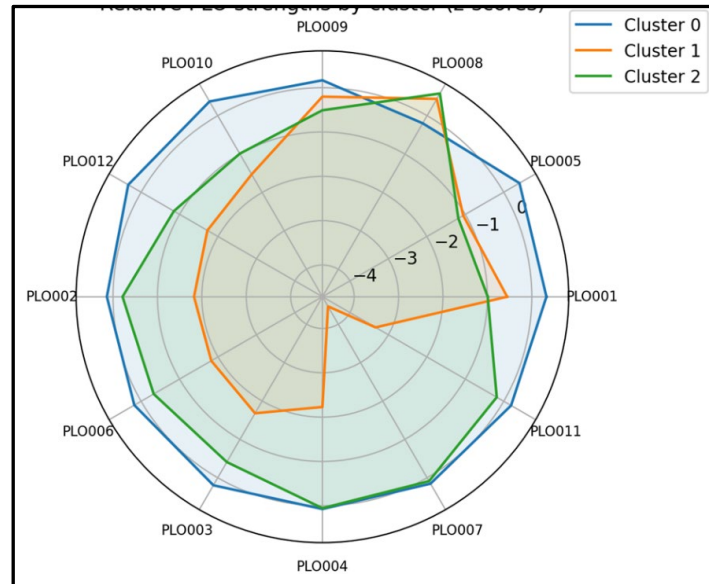


Fig 4: Spider Web Chart on Relative PLO Strength by Cluster

4. Discussion and Conclusion

Based on the study findings, several recommendations have been proposed to help students improve their academic achievements in the upcoming semester. One recommendation is to implement a continuous monitoring system using AI to provide feedback on student performance and suggest improvement steps through the Performance Monitoring Program. Adaptive Learning Modules: Provide learning materials tailored to individual needs based on their predicted performance results. Data-Driven Academic Guidance: Provide regular academic support to students at risk of academic decline. Additional Skills Training: Offer supplementary skill modules in targeted areas to help students refine their competencies before entering their final year of study. Industry Collaboration: Foster closer relationships with industries to provide students in their chosen fields with more practical training opportunities. This study demonstrates that AI can be used to predict the academic achievements of polytechnic students in the upcoming semester with high accuracy. Therefore, it is recommended that educational institutions utilise this technology to monitor student performance, ensuring more effective talent development. The proposed recommendations can help students achieve better performance and enhance their employability before graduation.

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Keberkesanan Perisian EASy68K dalam Pembelajaran Bahasa Himpunan

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ABSTRAK

Kajian ini dijalankan bagi menilai keberkesanan penggunaan perisian EASy68K dalam proses pengajaran dan pembelajaran topik bahasa himpunan bagi subjek DFC10263 *Computer Architecture*. Topik ini merangkumi pengaturcaraan menggunakan unit pengawal, pendaftar dan memori. Perisian EASy68K digunakan sebagai alat bantu mengajar (ABM) untuk membantu pelajar memahami bahasa himpunan dengan lebih berkesan. Kajian ini menilai beberapa aspek utama iaitu kebolehgunaan dan reka bentuk antara muka EASy68K, tahap pemahaman serta penglibatan pelajar dalam proses pembelajaran dan kemahiran dalam penulisan atur cara. Seramai 131 pelajar semester satu sesi 1 2024/2025 dari program Diploma Teknologi Maklumat, Jabatan Teknologi Maklumat dan Komunikasi, Politeknik Muadzam Shah telah terlibat sebagai responden. Dapatan menunjukkan bahawa penggunaan EASy68K memberi impak positif terhadap pengajaran dan pembelajaran bahasa himpunan. Nilai purata min keseluruhan ialah 4.34 bersamaan 87.8% menunjukkan tahap persetujuan yang tinggi dalam aspek kebolehgunaan perisian, peningkatan kefahaman, minat pelajar dan keupayaan menulis atur cara. Hampir keseluruhan pelajar bersetuju bahawa penggunaan EASy68K telah membantu mereka memahami konsep bahasa himpunan dengan lebih mendalam, meningkatkan motivasi dan penglibatan dalam kelas serta menjadikan pembelajaran lebih interaktif dan menyeronokkan. Secara keseluruhan, EASy68K terbukti sebagai alat bantu pengajaran yang efektif, efisien dan relevan dalam meningkatkan penguasaan pelajar terhadap bahasa himpunan.

Kata kunci: Perisian, EASy68K, bahasa himpunan, alat bantu mengajar

1. PENDAHULUAN

Subjek DFC10263 *Computer Architecture* merupakan subjek yang ditawarkan kepada pelajar semester satu Diploma Teknologi Digital di Politeknik Muadzam Shah. Subjek ini mengandungi empat topik utama dan salah satunya adalah topik *Instruction Set and Assembly Language Programming*. Pelajar perlu mencapai dua hasil pembelajaran iaitu pelajar boleh menerangkan set arahan dan bahasa himpunan dan seterusnya pelajar boleh mendemonstrasi atur cara mudah dalam bahasa himpunan, operasi aritmetik dan operasi logik.

Pengajaran bahasa himpunan membolehkan pelajar memahami bagaimana perisian berinteraksi dengan perkakasan komputer pada tahap yang lebih rendah. Bahasa himpunan membolehkan pelajar menulis arahan yang dikendalikan langsung oleh pemproses, menjadikannya penting dalam memahami konsep-konsep seperti pengurusan memori, operasi aritmetik dan pengendalian data pada peringkat perkakasan. Walau bagaimanapun, pengajaran bahasa himpunan sering kali dianggap mencabar oleh pelajar terutamanya bagi mereka yang baru mempelajari subjek pengaturcaraan dan seni bina komputer. Bagi mengatasi cabaran dalam penguasaan bahasa himpunan, pelbagai perisian dan alat pembelajaran telah diperkenalkan bagi membantu pelajar memahami konsep-konsep berkaitan dengan lebih mudah dan berkesan. Antara perisian yang digunakan dalam pengajaran bahasa himpunan ialah EASy68K, iaitu persekitaran simulasi yang dibangunkan khusus untuk pengaturcaraan mikroprosesor Motorola 68K.

Perisian EASy68K telah digunakan sebagai alat bantu mengajar bahasa himpunan dalam subjek *Computer Architecture* di Politeknik Muadzam Shah. Penggunaan EASy68K dalam sesi praktikal dimulakan dengan pemasangan perisian pada komputer makmal diikuti pendedahan mengenai menu-menu dan fungsi yang ada dalam perisian tersebut. Seterusnya pelajar akan meneroka perisian ini untuk menulis atur cara dan menganalisis output yang dihasilkan. Pelajar turut didedahkan dengan kaedah mengenal pasti dan memperbaiki ralat dalam atur cara yang ditulis.

Oleh itu, kajian ini dijalankan bagi menilai keberkesanan penggunaan perisian EASy68K dalam meningkatkan kefahaman pelajar terhadap bahasa himpunan. Kajian ini turut menumpukan perhatian kepada sejauh mana kaedah pengajaran berasaskan perisian dapat membantu pelajar memahami konsep-konsep bahasa himpunan dengan lebih mendalam. Dengan meneliti persepsi pelajar terhadap penggunaan perisian ini sebagai alat bantu pengajaran, kajian ini diharapkan dapat memberikan gambaran yang lebih jelas mengenai manfaat dan cabaran penggunaan perisian, khususnya dalam subjek DFC20163 *Computer Architecture* di Politeknik Muadzam Shah.

1.1. Penyataan Masalah

Pengajaran dan pembelajaran bahasa himpunan adalah komponen penting dalam pendidikan teknologi komputer. Walaupun perisian EASy68K telah digunakan secara meluas, masih terdapat kekurangan dalam pemahaman mengenai tahap keberkesanan penggunaannya dalam meningkatkan pemahaman pelajar terhadap konsep-konsep penting dalam bahasa himpunan. Terdapat kebimbangan mengenai tahap kebolehgunaan dan reka bentuk antara muka perisian yang mungkin mempengaruhi pengalaman pelajar serta sejauh mana perisian ini dapat meningkatkan penglibatan pelajar dalam proses pembelajaran. Selain itu, kemahiran pelajar dalam menulis atur cara menggunakan perisian EASy68K juga perlu dinilai untuk memastikan bahawa perisian ini dapat memberi impak yang positif terhadap pencapaian akademik pelajar dalam subjek berkenaan. Oleh itu, kajian ini diperlukan untuk menilai dan memberi gambaran yang lebih jelas tentang keberkesanan perisian EASy68K dalam mencapai objektif pembelajaran bahasa himpunan di kalangan pelajar.

1.2. Objektif Kajian

Objektif am kajian ini adalah untuk menilai keberkesanan perisian EASy68K dalam pembelajaran bahasa himpunan. Antara objektif khusus kajian ini adalah:

- i. Menganalisis tahap kebolehgunaan dan reka bentuk antara muka perisian EASy68K.
- ii. Menilai tahap pemahaman konsep dan penglibatan pelajar dalam penggunaan perisian EASy68K sepanjang proses pembelajaran.
- iii. Mengukur tahap kemahiran pelajar dalam penulisan atur cara menggunakan perisian EASy68K.

1.3. Persoalan Kajian

Berikut adalah persoalan kajian berdasarkan objektif kajian:

- i. Bagaimanakah kebolehgunaan dan reka bentuk antara muka perisian EASy68K mempengaruhi pengalaman pengguna?
- ii. Sejauh manakah perisian EASy68K meningkatkan pemahaman dan penglibatan pelajar dalam proses pembelajaran bahasa himpunan?
- iii. Bagaimanakah perisian EASy68K mempengaruhi kemahiran pelajar dalam penulisan atur cara?

2. KAJIAN LITERATUR

Alat bantu mengajar merupakan sebahagian daripada media pengajaran yang merujuk kepada bahan audio visual serta bahan berkaitan yang digunakan dalam pelaksanaan pengajaran dan pembelajaran (De Abreu, 2019). Justeru, alat bantu ini memainkan peranan dalam menyokong keberkesanan proses pengajaran dan pembelajaran. Dalam era digital masa kini, penggunaan teknologi seperti perisian

simulasi dan interaktif semakin mendapat tempat dalam bilik kuliah. Penggunaan alat bantu mengajar interaktif turut dikenal pasti sebagai pendekatan yang berkesan dalam meningkatkan kefahaman dan minat pelajar terhadap subjek pengaturcaraan. Kajian oleh Mohd Yusoff et al. (2021) menunjukkan bahawa bahan pengajaran interaktif mampu membantu pelajar memahami konsep asas pengaturcaraan dengan lebih baik di samping meningkatkan motivasi mereka dalam proses pembelajaran. Elemen visual, simulasi dan interaktif dalam alat bantu tersebut menjadikan sesi pengajaran lebih menarik dan mudah difahami.

Selain itu, kajian oleh Quah, Banua dan Zulkifle (2023) menekankan keberkesanan pembelajaran berasaskan permainan dalam kursus asas pengaturcaraan. Pendekatan ini bukan sahaja meningkatkan minat dan sikap positif pelajar, malah menggalakkan penglibatan aktif dan keseronokan dalam pembelajaran. Pelajar menunjukkan kecenderungan yang lebih tinggi untuk menyelesaikan tugas dan memahami konsep apabila kaedah pembelajaran bersifat interaktif dan menyeronokkan digunakan. Di samping itu, pengaturcara yang menggunakan perisian untuk menulis dan menguji kod secara langsung memperoleh pemahaman yang lebih mendalam mengenai pengaturcaraan berbanding mereka yang hanya bergantung kepada pembelajaran secara teori (Nariman, 2020). EASy68K memberikan peluang kepada pelajar untuk meningkatkan kemahiran penulisan atur cara dengan menyediakan persekitaran pembelajaran yang lebih praktikal. Dengan menggunakan EASy68K, pelajar tidak memerlukan mikroprosesor fizikal atau papan litar, menjadikannya lebih mudah dan kos efektif untuk pendidikan dan latihan terutamanya di institusi yang tidak mempunyai peralatan yang mahal.

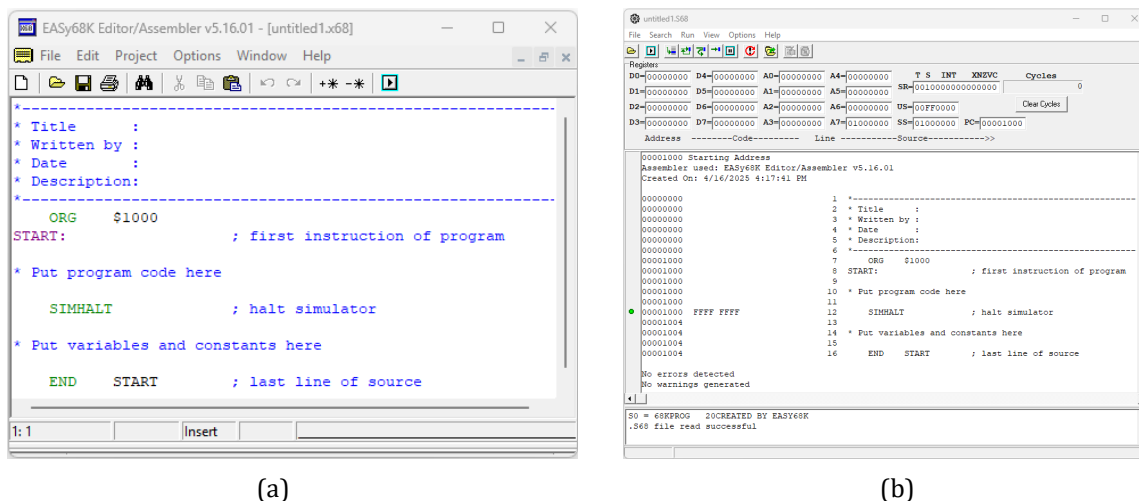
Bahasa himpunan adalah bahasa pengaturcaraan yang digunakan untuk menulis atur cara pada tahap yang sangat rendah, hampir dengan bahasa mesin (Allibang, 2020). Bahasa ini direka untuk memberikan pengaturcara kawalan langsung terhadap perkakasan komputer, membolehkan mereka menulis kod yang lebih efisien dan mengawal cara perkakasan melaksanakan arahan tertentu (Stallings, 2018). Sebagai perbandingan, bahasa pengaturcaraan yang lebih tinggi seperti C atau Python menyediakan tahap pengabstrakan yang lebih tinggi tetapi tidak memberi kawalan yang mendalam terhadap perkakasan (Bryant & O'Hallaron, 2015). Walaupun bahasa-bahasa ini memudahkan proses pembangunan, ia tidak memberikan kawalan yang mendalam terhadap perkakasan, menjadikannya kurang efisien dalam situasi yang memerlukan prestasi tinggi (Larson & Kim, 2008). Salah satu kelebihan utama bahasa himpunan adalah kemampuannya memberikan kawalan penuh kepada pengaturcara terhadap perkakasan, membolehkan mereka menulis program yang dioptimumkan untuk kelajuan dan penggunaan sumber yang lebih efisien (Wassberg, 2020). Oleh itu, bahasa himpunan sering digunakan dalam pembangunan perisian sistem, pengaturcaraan terbenam (*embedded programming*) serta dalam situasi yang memerlukan prestasi tinggi dan kawalan khusus terhadap perkakasan seperti dalam sistem pengendalian perkakasan atau pembangunan peranti elektronik (Wolf, 2008).

Dalam sains komputer, pengaturcaraan bahasa himpunan tidak hanya terhad kepada tujuan praktikal yang segera seperti manipulasi perkakasan secara langsung dan pengoptimuman prestasi, tetapi juga melibatkan aspek-aspek yang lebih mendalam (Nath, 2024). Bahasa himpunan memberikan peluang kepada pengaturcara untuk memahami dengan lebih terperinci bagaimana komputer berfungsi pada tahap yang lebih rendah, seperti cara arahan diproses oleh pemproses dan bagaimana memori dikendalikan (Sarangi, 2021). Selain itu, penguasaan bahasa himpunan membolehkan pengaturcara untuk meningkatkan kecekapan penggunaan sumber sistem dengan lebih efisien dan menguasai konsep-konsep asas yang menjadi landasan bagi pengaturcaraan dalam bahasa yang lebih tinggi (Streib, 2020). Sebagai contoh, apabila pengaturcara memahami cara arahan mesin diproses dan pengurusan memori, mereka akan dapat merancang dan menulis kod yang lebih cekap dan lebih berkualiti.

Dalam penulisan aturcara bahasa himpunan, pelajar sering menghadapi kesukaran dalam penulisan atur cara bahasa himpunan, termasuk mentafsir tugas, memahami ungkapan aritmetik dan membina reka bentuk program yang betul (Gobil et al., 2009). Kesukaran ini lebih ketara apabila pembelajaran berfokus kepada teori semata-mata (Quah et al., 2023). Kekangan dalam membina kemahiran pengaturcaraan turut menjejaskan keupayaan pelajar menulis dan memahami kod dengan berkesan. Penggunaan perisian EASy68K membantu mengatasi masalah ini dengan memudahkan pemahaman pelajar terhadap konsep aras rendah seperti terjemahan arahan kepada kod mesin dan pengendalian

data oleh mikroprosesor. Bahasa himpunan berfungsi sebagai antara muka pengaturcaraan yang paling dekat dengan perkakasan. Setiap jenis mikroprosesor, seperti Motorola 68K, Intel x86 dan Advanced RISC Machines (ARM) mempunyai set arahan tersendiri dan setiap arahan dalam set tersebut boleh diprogramkan melalui bahasa himpunan (Hyde, 2021). Set arahan ini berbeza mengikut seni bina mikroprosesor masing-masing. Contohnya, Mikroprosesor Motorola 68K menggunakan set arahan yang lebih kompleks berbanding mikroprosesor yang lebih sederhana (Comer, 2024). Bahasa himpunan untuk 68K menyokong pelbagai operasi aritmetik, logik dan pengurusan memori yang berbeza.

EASy68K ialah perisian simulasi yang direka khusus untuk pengajaran bahasa himpunan bagi mikroprosesor Motorola 68K (Khan, 2024). Ia menyediakan persekitaran pengaturcaraan yang mesra pengguna melalui antara muka grafik, membolehkan pengguna menulis, menyusun dan menguji kod tanpa memerlukan perkakasan sebenar. Ciri ini menjadikannya alat bantu mengajar yang berkesan, khususnya dalam pendidikan tinggi seperti di politeknik dan universiti (López et al., 2008). Perisian ini turut menyediakan alat penyahpepitan (*debugging tools*) yang membantu pelajar menjejak pelaksanaan kod secara terperinci, mengenal pasti ralat dan memperbaikinya (Null, 2023). Dengan itu, pelajar dapat memahami konsep asas seperti pengurusan memori, kawalan aliran dan operasi logik secara lebih mendalam. Tambahan pula, antara muka yang mudah digunakan menjadikan EASy68K sesuai untuk pelajar baharu, di samping menjimatkan kos dan mengatasi keperluan kepada mikroprosesor.



(a) (b)
Rajah 1: (a) Editor EASy68K, (b) Paparan output EASy68K

Untuk menggunakan EASy68K, pelajar menulis kod bahasa himpunan dalam editor yang disediakan seperti Rajah 1(a), di mana sebarang ralat akan dipaparkan secara automatik. Perisian ini juga memaparkan output program seperti yang ditunjukkan dalam Rajah 1(b), termasuk nilai-nilai dalam pendaftar dan memori. Ciri-ciri ini membolehkan pelajar memahami dengan lebih jelas proses pengurusan data dalam mikroprosesor 68K. Secara keseluruhan, bahasa himpunan memainkan peranan yang penting dalam pendidikan pengaturcaraan kerana ia memberikan pelajar pemahaman mendalam tentang cara komputer memproses arahan pada tahap perkakasan dan bagaimana kod mesin berfungsi. Pemahaman ini membolehkan pelajar menguasai asas-asas pengaturcaraan yang kritikal dan memperkukuhkan kemahiran teknikal yang diperlukan untuk memahami dan bekerja dengan sistem komputer secara lebih efektif.

3. METODOLOGI KAJIAN

Metodologi kajian ini merangkumi reka bentuk kajian, kaedah pengumpulan data serta teknik analisis yang digunakan. Kajian ini menggunakan pendekatan tinjauan kuantitatif bagi menilai keberkesanan penggunaan perisian EASy68K dalam pengajaran dan pembelajaran topik bahasa himpunan dalam kalangan pelajar. Pendekatan ini dipilih kerana ia membolehkan pengumpulan data daripada sampel pelajar yang seterusnya dapat digunakan untuk membuat generalisasi terhadap populasi secara

keseluruhan (Gül, 2023). Bagi memastikan kesahan instrumen, soal selidik yang digunakan telah melalui proses semakan kandungan oleh panel pakar dalam bidang pengajaran dan pembelajaran. Semakan ini bertujuan untuk memastikan setiap item adalah jelas dan sejajar dengan objektif kajian. Selain itu, penambahbaikan turut dilakukan terhadap item-item tertentu berdasarkan maklum balas yang diterima, bagi menjamin kejelasan dan kesesuaian instrumen sebelum digunakan dalam kajian.

Seramai 131 orang pelajar semester satu sesi 1 2024/2025 bagi program Diploma Teknologi Maklumat yang mendaftar subjek DFC20163 di Politeknik Muadzam Shah telah dipilih secara rawak sebagai sampel kajian. Soal selidik terdiri daripada dua bahagian: Bahagian A (demografi) dan Bahagian B (penggunaan EASy68K, penguasaan bahasa himpunan, minat, motivasi, penglibatan dan kecekapan tugas) menggunakan skala Likert lima mata (S, 2020). Data dikumpul secara dalam talian melalui Google Form selepas sesi pengajaran dan dianalisis secara deskriptif menggunakan perisian statistik bagi menentukan min dan peratusan. Analisis ini membantu mengenal pasti corak pemahaman dan impak penggunaan perisian terhadap proses pembelajaran pelajar.

4. HASIL DAPATAN KAJIAN

Hasil analisis Bahagian A responden melibatkan jantina dan kelas responden. Rajah 3(a) menunjukkan bahawa peratusan responden lelaki dalam kajian ini adalah 41% manakala 59% adalah responden perempuan. Sementara itu, Rajah 3(b) menunjukkan pecahan empat kelas responden, dengan 26.7% dari kelas DIT1A, 26% dari kelas DIT1B, 22.1% dari kelas DIT1C dan 25.2% dari kelas DIT1D.



Rajah 3: (a) Jantina responden, (b) Kelas responden

Seterusnya, analisis hasil dapatan Bahagian B dibahagikan kepada tiga aspek iaitu kemudahan penggunaan dan antara muka perisian EASy68K, peningkatan pemahaman serta penglibatan dalam proses pembelajaran dan kemahiran serta keberkesanan dalam penulisan atur cara.

Jadual 1: Kemudahan penggunaan dan antara muka perisian EASy68K

Bil	Item	Skor Min
1	Antara muka perisian EASy68K mesra pengguna dan sesuai untuk pelajar dari pelbagai tahap pengetahuan.	4.40
2	Perisian EASy68K menjadikan pembelajaran bahasa himpunan lebih mudah, interaktif dan berkesan.	4.35
3	Perisian EASy68K menjadikan pembelajaran bahasa himpunan lebih menarik.	4.44
Nilai purata min: 4.40		

Berdasarkan Jadual 1, analisis kemudahan penggunaan dan antara muka perisian EASy68K menunjukkan bahawa perisian ini sangat berkesan dalam meningkatkan pengalaman pembelajaran bahasa himpunan. Skor item pertama iaitu 4.40 menunjukkan bahawa kebanyakan pelajar merasakan antara muka perisian ini mesra pengguna dan sesuai untuk pelajar dari pelbagai tahap pengetahuan, menjadikannya mudah diakses oleh pelajar tanpa mengira pengalaman mereka dalam pengaturcaraan. Selain itu, skor 4.35 bagi item kedua menunjukkan bahawa EASy68K berjaya menjadikan pembelajaran bahasa himpunan lebih mudah, interaktif dan berkesan. Skor tertinggi iaitu 4.44 bagi item ketiga pula menggambarkan bahawa perisian ini berjaya menjadikan pembelajaran lebih menarik sekali gus meningkatkan minat pelajar terhadap topik yang sering dianggap sukar atau membosankan. Secara keseluruhan, nilai purata min 4.40 mencerminkan bahawa EASy68K adalah perisian yang sangat berguna dalam pendidikan bahasa himpunan, memberikan pengalaman pembelajaran yang mudah dan menarik serta berkesan.

Jadual 2: Peningkatan pemahaman dan penglibatan dalam proses pembelajaran

Bil	Item	Skor Min
1	Penggunaan perisian EASy68K membantu saya memahami konsep bahasa himpunan.	4.35
2	Penggunaan perisian EASy68K meningkatkan pemahaman saya tentang bahasa himpunan.	4.34
3	Penggunaan perisian EASy68K meningkatkan minat saya terhadap bahasa himpunan.	4.32
4	Penggunaan perisian EASy68K meningkatkan penglibatan saya dalam pembelajaran.	4.35
5	Penggunaan perisian EASy68K meningkatkan motivasi saya untuk belajar bahasa himpunan.	4.32

Nilai purata min: 4.34

Berdasarkan Jadual 2, hasil skor purata min 4.34 menunjukkan penggunaan perisian EASy68K memberikan impak yang sangat positif terhadap pelajar dalam memahami dan meningkatkan minat serta penglibatan mereka dalam pembelajaran bahasa himpunan. Skor tertinggi yang diperoleh iaitu 4.35, menunjukkan bahawa pelajar merasakan perisian ini sangat membantu mereka dalam memahami konsep dan meningkatkan penglibatan mereka dalam proses pembelajaran. Selain itu, perisian ini berjaya meningkatkan motivasi pelajar untuk terus belajar bahasa himpunan dengan skor min yang hampir konsisten tinggi iaitu 4.32. Ini menunjukkan bahawa EASy68K bukan sahaja memperkukuhkan pemahaman konsep teknikal bahasa himpunan tetapi juga mampu menarik minat dan meningkatkan komitmen pelajar dalam subjek yang sering dianggap sukar dan membosankan.

Jadual 3: Kemahiran dan keberkesanan dalam penulisan atur cara

Bil	Item	Skor Min
1	Saya boleh menulis atur cara bahasa himpunan untuk mod-mod pengalamatan menggunakan perisian Easy68K.	4.33
2	Saya boleh menulis atur cara bahasa himpunan untuk operasi aritmetik (contoh: ADD, SUB, DIVU, MULU) menggunakan perisian Easy68K.	4.43
3	Saya boleh menulis atur cara bahasa himpunan untuk operasi logik (contoh: OR, NOT, AND) menggunakan perisian Easy68K.	4.42
4	Perisian EASy68K meningkatkan kemampuan saya untuk menyiapkan tugas dengan lebih cekap dan yakin.	4.38

Nilai purata min: 4.39

Berdasarkan Jadual 3, analisis kemahiran dan keberkesanan dalam penulisan atur cara menggunakan perisian EASy68K menunjukkan keputusan yang sangat positif. Skor min tertinggi iaitu 4.43 bagi item kedua menunjukkan bahawa pelajar dapat menulis atur cara bahasa himpunan untuk operasi aritmetik seperti ADD, SUB, DIVU dan MULU dengan baik menggunakan EASy68K. Begitu juga skor 4.42 bagi item ketiga menunjukkan kemahiran pelajar sangat baik dalam menulis atur cara untuk operasi logik seperti OR, NOT dan AND. Skor 4.33 bagi item pertama menunjukkan pelajar berasa yakin dalam menulis atur cara untuk mod-mod pengalamatan menggunakan perisian ini. Secara keseluruhan, skor purata min 4.39 mencerminkan bahawa EASy68K sangat berkesan dalam meningkatkan kemahiran penulisan atur cara, meningkatkan kecekapan dan keyakinan pelajar dalam menyiapkan tugas pengaturcaraan bahasa himpunan.



Rajah 4: Kebolehgunaan perisian EASy68K

Berdasarkan Rajah 4, majoriti responden iaitu sebanyak 86% melaporkan bahawa perisian EASy68K mudah dan cekap digunakan, menunjukkan bahawa ia berjaya memenuhi ciri mesra pengguna dan sesuai untuk pelajar dari pelbagai tahap pengetahuan. Reka bentuk antara muka dan fungsinya memberi kesan positif terhadap pengalaman pengguna. Namun, 14% responden menghadapi kesukaran disebabkan oleh kurang pengalaman teknikal dan cabaran penyesuaian awal. Secara keseluruhannya,

maklum balas menunjukkan bahawa EASy68K merupakan alat bantu mengajar yang berkesan, mesra pengguna dan mudah diakses, walaupun sokongan tambahan diperlukan bagi segelintir pelajar yang menghadapi cabaran dalam penggunaannya.

5. KESIMPULAN

Kesimpulannya, kajian ini menunjukkan bahawa penggunaan perisian EASy68K dalam proses pengajaran dan pembelajaran topik bahasa himpunan bagi subjek DFC10263 *Computer Architecture* adalah sangat berkesan. Sebahagian besar pelajar mendapati perisian ini membantu mereka memahami konsep bahasa himpunan dengan lebih mendalam serta meningkatkan kefahaman teori dan amali dalam penulisan atur cara. Penggunaan EASy68K juga berjaya meningkatkan minat pelajar terhadap subjek ini sekaligus menjadikan proses pembelajaran lebih interaktif, menarik dan berkesan. Selain itu, kajian mendapati bahawa perisian ini memberi impak positif terhadap motivasi pelajar, tempoh penyelesaian tugas dan tahap kebolegunaan perisian. Kebanyakan pelajar berpuas hati dengan antara muka yang mesra pengguna dan reka bentuk yang efisien, menjadikannya mudah digunakan dalam sesi pembelajaran. Penggunaan perisian ini juga berjaya meningkatkan motivasi dan penglibatan pelajar dalam pengajaran serta membantu mereka menyiapkan tugas dengan lebih pantas dan tepat.

Walau bagaimanapun, kajian ini mempunyai beberapa limitasi. Ia hanya melibatkan satu kohort pelajar dan tidak mewakili keseluruhan populasi pelajar. Penilaian juga dibuat berdasarkan persepsi pelajar semata-mata tanpa mengambil kira data prestasi akademik yang lebih terperinci. Sehubungan itu, kajian masa hadapan disarankan melibatkan lebih ramai responden merentasi beberapa kohort dan memasukkan analisis prestasi sebenar pelajar. Di samping itu, penyediaan modul latihan atau video tutorial dicadangkan bagi menyokong pembelajaran sendiri. Penggunaan perisian ini juga boleh diterapkan dalam tugas berasaskan projek untuk meningkatkan kemahiran praktikal dan pendedahan kepada situasi sebenar industri.

Secara keseluruhan, perisian EASy68K terbukti menjadi alat bantu mengajar yang sangat efektif dalam meningkatkan kemahiran serta penglibatan pelajar dalam pembelajaran bahasa himpunan. Penggunaannya berjaya memperkukuh pemahaman pelajar terhadap konsep teori dan praktikal, di samping meningkatkan interaksi antara pelajar dan bahan pembelajaran secara langsung. Selain antara muka yang mesra pengguna, ciri simulasi interaktif membolehkan pelajar melihat hasil kerja mereka secara terus, menjadikan pemahaman konsep lebih mudah dan berkesan. Ini seterusnya menjadikan proses pembelajaran lebih menyeronokkan, meningkatkan penguasaan pelajar dalam bahasa himpunan dan memupuk kemahiran teknikal dan vokasional secara menyeluruh. Dengan pendekatan pembelajaran yang interaktif dan praktikal, pelajar bukan sahaja dapat mengukuhkan kemahiran teknikal mereka, malah turut membina keyakinan diri untuk menghadapi cabaran industri pada masa akan datang.

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An Exploratory Study on the Influence of Carrymark Disclosure and Past Year Question Written Practice on Motivation and Preparedness among Hospitality Law Students

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ABSTRACT

Ensuring motivation and preparedness for final examinations remains a challenge for Diploma in Hotel Management (DHM) students at Politeknik Ibrahim Sultan (PIS), who often lack prior legal exposure. This exploratory study investigates how transparent carrymark disclosure and structured practice using past-year questions relate to students' motivation, preparedness, and performance in the Hospitality Law course. A total of 40 DHM students participated. Data were collected via an online survey and triangulated with Microsoft Teams submission records. Descriptive analysis revealed that 55% of students were aware of their carrymark, and although 98% claimed to have practised past-year questions, only 35% had submitted written work. Students who were aware of their carrymark showed higher motivation levels and mean final scores. Those who submitted written practice also scored higher on average, but this was less conclusive due to limited group variation. Mean scores for motivation, confidence, and preparedness were all high ($M \approx 4.2$, $SD < 1.0$). These findings suggest that formative strategies such as carrymark transparency and enforced revision can be positively associated with academic motivation and perceived readiness. The study underscores the need for continuous feedback and active follow-through in revision practices. Future studies should expand this inquiry to other hospitality programmes and institutions.

Keywords: Carrymarks; motivation; final examination; formative assessment; Technical and Vocational Education and Training (TVET); Hospitality Law; pedagogy

1. INTRODUCTION

The contemporary hospitality industry, characterized by intense competition, necessitates that graduates possess not only robust technical and managerial competencies but also a profound understanding of legal principles. This legal acumen is indispensable for ensuring regulatory compliance, mitigating potential liabilities, and safeguarding the multifaceted interests of various stakeholders within the sector (Heo & Lee, 2019; Hussin et al., 2022; Yeoh & Ong, 2020). Consequently, the Hospitality Law course has been integrated as a core subject within the Diploma in Hotel Management (DHM) curriculum at Politeknik Ibrahim Sultan. This strategic inclusion aims to cultivate fundamental legal literacy directly applicable to the hospitality and tourism domains, motivation and readiness, which are recognised as critical factors for student success in TVET pathways, further emphasise the need for transparent and supportive assessment practices that can sustain students' engagement and self-regulation (Omar & Nordin, 2024). This pedagogical alignment also resonates with the Malaysian Qualifications Agency's (MQA) Programme Standards for Arts and Design, which emphasize the cultivation of broad generic skills, including incisive analysis, logical reasoning, creative problem-solving, clear communication, and practical negotiation abilities (Ismail et al., 2019; MQA, 2020; Razak & Patel, 2020).

Despite these curricular advancements, a significant pedagogical challenge pertains to the substantial proportion of DHM students who originate from non-legal academic backgrounds. This often results in a discernible lack of prior experience in interpreting statutory provisions, which has been observed to contribute to diminished confidence, a propensity towards passive learning approaches, and inconsistencies in performance during summative assessments (Hunter & Lauchland, 2019; Razak et al., 2020; Ridley, 1994; Timmerman, 2017).

To effectively mitigate these concerns, existing literature consistently highlights that the implementation of transparent continuous assessment and the provision of timely, constructive feedback can profoundly influence student motivation, enhance engagement, and foster the development of self-directed learning capabilities, particularly within Technical and Vocational Education and Training (TVET) contexts (Filgona et al., 2020; Hattie & Timperley, 2007; Jabarullah & Hussain, 2019; Nicol & Macfarlane-Dick, 2006). A salient example of this strategy involves the early disclosure of continuous assessment grades, commonly known in Malaysia as “carry marks” — which represent the portion of coursework marks accumulated before the final examination. This transparency empowers students to promptly ascertain their academic standing, thereby facilitating the identification of areas requiring improvement and the timely initiation of remedial actions well in advance of final examinations (Carless & Boud, 2018; Razak et al., 2020; Yorke, 2003). Another commonly used strategy is to engage with past-year examination questions, which helps students anticipate exam trends and familiarizing oneself with question formats, which can help students feel more prepared and confident during high-stakes assessments (Ontong & Bruwer, 2020; Race, 2015).

Building on these insights and gaps, this study aims to address the lack of empirical data concerning the combined effects of carrymark disclosure and past-year question practices in Malaysian polytechnic settings, particularly within the Hospitality Law course. Preliminary classroom observations revealed a disconnect between students’ perceived motivation and their actual engagement in revision efforts.

To systematically explore these issues, this paper sets out to achieve the following objectives:

- i. to examine the effect of early carrymark disclosure on students’ motivation before the final examination;
- ii. to investigate the impact of written practice using past-year examination questions on students’ confidence and preparedness; and
- iii. to assess students’ overall perception of the effectiveness of early carrymark disclosure and past-year question practice in improving academic performance. The remainder of this paper is organised as follows:

Section 2 presents a review of relevant literature; Section 3 describes the research methodology; Section 4 discusses the findings; and Section 5 concludes with implications and recommendations for future practice and research.

2. LITERATURE REVIEW

2.1. Carrymark Transparency and Continuous Assessment

Transparent continuous assessment practices have been widely acknowledged as crucial in enhancing student accountability and encouraging proactive learning behaviours (Yorke, 2003; Carless & Boud, 2018). Recent scholarship continues to reinforce this, with studies highlighting the positive impact of clear assessment criteria and timely feedback on student learning. For instance, Al-Kadiri (2020) emphasized that transparent assessment practices, including the continuous disclosure of student progress, significantly reduce student anxiety and foster a sense of fairness, thereby promoting deeper engagement. Similarly, Yñiguez-Ovando et al. (2023) demonstrated that adopting e-continuous assessment tools can strengthen feedback timeliness and accuracy, which directly supports carrymark transparency by ensuring students receive up-to-date progress information, thereby lowering dropout risks and boosting pass rates. In line with this finding, research by Chen and Wu (2021) in a higher education context demonstrated that when students are regularly informed of their carrymark, they are

better positioned to monitor their own progress and plan effective revision strategies, leading to improved self-regulation. Early carrymark disclosure has been consistently linked with reduced anxiety and increased motivation, as students gain clarity about their strengths and weaknesses prior to final examinations (Hattie & Timperley, 2007). This aligns with recent reviews confirming that formative assessment practices consistently foster students' self-efficacy and self-esteem across various learning contexts (Yan & Singh, 2022). Likewise, Li and Singh (2022) highlighted that continuous formative assessment practices foster stronger learning motivation and reinforce students' self-efficacy, especially in the Malaysian TVET context. In the context of technical and vocational education, such transparency is particularly vital, given the diverse academic preparedness of students (Filgona et al., 2020). Lim and Tan (2022) further elaborate on this, suggesting that for vocational students, tangible and consistent feedback on their performance, including carrymarks, provides crucial scaffolding for their learning journey, bridging potential knowledge gaps. Recent evidence also confirms that continuous assessment practices have a significant positive relationship with students' final examination scores, especially when students remain motivated to attend lectures and engage actively in learning activities (Egede & Omiegbe, 2023). Supporting this claim, Waskito et al. (2022) demonstrated that integrating formative assessment with timely feedback significantly improves student achievement in technical and vocational programs. Despite these positive practices, limited empirical research has specifically examined how carrymark transparency operates within Hospitality Law modules in Malaysian polytechnics, highlighting a clear need for targeted investigation in this context. This highlights a need for further research on transparent continuous assessment within Hospitality Law modules at the polytechnic level and emphasises the importance of understanding students' motivation and readiness to persist in TVET contexts (Omar & Nordin, 2024). In addition to transparent carrymark disclosure, engaging students with past-year question practice represents another common strategy to strengthen exam preparedness.

2.2. Practice with Past-Year Questions

Berikut adalah persoalan kajian berdasarkan objektif kajian:

Engaging with past-year questions remains a prevalent and effective strategy among students preparing for high-stakes assessments (Race, 2015). This approach serves as a powerful diagnostic and deductive learning tool, enabling learners to predict exam trends, develop familiarity with expected question formats, and identify areas requiring further attention (Ontong & Bruwer, 2020). Recent studies continue to validate the efficacy of this method. Guo and Zhang (2019) found that consistent practice improves retention, while Ahmad and Rashid (2021) emphasised that incorporating self-correction enhances critical thinking and problem-solving skills, moving beyond mere rote memorization. Nevertheless, over-reliance on rote practice without conceptual understanding may hinder higher-order thinking (Rust, 2007). Integrating structured feedback into practice sessions helps mitigate this risk and enhances learning effectiveness to maximise the effectiveness of this traditional revision method (Nicol & Macfarlane-Dick, 2006). Poon and Wong (2023) further advocate for incorporating model answers or detailed rubrics with past-year questions to guide students toward a deeper understanding of expected responses and legal reasoning. Recent neuroscientific findings suggest that writing answers by hand, rather than typing or copying digitally, activates deeper cognitive processing and enhances long-term retention through kinaesthetic reinforcement (Mueller & Oppenheimer, 2014; Van der Weel & Van der Meer, 2020; Ibaibarriaga et al., 2025). Supporting this, a recent meta-analysis confirms that handwritten tasks consistently produce higher retention outcomes than digital note-taking in classroom contexts (Allen et al., 2020). In addition, students' motivation and self-efficacy are vital factors sustaining this practice and strengthening overall learning preparedness (Omar & Nordin, 2024). This study therefore required students to submit handwritten responses to leverage this cognitive advantage in mastering complex legal content.

Despite its popularity, studies focusing on the combined influence of past-year question practice and carrymark awareness within Hospitality Law courses, especially for non-law students, remain scarce.

2.3. Student Motivation and Self-Regulated Learning

Student motivation plays a pivotal role in academic success, serving as a primary driver for engagement and the adoption of effective self-regulated learning strategies (Filgona et al., 2020; Jabarullah & Hussain, 2019). When students receive timely feedback and clear performance indicators, they are more likely to set personal goals, monitor progress, and employ effective revision techniques (Hattie & Timperley, 2007). Recent research underscores the intricate relationship between assessment practices and student motivation. Ismail and Abdullah (2020) demonstrated that transparent assessment, including regular feedback on continuous assessment components, significantly enhances students' intrinsic motivation by providing them with a clear understanding of their progress and areas for improvement. In legal education for hospitality students, fostering motivation is particularly important to overcome the barriers posed by complex statutory language and case-based reasoning (Hunter & Lauchland, 2019; Ridley, 1994). Ong and Lee (2024) further argue that for non-law students navigating legal subjects, positive reinforcement and a clear connection between effort and performance, facilitated by transparent assessment, are crucial in sustaining their engagement and reducing feelings of intimidation. While existing literature acknowledges the role of assessment transparency and practice exercises in sustaining motivation, empirical validation in Malaysian polytechnic settings is still limited, especially for courses designed for non-law learners like Hospitality Law modules.

2.4. Identified Research Gap

In summary, prior studies consistently underline the potential benefits of transparent carrymark disclosure and structured revision using past-year questions. Both strategies individually contribute to improved student preparedness, confidence, and motivation. Yet, there is a noticeable lack of recent empirical work investigating their combined impact on student motivation and final examination performance, particularly within the specific and unique context of Hospitality Law modules offered to non-law students in Malaysian polytechnics. Addressing this significant gap, the present study aims to contribute new evidence on how these traditional and transparent assessment practices interact to influence learner motivation and academic achievement, offering valuable insights for pedagogical enhancements in vocational legal education.

3. METHODOLOGY

3.1. Research Design

This study employed a quantitative research design utilizing a descriptive and correlational approach to investigate the influence of carrymark transparency and past-year written practice on students' motivation and final examination performance in a Hospitality Law course. A cross-sectional survey method was adopted, allowing for the collection of data on respondents' perceptions, self-reported behaviours, and academic outcomes at a specific point in time (Creswell, 2014; Hair et al., 2018). This design is particularly suitable for exploring relationships between variables without direct manipulation, providing insights into prevailing conditions and associations within the target population (Fraenkel et al., 2012).

3.2. Population and Sampling

The target population for this study comprised students enrolled in the Diploma in Hotel Management (DHM) programme at Politeknik Ibrahim Sultan (PIS) who were undertaking the Hospitality Law module. Specifically, participants were drawn from Semester 4 classes (DHM4A and DHM4B), which constituted the primary cohort exposed to the course's regular assessment and teaching practices to broaden the range of student experiences and provide richer variation for examining carrymark awareness and practice engagement within the module, a small number of Semester 5 students who were either repeating the Hospitality Law course or taking it for the first time in the current semester were included.

A purposive sampling technique was employed to select participants, ensuring that all respondents had direct exposure to both the continuous carrymark disclosure process and opportunities for past-year question practice within the same academic semester. This non-probability sampling method was chosen to intentionally select information-rich cases relevant to the research questions (Palinkas et al., 2015). A total of 40 students voluntarily participated in the study. While this sample size might be considered modest, it represents a significant proportion of the specific cohort taking the Hospitality Law module at PIS during the study period, offering focused insights into this niche context. However, the modest sample size and context-specific focus limit the generalizability of findings beyond the immediate cohort. While sufficient for exploratory insights, future studies with larger and more diverse samples across multiple institutions are needed to strengthen external validity.

3.3. Data Collection Procedures

Data collection followed a two-step quantitative process designed to enhance data credibility through cross-verification. First, quantitative data on students' perceptions, motivation levels, confidence, and self-reported engagement with past-year practice were gathered through an online questionnaire. The survey instrument was administered via Google Forms, ensuring ease of access and data compilation. All questions were closed-ended, primarily utilizing a five-point Likert scale (e.g., 1 = Strongly Disagree to 5 = Strongly Agree) to quantify perceptions effectively (Dillman et al., 2014).

Second, actual records of students' practice submissions were retrieved from Microsoft Teams to cross-check self-reported responses, providing an objective measure of engagement with past-year questions. This triangulation of self-reported and objective data strengthened the internal validity of the findings (Patton, 2015). Final examination scores for all participating students were also obtained from official academic records, offering a direct measure of academic performance. Specifically, students were required to submit handwritten responses, building on proven advantages for deeper cognitive processing (see 2.2).

3.4. Instrumentation

The primary research instrument was a self-administered questionnaire structured into several sections corresponding to the study's variables: student motivation, confidence in learning, perceived impact of carrymark transparency, and engagement with past-year questions. The items within the questionnaire were adapted from established theoretical frameworks and empirical studies in the field of educational psychology and assessment, specifically drawing insights from Hattie & Timperley (2007) on feedback and motivation, and Nicol & Macfarlane-Dick (2006) on formative assessment and self-regulation.

To ensure content validity, the initial draft of the questionnaire underwent rigorous expert review. Two experienced lecturers specializing in hospitality education and curriculum development at the polytechnic level critically evaluated the relevance, clarity, and comprehensiveness of each item, providing feedback for refinement. A pilot test was subsequently conducted with five students who were representative of the target population but not part of the main study sample. This pilot aimed to assess the questionnaire's clarity, comprehensibility, and to identify any ambiguities or issues with the Likert scale phrasing. Based on feedback from the pilot test, minor revisions were implemented to enhance the instrument's overall reliability and usability.

3.5. Data Analysis

The collected quantitative data were meticulously coded and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) software, Version 28.0 (IBM Corp.). To summarize the key characteristics of the data, frequencies, means, and standard deviations were computed for all Likert-scale items and demographic variables.

To investigate the relationship between practice engagement and self-reported behaviours, cross-tabulation was performed between the extracted practice submission rates from Microsoft Teams and

students' self-reported engagement levels from the questionnaire. This allowed for the identification of discrepancies or consistencies, enriching the interpretation of the data.

A comparative descriptive analysis was also conducted to examine potential differences in final examination scores. Specifically, independent samples t-tests were conducted to compare mean final examination scores between groups (e.g., high engagement vs. low engagement in past-year practice, or groups with perceived high vs. low carrymark transparency), after verifying assumptions such as normality and homogeneity of variance. Where assumptions for parametric tests were not met, appropriate non-parametric alternatives, such as the Mann-Whitney U test, were utilized. While primarily descriptive, this comparative approach aimed to highlight potential associations and provide preliminary insights into the influence of the studied variables on academic performance. A cross-tabulation analysis was also performed to compare students' self-reported engagement with the actual written practice submission records obtained from Microsoft Teams. This step enabled the identification of discrepancies or consistencies between perceived and documented practice behaviours, enriching the interpretation of the quantitative data.

3.6. Ethical Considerations

The ethical integrity of the research was paramount throughout the study. Formal approval for conducting the research was obtained from the relevant academic authorities at Politeknik Ibrahim Sultan. Informed consent was meticulously obtained from all respondents prior to their participation. This included providing a clear explanation of the study's purpose, the voluntary nature of participation, the right to withdraw at any time without penalty, and assurances regarding the use of their data. Anonymity and confidentiality were strictly maintained for all participants. No personally identifiable information was collected in the online questionnaire. While practice submission records from Microsoft Teams were accessed, these were de-identified and aggregated for analysis to ensure individual privacy. All collected data were stored securely on password-protected devices, accessible only to the primary researcher, and will be retained for a period consistent with institutional research ethics policies before secure deletion. The study rigorously adhered to the research ethics guidelines and policies stipulated by Politeknik Ibrahim Sultan, ensuring the well-being and rights of all participants.

4. RESULTS

This study involved a total of 40 students from the Hospitality Law course, purposely to explore the influence of carrymark disclosure and past-year question written practice on their motivation, confidence and preparedness. Three core constructs were measured using validated items, with high internal consistency as shown in Table 1.

Table 1: Reliability Statistics

Item	Cronbach's Alpha	No. of items
Motivation	.867	3
Preparedness	.923	2
Performance Perception	.951	2

Overall, the mean scores (Table 2) indicate that students generally agreed or strongly agreed with the statements related to motivation, preparedness, and confidence. The low standard deviations in most items suggest a consistent response pattern across the group, especially in areas of preparedness and performance perception.

Table 2: Descriptive Analysis

Questionnaire Item	Mean Score	SD
Motivation1 (Q5)	3.8500	1.29199
Motivation2 (Q6)	4.0750	1.04728
Motivation3 (Q7)	4.2000	.99228
Preparedness1 (Q9)	4.6000	.59052
Preparedness2 (Q10)	4.5250	.71567

Questionnaire Item	Mean Score	SD
Confidence (Q11)	4.5750	.59431
PerformancePerception1 (Q12)	4.6000	.59052
PerformancePerception2 (Q13)	4.5250	.64001

An independent samples t-test showed statistically significant differences in motivation levels between students who knew and those who did not know their carrymarks (see Table 3).

Table 3: Independent Sample t-Test

CarrymarkAware	t	Sig. (2-tailed)
Motivation1	7.214	0.000
Motivation2	5.997	0.000
Motivation3	4.563	0.000

Note: Carrymark Awareness (1 = Aware, 0 = Not Aware)"

Nevertheless, the effect of written practice of past-year questions was limited due to an imbalance in response (only 1 student did not practice), and t-test results showed no statistically significant differences for preparedness or confidence based on this variable.

To measure the correlation between variables, Pearson correlation analysis showed strong and significant associations between confidence, preparedness, and performance perception. Table 4 shows that motivation was moderately correlated with performance perception.

Table 4: Correlation of Performance Perception with Other Constructs

		Motivation	Confidence
Performance Perception	Pearson Correlation	.436***	.804**
	Sig. (2-tailed)	.000	.000
	N	40	40

*** $p < .001$, ** $p < .01$, * $p < .05$

Note: Only correlations with Performance Perception are presented here for brevity.

In addition to these correlational findings, Table 5 presents a descriptive comparison of mean final grade points by carrymark awareness and actual past-year question submission. The results show that students who were aware of their carrymarks and submitted written practice generally achieved higher mean scores than their peers. However, the relatively small subgroup sizes (e.g., $N = 7-14$ per group) reduce the statistical power and limit the generalisability of these comparisons. Group sizes were also not equally distributed, particularly in terms of written submission behaviour. Thus, the observed trends should be interpreted as descriptive rather than conclusive, highlighting the need for further research with larger and more balanced samples. This discrepancy between self-reported practice and actual submission also suggests that while students recognise the value of exam practice, their actual follow-through was limited—potentially affecting genuine exam preparedness.

Table 5: Mean Final Grade Point (on 4.00 GPA Scale) by Carrymark Awareness and Past-Year Practice Submission

Group	Mean Final Grade Point (Converted)	SD	N
Aware & Submitted	3.04	0.83	8
Aware & Not Submitted	2.79	0.59	14
Not Aware & Submitted	3.43	0.74	7
Not Aware & Not Submitted	2.48	0.87	14

Note: Converted grade points use 4.00 GPA scale.

5. DISCUSSION

The findings from this study support the first research objective: revealing early carrymarks significantly increased students' motivation by clarifying performance expectations and reducing anxiety, consistent with Razak et al. (2020) and Egede & Omiegbe (2023).

Regarding the second objective, although students generally reported high confidence and preparedness, the effect of written past-year practice was inconclusive due to the very small non-practising group (N=1), limiting the reliability of any comparison. This limitation underscores the need for more balanced groups in future research.

Correlational analyses showed that preparedness, confidence, and perceived performance were strongly associated, while motivation was moderately correlated with performance perception. This aligns with Nicol & Macfarlane-Dick (2006) and Razak et al. (2020), who highlight the role of clear feedback in fostering self-regulation and preparedness.

Together, these findings affirm the third research objective: both transparent carrymark disclosure and formative practice (past-year questions) contribute to higher self-efficacy and perceived exam readiness. However, the gap between students' self-reported practice and actual submission indicates that while they understand the importance of practice, consistent follow-through was limited, highlighting an area for targeted instructional support.

Finally, the handwriting requirement in this study reinforced deeper cognitive processing and long-term retention, consistent with Mueller & Oppenheimer (2014), Van der Weel & Van der Meer (2020), and Allen et al. (2020). This suggests that encouraging handwritten revision tasks can further strengthen learning outcomes in Hospitality Law modules.

In terms of instructional design implications, these findings highlight the importance of embedding structured formative assessment and transparent feedback into course delivery. Carrymark disclosure should function not merely as administrative information, but as an active formative checkpoint that supports revision planning. Handwritten formative tasks, reinforced with deadlines and rubrics, can enhance student accountability and cognitive processing. Moreover, leveraging platforms such as Microsoft Teams allows for consistent tracking and personalised feedback, aligning with MQA's emphasis on assessment for learning and promoting proactive, self-regulated learning in TVET settings.

6. CONCLUSION AND FUTURE DIRECTIONS

This study highlights the role of early carrymark disclosure and written practice with past-year questions in enhancing students' motivation, self-efficacy, and exam readiness. Transparent assessment and active revision promote self-regulated learning though inconsistent follow-through suggests a need for better instructional support. Future studies should explore qualitative insights and broader applications to improve teaching practices for non-law students in vocational legal education.

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Pemahaman dan Sikap Pelajar MPU22071 Kursus Integriti dan Antirasuah (KIAR) Terhadap Amalan Rasuah

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ABSTRAK

Kajian ini bertujuan untuk menilai tahap pemahaman dan sikap pelajar MPU22071 Kursus Integriti dan Antirasuah (KIAR) terhadap amalan rasuah, serta mengkaji hubungan antara pemahaman rasuah dan sikap menolak rasuah. Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk tinjauan, melibatkan 83 orang pelajar. Persampelan bertujuan digunakan untuk memilih responden. Data dikumpul melalui soal selidik yang merangkumi demografi, pemahaman rasuah, sikap terhadap rasuah, sumber maklumat, dan persepsi terhadap kursus KIAR. Analisis data melibatkan statistik deskriptif dan korelasi Pearson. Dapatan analisis deskriptif menunjukkan bahawa pelajar Politeknik Ibrahim Sultan (PIS) mempunyai tahap pemahaman dan sikap yang tinggi terhadap isu rasuah, dengan kebanyakan item mencatatkan nilai min melebihi 4.00 (skala Likert 5 mata). Pelajar menunjukkan kesedaran tinggi tentang definisi rasuah dan pendirian tegas untuk tidak terlibat. Korelasi Pearson mendedahkan hubungan positif yang kuat dan signifikan antara pemahaman rasuah dan kesediaan menolak rasuah ($r=0.760$, $p<0.001$). Hasil ujian hipotesis menunjukkan bahawa pengetahuan tentang rasuah dan keupayaan memberi contoh rasuah serta sikap menolak rasuah mempunyai hubungan signifikan dengan keberkesanan kursus KIAR. Secara keseluruhannya, kajian ini mengesahkan bahawa program pendidikan antirasuah seperti KIAR adalah relevan dan berkesan dalam meningkatkan kesedaran serta membentuk sikap positif antirasuah dalam kalangan pelajar politeknik. Keberkesanan ini menyumbang kepada pembinaan komitmen moral yang kukuh dan sejajar dengan matlamat pencegahan rasuah di peringkat nasional.

Kata kunci: Kursus Integriti dan Anti Rasuah (KIAR), Pemahaman, Sikap, Amalan Rasuah

1. PENGENALAN

Rasuah merupakan salah satu isu global yang memberi impak negatif kepada pembangunan ekonomi, politik dan sosial sesebuah negara. Menurut Transparency International (2023), Malaysia mencatatkan skor 47 dalam Indeks Persepsi Rasuah (CPI), menunjukkan tahap persepsi yang sederhana tetapi masih membimbangkan. Rasuah bukan sahaja melibatkan wang atau barangan, tetapi juga merangkumi penyalahgunaan kuasa untuk kepentingan peribadi. Di peringkat nasional, Suruhanjaya Pencegahan Rasuah Malaysia (SPRM) melaporkan peningkatan jumlah kes rasuah yang melibatkan golongan muda, khususnya mereka yang berada di Institusi Pengajian Tinggi (SPRM, 2023).

Sebagai langkah konkrit untuk menyemai nilai integriti di peringkat pendidikan tinggi, kerajaan Malaysia telah memperkenalkan Kursus MPU22071: Kursus Integriti dan Antirasuah (KIAR) sebagai subjek wajib di semua politeknik di bawah Kementerian Pendidikan Tinggi (KPT). Kursus ini merupakan sebahagian daripada Mata Pelajaran Umum (MPU) yang perlu diluluskan oleh setiap pelajar sebagai syarat pengijazahan. Inisiatif ini selaras dengan aspirasi Pelan Antirasuah Nasional (NACP) 2019–2023, yang meletakkan pendidikan sebagai teras utama dalam usaha membanteras rasuah melalui pendekatan pencegahan. Pelaksanaan subjek ini bertujuan membekalkan pelajar dengan pengetahuan asas tentang konsep, bentuk dan kesan rasuah, serta membentuk sikap dan tingkah laku yang mencerminkan prinsip integriti dalam kehidupan peribadi dan profesional.

Pendidikan memainkan peranan penting dalam memupuk integriti dan nilai murni dalam kalangan pelajar (Mohamad Tarmize et al., 2020). Kursus seperti MPU22071 (KIAR) di institusi politeknik bertujuan untuk meningkatkan kesedaran, pengetahuan dan sikap pelajar terhadap isu rasuah. Namun, masih terdapat keperluan untuk menilai sejauh mana keberkesanan kursus ini dalam membentuk pemahaman dan sikap pelajar terhadap amalan rasuah. Justeru, kajian ini dijalankan untuk menilai tahap pemahaman dan sikap pelajar Politeknik Ibrahim Sultan terhadap amalan rasuah, khususnya dalam kalangan mereka yang mengikuti kursus MPU22071 (KIAR). Kajian ini diharapkan dapat memberikan gambaran awal terhadap keberkesanan pendidikan integriti di peringkat Institusi Pengajian Tinggi (IPT).

2. PENYATAAN MASALAH

Isu rasuah di Malaysia masih menjadi satu cabaran besar meskipun pelbagai langkah pencegahan telah diperkenalkan oleh pihak berkuasa. Rasuah bukan sahaja menjejaskan integriti pentadbiran awam, tetapi turut melibatkan pelbagai lapisan masyarakat termasuk golongan muda. Laporan SPRM (2023) menunjukkan bahawa terdapat peningkatan jumlah tangkapan berkaitan rasuah dalam kalangan belia berumur antara 18 hingga 30 tahun, yang merangkumi sebahagian besar pelajar institusi pengajian tinggi. Perkara ini menunjukkan bahawa wujudnya jurang antara pengetahuan teori yang diperoleh dalam bilik kuliah dengan amalan nilai integriti dalam kehidupan sebenar.

Walaupun kursus MPU22071 (KIAR) diwajibkan kepada pelajar politeknik bagi meningkatkan kesedaran dan pengetahuan tentang bahaya rasuah, tetapi keberkesanan kursus ini masih belum dikaji secara mendalam. Tambahan pula, kajian lepas lebih banyak tertumpu kepada universiti awam dan swasta, manakala kajian yang melibatkan politeknik masih terhad. Kajian seperti Baharudin (2021) menunjukkan bahawa kesedaran pelajar terhadap rasuah bergantung kepada pendedahan dan pendidikan formal yang diterima.

Ketiadaan data empirik yang komprehensif mengenai pemahaman dan sikap pelajar politeknik terhadap jenayah rasuah boleh menjejaskan usaha penambahbaikan kurikulum serta pelaksanaan intervensi pendidikan antirasuah yang bersesuaian. Oleh itu, kajian ini dijalankan untuk mengisi jurang tersebut dengan meneliti secara khusus tentang pemahaman dan sikap pelajar Politeknik Ibrahim Sultan terhadap amalan rasuah.

3. OBJEKTIF KAJIAN

- i. Menenal pasti tahap pemahaman rasuah dalam kalangan pelajar PIS
- ii. Menenal pasti sikap pelajar PIS terhadap amalan rasuah.
- iii. Mengkaji hubungan antara pemahaman rasuah dan sikap pelajar PIS terhadap amalan rasuah.

4. PERSOALAN KAJIAN

- i. Apakah tahap pemahaman rasuah dalam kalangan pelajar PIS?
- ii. Apakah sikap pelajar PIS terhadap amalan rasuah?
- iii. Bagaimanakah hubungan antara pemahaman rasuah dan sikap pelajar terhadap amalan rasuah?

5. METODOLOGI

Kajian ini menggunakan pendekatan kuantitatif dengan reka bentuk kajian berbentuk tinjauan deskriptif. Pendekatan ini dipilih bagi membolehkan penyelidik mengukur tahap pemahaman dan sikap pelajar terhadap amalan rasuah serta mengenal pasti hubungan antara kedua-dua pemboleh ubah tersebut. Kaedah ini sesuai digunakan apabila penyelidik ingin mengumpul data daripada populasi tertentu melalui instrumen soal selidik. Penyelidik menggunakan teknik sampel bertujuan (Purposive Sampling) bagi kajian tinjauan terhadap 83 orang pelajar yang mengikuti kursus MPU22071 (KIAR). Penyelidik memilih responden berdasarkan kriteria khusus, iaitu pelajar yang telah mengikuti kursus KIAR. Kaedah ini sesuai bagi kajian yang memerlukan responden yang mempunyai pengalaman atau

pendedahan yang relevan terhadap topik kajian. Menurut Etikan et al. (2016) pensampelan bertujuan ialah satu teknik pensampelan bukan kebarangkalian di mana penyelidik memilih peserta berdasarkan pengetahuan mereka, hubungan mereka dengan isu yang dikaji, dan tujuan kajian.

Instrumen kajian ini mempunyai 3 bahagian iaitu demografi, pemahaman terhadap rasuah dan sikap terhadap rasuah. Kaedah pensampelan bertujuan digunakan dan saiz sampel berdasarkan jadual penentuan saiz sample yang diberikan oleh Krejcie dan Morgan (1970). Analisis kuantitatif menggunakan SPSS melibatkan demografi, statistik deskriptif dan korelasi Pearson. Dapatan ini penting bagi menilai keberkesanan kursus KIAR dan mencadangkan penambahbaikan agar penyampaian pendidikan antirasuah lebih berkesan di institusi pengajian tinggi. Seterusnya, tafsiran nilai min untuk kajian ini berdasarkan pada 5 skala likert dalam Jadual 1.

Jadual 1: Skala 5 likert

Skala	Pemberat min skala interval	Persamaan deskriptif min
5	4.21 - 5.00	Sangat tinggi
4	3.41 - 4.20	Tinggi
3	2.61 - 3.40	Sederhana
2	1.81 - 2.60	Rendah
1	1.00 - 1.80	Sangat rendah

6. DAPATAN KAJIAN DAN PERBINCANGAN

Bab ini menganalisis data soal selidik daripada 83 pelajar semester 2 Jabatan Kejuruteraan Mekanikal di Politeknik Ibrahim Sultan yang mengikuti Kursus Integriti dan Anti Rasuah (KIAR). Tujuan utama adalah untuk menilai tahap pemahaman dan sikap pelajar terhadap rasuah serta hubungannya dengan keberkesanan kursus KIAR.

6.1. Analisis Demografi

Analisis demografi dalam kajian ini bertujuan untuk memahami ciri-ciri asas responden yang terlibat. Seramai 83 orang pelajar semester 2 dari Jabatan Kejuruteraan Mekanikal (JKM) dan Jabatan Pelancongan dan Hospitaliti (JPH) telah mengambil bahagian dalam kajian ini. Data demografi merangkumi jantina, umur dan jabatan pelajar. Maklumat ini penting bagi memastikan bahawa sampel kajian adalah seimbang dan sesuai mewakili populasi pelajar yang mengikuti kursus MPU22071 Kursus Integriti dan Anti Rasuah (KIAR) di Politeknik Ibrahim Sultan.

Jadual 2: Taburan Demografi Responden

Perkara	Kategori	Frekuensi	Peratusan (%)
Jantina	Lelaki	64	77.11
	Perempuan	19	22.89
Umur	19 tahun	60	72.29
	Lain-lain	23	27.71
Jabatan	JKM	56	67.47
	JPH	27	32.53

Daripada segi jantina, responden didominasi oleh pelajar lelaki sebanyak 77.11% berbanding perempuan sebanyak 22.89%. Kepelbagaian jantina ini juga membantu memberikan pandangan yang seimbang terhadap tahap pemahaman dan sikap terhadap amalan rasuah berdasarkan latar belakang responden yang pelbagai.

Dari segi umur, analisis menunjukkan bahawa majoriti pelajar berada pada umur 19 tahun iaitu sebanyak 72.29%. Kumpulan umur ini selaras dengan umur purata pelajar semester 2 di politeknik. Selebihnya (27.71%) terdiri daripada pelajar berumur selain daripada 19 tahun, termasuk pelajar yang berumur 18 tahun, 20 tahun dan beberapa individu lain dalam lingkungan awal 20-an. Data ini menunjukkan bahawa sebahagian besar pelajar yang terlibat dalam kajian ini berada dalam kelompok umur muda yang sedang membentuk nilai dan prinsip etika dalam kehidupan mereka, justeru sangat

sesuai dijadikan sasaran untuk intervensi pendidikan integriti seperti kursus KIAR. Dari aspek jabatan pula, sebanyak 67.47% daripada responden berasal daripada Jabatan Kejuruteraan Mekanikal (JKM) manakala 32.53% daripada Jabatan Pelancongan dan Hospitaliti (JPH).

Secara keseluruhannya, taburan demografi ini mencerminkan komposisi sebenar pelajar yang mengikuti kursus KIAR di Politeknik Ibrahim Sultan. Ia memberikan justifikasi bahawa sampel kajian adalah sesuai dan mencukupi untuk meneruskan analisis kuantitatif yang lebih mendalam dalam bab-bab seterusnya. Dengan latar belakang demografi yang seimbang dan mewakili, dapatan kajian ini dapat dianggap sebagai sah dan mempunyai kebolehgunaan dalam kalangan pelajar politeknik di Malaysia, khususnya dalam konteks pembentukan sikap antirasuah.

6.2. Analisis Deskriptif

Analisis deskriptif dijalankan bagi menilai tahap pemahaman dan sikap pelajar terhadap amalan rasuah berdasarkan 15 item soal selidik. Analisis ini menggunakan statistik min dan sisihan piawai untuk mengenal pasti purata tahap persetujuan pelajar terhadap kenyataan-kenyataan yang dikemukakan. Skala Likert 5 mata telah digunakan, iaitu 1 (Sangat Tidak Setuju) hingga 5 (Sangat Setuju). Nilai min yang tinggi menunjukkan persetujuan yang kuat terhadap item tersebut, manakala nilai sisihan piawai mencerminkan sejauh mana variasi jawapan antara responden.

Jadual 3: Statistik Deskriptif Item Soal Selidik

Bil	Item	Min	Sisihan Piawai
1	Saya tahu apa itu rasuah	4.62	0.84
2	Saya boleh memberikan contoh perbuatan rasuah	4.57	0.89
3	Saya tahu bahawa menerima hadiah sebagai balasan perkhidmatan boleh dianggap sebagai rasuah	4.12	1.25
4	Saya sedar bahawa kegagalan melaporkan rasuah boleh dikenakan tindakan undang-undang	4.48	0.82
5	Saya memahami bahawa rasuah boleh berlaku dalam pelbagai bentuk, termasuk penyelewengan	4.59	0.81
6	Saya percaya bahawa rasuah adalah perbuatan yang salah dan tidak bermoral	4.53	0.87
7	Saya akan melaporkan jika mengetahui seseorang terlibat dalam rasuah	4.54	0.92
8	Saya tidak akan terlibat dalam rasuah walaupun diberi peluang	4.60	0.88
9	Saya percaya bahawa tindakan tegas perlu diambil terhadap pelaku rasuah	4.61	0.86
10	Kursus KIAR membantu saya memahami konsep rasuah	4.55	0.88
11	Kursus ini meningkatkan kesedaran saya tentang bahaya rasuah	4.56	0.85
12	Saya berasa lebih yakin untuk menolak rasuah selepas mengikuti kursus ini	4.57	0.87
13	Kandungan kursus ini relevan dengan situasi semasa berkaitan rasuah	4.54	0.84
14	Saya mencadangkan kursus ini diteruskan dan diperluas kepada pelajar lain	4.58	0.83
15	Saya percaya bahawa nilai integriti perlu dipertahankan dalam semua situasi	4.60	0.79

Hasil analisis deskriptif mendapati bahawa kesemua 15 item mencatatkan nilai min melebihi 4.00, dengan majoriti berada dalam julat 4.50 ke atas, menunjukkan bahawa pelajar mempunyai tahap pemahaman dan sikap yang tinggi terhadap isu rasuah. Item dengan nilai min tertinggi ialah item 1 (Saya tahu apa itu rasuah) dengan min 4.62, diikuti oleh item 8 (Saya tidak akan terlibat dalam rasuah walaupun diberi peluang) dan item 9 (Saya percaya bahawa tindakan tegas perlu diambil terhadap pelaku rasuah) masing-masing dengan min 4.60 dan 4.61. Ini membuktikan bahawa para pelajar bukan sahaja mempunyai kesedaran terhadap definisi rasuah tetapi juga mempamerkan pendirian tegas untuk tidak terlibat dalam sebarang bentuk rasuah.

Item 3 (Saya tahu bahawa menerima hadiah sebagai balasan perkhidmatan boleh dianggap sebagai rasuah) pula mencatatkan min paling rendah, iaitu 4.12, dengan sisihan piawai tertinggi sebanyak 1.25. Ini menunjukkan bahawa walaupun secara purata pelajar bersetuju dengan kenyataan tersebut, terdapat sedikit kekeliruan atau perbezaan pandangan dalam kalangan responden. Ini mungkin disebabkan oleh kekeliruan antara hadiah sebagai bentuk penghargaan dan hadiah yang berniat rasuah. Justeru, aspek ini memerlukan penekanan yang lebih dalam kursus integriti seperti KIAR bagi menjelaskan sempadan antara hadiah yang dibenarkan dan perbuatan rasuah.

Item-item yang berkaitan dengan sikap dan tindakan, seperti item 7 (Saya akan melaporkan jika mengetahui seseorang terlibat dalam rasuah) dan item 8 (Saya tidak akan terlibat dalam rasuah walaupun diberi peluang) menunjukkan nilai min masing-masing 4.54 dan 4.60. Ini menunjukkan bahawa pelajar bukan sahaja memahami isu rasuah tetapi juga mempunyai kesanggupan bertindak secara proaktif untuk membanteras perbuatan tersebut. Ini adalah hasil yang positif bagi program pendidikan integriti dan menunjukkan keberkesanan pendekatan pembelajaran yang digunakan dalam kursus KIAR.

Dari sudut kesedaran terhadap kursus, item 10 hingga item 14 memberikan gambaran bahawa kursus MPU22071 diterima baik oleh pelajar. Item 11 (Kursus ini meningkatkan kesedaran saya tentang bahaya rasuah) mencatatkan min 4.56, manakala item 14 (Saya mencadangkan kursus ini diteruskan dan diperluas kepada pelajar lain) mendapat min 4.58, antara yang tertinggi dalam konstruk ini. Ini menunjukkan bahawa pelajar bukan sahaja mendapat manfaat daripada kursus, malah menyokong usaha untuk meluaskan pendedahan kursus ini kepada lebih ramai pelajar. Tambahan pula, item 15 yang menyentuh tentang nilai sejagat (Saya percaya bahawa nilai integriti perlu dipertahankan dalam semua situasi) juga mencatatkan min tinggi (4.60) dan sisihan piawai rendah (0.79), membuktikan bahawa nilai integriti sudah mula berakar umbi dalam diri pelajar.

Dari segi kebolehpercayaan jawapan, sisihan piawai keseluruhan berkisar antara 0.79 hingga 1.25. Ini menunjukkan bahawa jawapan pelajar agak konsisten dan tidak terlalu jauh berbeza antara satu sama lain. Sisihan piawai yang tinggi pada beberapa item seperti item 3 dan item 7 mencadangkan bahawa terdapat sebahagian pelajar yang masih ragu-ragu atau kurang jelas dalam tindakan sebenar yang perlu diambil, terutamanya dalam situasi melaporkan kes rasuah atau mengenal pasti bentuk hadiah yang boleh dianggap sebagai sogokan.

Secara keseluruhan, analisis deskriptif ini memberikan gambaran yang sangat positif terhadap tahap pengetahuan dan sikap pelajar di Politeknik Ibrahim Sultan terhadap isu rasuah. Dapatan ini menyokong keberkesanan kursus MPU22071 dalam meningkatkan kesedaran serta pembentukan sikap antirasuah dalam kalangan pelajar politeknik. Ia juga menunjukkan bahawa pendekatan yang digunakan oleh pensyarah serta kandungan kursus adalah sesuai dan berkesan dalam menyampaikan mesej integriti. Namun demikian, penambahbaikan dari segi memperincikan konsep rasuah dalam bentuk harian seperti hadiah dan imbuhan tetap diperlukan bagi memperkukuhkan kefahaman pelajar dan mengelakkan kekeliruan.

6.3. Analisis Korelasi

Analisis korelasi Pearson dijalankan bagi menilai hubungan linear antara tahap pemahaman pelajar mengenai rasuah dan sikap mereka terhadap penolakan rasuah. Dua item daripada soal selidik telah dipilih untuk tujuan ini, iaitu "Saya tahu apa itu rasuah" mewakili konstruk pemahaman, dan "Saya tidak akan terlibat dalam rasuah walaupun diberi peluang" mewakili konstruk sikap. Kedua-dua item dianalisis secara statistik menggunakan pekali korelasi Pearson (r) untuk menentukan kekuatan dan arah hubungan antara dua pemboleh ubah tersebut. Jadual korelasi ini dibina menyerupai format paparan dalam SPSS bagi memberikan gambaran profesional dan standard analisis data kuantitatif.

Jadual 4: Korelasi Pearson (Output SPSS)

	Saya tahu apa itu rasuah	Saya tidak akan terlibat dalam rasuah walaupun diberi peluang
Saya tahu apa itu rasuah	Pearson Correlation	1.000
	Sig. (2-tailed)	–
	N	83
Saya tidak akan terlibat dalam rasuah walaupun diberi peluang	Pearson Correlation	.760**
	Sig. (2-tailed)	.000
	N	83

Nota: Korelasi adalah signifikan pada aras 0.01 (2-hala)

Keputusan korelasi dalam Jadual 4 menunjukkan bahawa terdapat hubungan positif yang kuat dan signifikan secara statistik antara tahap pemahaman pelajar tentang rasuah dan kesediaan mereka untuk tidak terlibat dalam rasuah. Nilai pekali korelasi Pearson yang diperoleh adalah $r = 0.760$ dengan tahap signifikan $p = 0.000$. Ini bermakna, semakin tinggi tahap kefahaman pelajar terhadap maksud dan konsep rasuah, semakin tinggi kecenderungan mereka untuk menolak sebarang bentuk penglibatan dalam amalan tersebut. Korelasi ini juga berada dalam julat yang dianggap sebagai kuat menurut panduan Cohen (1988), yang mentafsirkan korelasi melebihi 0.70 sebagai hubungan yang sangat kukuh.

6.4. Perbincangan

Dapatan menunjukkan bahawa pelajar mempunyai tahap pemahaman yang tinggi terhadap konsep rasuah serta mampu mengenal pasti dan memberikan contoh perbuatan rasuah. Mereka juga mempamerkan sikap positif dan pendirian yang kukuh dalam menolak rasuah serta bersedia bertindak secara proaktif dalam membanterasnya. Penemuan ini selari dengan dapatan kajian oleh Manan et al. (2022) yang mendapati bahawa pendidikan integriti yang berstruktur mampu meningkatkan kesedaran dan komitmen pelajar terhadap nilai-nilai antirasuah.

Analisis korelasi mengesahkan wujudnya hubungan yang kuat dan signifikan antara pengetahuan pelajar tentang rasuah dengan kesediaan mereka untuk tidak terlibat dalam amalan tersebut. Semakin tinggi tahap pengetahuan, semakin kuat niat untuk menolak rasuah. Ini bertepatan dengan teori Bandura (1986) yang menekankan bahawa pemerolehan kognitif dan pembelajaran sosial boleh membentuk tingkah laku moral. Dapatan ini turut menyokong kajian oleh Othman et al. (2021) yang menunjukkan pengetahuan antirasuah berkait rapat dengan pembentukan sikap etika dalam kalangan pelajar institusi pengajian tinggi.

Secara keseluruhannya, kajian ini mengesahkan bahawa program pendidikan antirasuah seperti KIAR adalah sangat relevan dan berkesan dalam meningkatkan kesedaran serta membentuk sikap positif dalam kalangan pelajar. Keberkesanan ini bukan hanya terhad kepada peningkatan pengetahuan, tetapi turut berjaya membina komitmen moral yang kukuh, sejajar dengan matlamat Pelan Antirasuah Nasional (NACP) 2019-2023 yang menekankan pendidikan sebagai teras pencegahan rasuah. Dapatan ini juga memperkukuh kajian oleh Abdullah et al. (2018) yang menyatakan bahawa program pendidikan antirasuah yang sistematik mampu menjadi alat transformasi sosial dalam melahirkan generasi bebas rasuah.

7. KESIMPULAN

Kesimpulannya, kajian ini menyumbang kepada pembangunan literatur dalam bidang pendidikan integriti dan antirasuah, serta memberi implikasi penting kepada penggubal dasar, pendidik dan pihak institusi dalam memastikan generasi muda Malaysia dibentuk dengan nilai integriti yang utuh, kukuh dan tahan uji dalam menghadapi cabaran dunia sebenar. Kajian ini telah berjaya memberikan gambaran yang jelas tentang tahap pemahaman dan sikap pelajar Politeknik Ibrahim Sultan terhadap amalan rasuah melalui penilaian terhadap pelaksanaan Kursus MPU22071 (KIAR). Berdasarkan dapatan yang diperoleh, jelas menunjukkan bahawa kursus ini berperanan penting dalam menyemai nilai integriti serta meningkatkan kesedaran pelajar tentang bahaya rasuah dan kepentingan penolakan terhadapnya. Hubungan yang signifikan antara pemahaman dan sikap pelajar membuktikan bahawa pengetahuan yang kukuh dapat mendorong pembentukan tingkah laku yang positif dan beretika.

Kajian ini juga mengesahkan bahawa pendidikan antirasuah yang dilaksanakan secara sistematik dan relevan dengan konteks pelajar mampu memberi impak yang bermakna terhadap pembangunan moral belia. Kursus seperti KIAR bukan sekadar memenuhi keperluan kurikulum, tetapi juga menyumbang secara langsung kepada matlamat nasional dalam usaha membanteras rasuah dari akar umbi melalui pendekatan pencegahan awal. Walau bagaimanapun, terdapat keterbatasan dari segi saiz sampel dan skop institusi. Justeru, saranan kajian lanjutan telah dikemukakan bagi memperluaskan pemahaman terhadap keberkesanan pendidikan integriti di peringkat yang lebih meluas dan mendalam.

8. CADANGAN

Berdasarkan dapatan dan had kajian ini, terdapat beberapa cadangan yang boleh dipertimbangkan untuk kajian lanjutan pada masa akan datang antaranya dicadangkan untuk diperluaskan kepada pelajar dari pelbagai jabatan serta melibatkan lebih banyak politeknik di seluruh negara. Pendekatan ini dapat memberikan gambaran yang lebih menyeluruh dan membolehkan generalisasi dapatan dilakukan secara lebih tepat terhadap populasi pelajar politeknik. Selain itu, kajian lanjutan juga wajar meneroka perbandingan antara pelajar institusi berbeza seperti politeknik, kolej komuniti dan universiti awam bagi menilai keberkesanan kursus integriti dalam konteks institusi pengajian tinggi yang pelbagai. Kajian perbandingan ini penting kerana latar belakang pelajar, budaya institusi dan pendekatan pengajaran mungkin mempengaruhi tahap pemahaman serta sikap pelajar terhadap isu rasuah. Akhir sekali, penggunaan kaedah kualitatif seperti temu bual mendalam atau perbincangan kumpulan fokus (FGD) juga dicadangkan sebagai pelengkap kepada kaedah kuantitatif. Kaedah ini dapat memberi pemahaman lebih mendalam terhadap motivasi, nilai dan pandangan pelajar tentang rasuah yang tidak dapat dinyatakan sepenuhnya melalui soal selidik sahaja. Gabungan kaedah kuantitatif dan kualitatif (mixed method) mampu menghasilkan dapatan yang lebih kaya dan holistik.

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Keperluan Penguasaan Bahasa Arab dalam TVET Pelancongan: Implikasi Terhadap Kebolehpasaran Graduan

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ABSTRAK

Pertumbuhan sektor pelancongan Islam di Malaysia, khususnya dari negara Timur Tengah, telah menonjolkan kepentingan strategik penguasaan Bahasa Arab dalam kalangan tenaga kerja pelancongan. Kajian ini meneliti keperluan penguasaan Bahasa Arab dalam kalangan pelajar program Diploma Pengurusan Pelancongan di institusi Pendidikan dan Latihan Teknikal dan Vokasional (TVET) politeknik serta hubungannya dengan kebolehpasaran graduan. Kajian ini menggunakan pendekatan konseptual dan deskriptif melalui analisis kandungan literatur yang merangkumi jurnal berindeks, laporan dasar, serta sumber akademik terkini. Dapatan menunjukkan kelemahan ketara dalam pengajaran Bahasa Arab di TVET, yang masih berpusat kepada teori dan tidak selari dengan keperluan industri. Kursus Bahasa Arab yang hanya ditawarkan sebagai subjek elektif, kekurangan pendekatan praktikal, kurangnya integrasi nilai budaya Arab, serta latihan industri yang terbatas bagi pensyarah dan pelajar telah mengehadkan impak pembelajaran terhadap kebolehpasaran graduan. Graduan yang menguasai Bahasa Arab berpotensi tinggi untuk menyertai bidang seperti hospitaliti halal, pengurusan umrah dan haji, serta pelancongan Islam antarabangsa. Kajian ini mencadangkan reformasi kurikulum merangkumi pembangunan modul berasaskan industri, integrasi nilai budaya dalam Pengajaran dan Pembelajaran (PdP), pelaksanaan Bahasa Arab sebagai kursus teras, serta penggunaan teknologi imersif seperti simulasi realiti maya (VR), dan chatbot berbahasa Arab. Bahasa Arab harus dilihat bukan sekadar sebagai bahasa asing, tetapi sebagai kompetensi profesional yang penting untuk memperkukuh kedudukan Malaysia dalam pasaran pelancongan Islam global.

Kata kunci: Bahasa Arab, TVET, pelancongan Islam, kebolehpasaran graduan, reformasi kurikulum, politeknik Malaysia.

1. PENDAHULUAN

Sektor pelancongan Islam di Malaysia terus berkembang secara dinamik seiring dengan peningkatan ketibaan pelancong dari negara-negara Timur Tengah seperti Arab Saudi, Emiriah Arab Bersatu dan Qatar. Negara ini telah berjaya memposisikan dirinya sebagai destinasi mesra Muslim di peringkat global, sejajar dengan Dasar Pelancongan Negara dan aspirasi Malaysia sebagai Hab Pelancongan Halal. Pelancong Arab bukan sahaja mencatatkan kadar perbelanjaan per kapita tertinggi, malah menunjukkan kecenderungan terhadap perkhidmatan hospitaliti yang patuh syariah dan berorientasikan nilai-nilai Islam (Hashim et al., 2013). Dalam konteks ini, Bahasa Arab memainkan peranan yang jauh melebihi fungsi komunikasi asas. Ia berperanan sebagai medium penyampaian nilai agama, simbol kepercayaan terhadap profesionalisme penyedia perkhidmatan, serta jambatan interaksi silang budaya yang lebih berkesan dan harmoni (Imran & Jaffar, 2017; Isa et al., 2024). Justeru, kecekapan dalam Bahasa Arab bukan sahaja meningkatkan kepuasan pelancong, malah berpotensi memperkukuh kredibiliti sektor pelancongan Islam Malaysia di mata dunia.

Namun begitu, laporan terdahulu menunjukkan bahawa kekurangan pekerja tempatan yang berkemahiran Bahasa Arab telah menjejaskan persepsi pelancong dan mengurangkan tahap kesetiaan pelanggan (Hashim et al., 2013). Lompong ini amat ketara di lokasi-lokasi strategik seperti lapangan terbang, hotel, pusat maklumat pelancongan dan agensi pengendali umrah. Kelemahan ini

mencerminkan keperluan mendesak untuk membangunkan modal insan yang bukan sahaja fasih berbahasa Arab, malah mampu mengaplikasikannya dalam konteks perkhidmatan berorientasikan syariah secara profesional. Meskipun Pendidikan dan Latihan Teknikal dan Vokasional (TVET), khususnya politeknik, telah menyediakan program dalam bidang pengurusan pelancongan, pengajaran Bahasa Arab dalam sistem ini masih belum selari dengan keperluan sebenar industri. Kursus Bahasa Arab lazimnya ditawarkan sebagai subjek elektif, berorientasikan teori dan kurang memberi penekanan kepada komunikasi lisan, latihan praktikal serta simulasi berasaskan senario industri (Hannani & Abu Bakar, 2020; Hidayat et al., 2022). Di samping itu, kekurangan integrasi elemen budaya Arab dalam proses pengajaran turut menjejaskan keupayaan pelajar untuk membina interaksi profesional yang mengambil kira sensitiviti budaya dan etika pelanggan Muslim (Zaini et al., 2019; Isa et al., 2024).

Dalam landskap TVET masa kini, faktor sosiobudaya turut memberi impak besar terhadap pemilihan bidang pengajian. Kajian oleh Nawi et al. (2024) menegaskan bahawa persepsi ibu bapa, pengaruh rakan sebaya, serta tanggapan masyarakat terhadap status dan reputasi TVET menjadi penentu penting kepada niat pelajar untuk menyertai program TVET, termasuk dalam bidang pelancongan. Maka, memperkukuh imej Bahasa Arab sebagai kemahiran strategik bernilai tinggi dalam sektor pelancongan halal adalah penting bagi menambah tarikan pelajar serta mengubah persepsi bahawa Bahasa Arab hanya bersifat akademik dan bukan profesional. Walaupun pelbagai penyelidikan telah dilaksanakan dalam skop pengajaran Bahasa Arab dan pendidikan TVET secara berasingan, masih terdapat kekurangan kajian yang secara langsung menghubungkan penguasaan Bahasa Arab dengan kebolehpasaran graduan politeknik, khususnya dalam konteks pelancongan Islam. Kajian terdahulu lebih banyak menumpukan aspek linguistik atau cabaran pedagogi secara umum, tanpa menelusuri implikasi strategik terhadap penempatan pekerjaan dalam industri pelancongan halal. Jurang penyelidikan yang jelas ini menjadi asas penting kepada pelaksanaan kajian ini.

Sehubungan itu, kajian ini dijalankan bagi meneliti secara kritikal keperluan penguasaan Bahasa Arab dalam kalangan pelajar program pelancongan di politeknik Malaysia, mengenal pasti cabaran pelaksanaan yang wujud, dan mencadangkan pendekatan strategik berasaskan industri serta sejajar dengan Dasar TVET Negara dan Revolusi Industri 4.0. Cadangan ini diharap mampu menyumbang kepada pembangunan graduan politeknik yang multibahasa, bersensitiviti budaya, dan bersedia bersaing dalam landskap pelancongan Islam antarabangsa yang semakin kompetitif.

2. SOROTAN LITERATUR

2.1. Bahasa Arab sebagai Aset Ekonomi dan Budaya dalam Pelancongan

Bahasa Arab bukan sekadar bahasa ibunda bagi pelancong dari Timur Tengah, malah telah berkembang sebagai medium komunikasi profesional dan diplomatik yang penting dalam industri pelancongan Islam global. Dalam konteks pelancongan patuh syariah, penguasaan Bahasa Arab membolehkan penyampaian maklumat yang lebih tepat serta penyaluran nilai-nilai agama dan budaya Islam dengan lebih berkesan. Kajian oleh Hashim et al. (2013) menunjukkan bahawa ketiadaan petugas yang mampu berkomunikasi dalam Bahasa Arab telah menjejaskan tahap kepuasan pelancong, di samping menimbulkan kekangan dalam penyampaian maklumat semasa perkhidmatan pelancongan diberikan. Imran & Jaffar (2017) memperkukuh dapatan ini dengan menyatakan bahawa Bahasa Arab tidak boleh dilihat sebagai alat komunikasi semata-mata, sebaliknya perlu disepadukan dengan kefahaman terhadap budaya Timur Tengah dan prinsip-prinsip syariah. Integrasi bahasa dan budaya ini membolehkan penyedia perkhidmatan pelancongan membina hubungan yang lebih bermakna, sekali gus meningkatkan kredibiliti dan profesionalisme dalam kalangan pengamal industri pelancongan Islam.

Kajian terkini oleh Isa et al. (2024) turut menekankan bahawa pelancong Arab sangat menghargai interaksi yang bersifat empatik, iaitu yang menunjukkan kefahaman terhadap nilai, emosi dan sensitiviti budaya mereka serta selaras dengan prinsip keislaman. Kecekapan dalam Bahasa Arab yang disertai dengan sensitiviti budaya mampu memberi kelebihan kepada penyedia perkhidmatan untuk memenuhi jangkaan pelancong yang mementingkan kehalusan adab dan kejelasan maklumat yang diterima. Dalam kerangka pendidikan semasa, Ghani et al. (2019) menggariskan keperluan agar pendekatan pengajaran

Bahasa Arab disesuaikan dengan gaya pembelajaran generasi TVET yang lebih cenderung kepada penggunaan teknologi dan aplikasi praktikal. Selaras dengan itu, Ghani et al. (2020) mencadangkan penggunaan platform Massive Open Online Courses (MOOC) sebagai medium pembelajaran fleksibel yang dapat memperluas keterlibatan pelajar terhadap kandungan Bahasa Arab yang relevan dengan industri pelancongan.

Menambah kepada rasional tersebut, kajian Jais (2015) terlebih dahulu telah menegaskan bahawa Bahasa Arab perlu diiktiraf sebagai satu elemen penting dalam kecekapan menjalankan perkhidmatan dan komunikasi yang patuh syariah. Menurut beliau, institusi politeknik harus mengambil peranan strategik dalam melahirkan tenaga kerja yang bukan sahaja kompeten secara teknikal, tetapi juga memiliki kefahaman menyeluruh terhadap nilai-nilai halal melalui penguasaan bahasa dan budaya Arab. Hal ini amat penting kerana industri pelancongan halal di Malaysia, yang berteraskan prinsip syariah, memerlukan bentuk komunikasi yang tepat, sensitif, dan sesuai dengan latar sosio-budaya pelanggan Timur Tengah. Justeru, dalam landskap pelancongan Islam yang semakin kompleks dan berlandaskan prinsip budaya dan etika Islam, penguasaan Bahasa Arab harus diangkat sebagai satu bentuk kecekapan strategik yang menggabungkan komunikasi profesional, sensitiviti budaya serta pematuhan prinsip syariah. Bahasa Arab bukan sekadar bahasa asing dalam kurikulum TVET, tetapi merupakan aset ekonomi dan budaya yang mampu meningkatkan kualiti interaksi, memperkukuh keyakinan pelancong Muslim, dan menyumbang secara langsung kepada penjenamaan Malaysia sebagai destinasi pelancongan Islam bertaraf antarabangsa.

2.2. Cabaran Dalam TVET: Kurikulum dan Pelaksanaan

Pengajaran Bahasa Arab dalam institusi TVET, khususnya di politeknik, masih berdepan dengan pelbagai cabaran yang menyukarkan pelaksanaan pengajaran yang bersesuaian dengan keperluan industri pelancongan Islam. Kajian oleh Hannani & Abu Bakar (2020) serta Hidayat et al. (2022) mendapati bahawa kandungan kursus Bahasa Arab yang sedia ada masih berfokus kepada aspek teori linguistik dan tatabahasa semata-mata. Kekurangan pendedahan kepada kemahiran praktikal seperti komunikasi pelanggan, situasi pekerjaan sebenar, dan penggunaan istilah teknikal pelancongan menjadikan pelajar kurang bersedia untuk berinteraksi secara profesional dalam persekitaran industri. Tambahan pula, pelabelan kursus Bahasa Arab sebagai subjek elektif telah menjejaskan tahap keutamaan dan keseriusan pelajar terhadap penguasaannya. Struktur ini mengurangkan pendedahan berterusan yang diperlukan untuk membina kemahiran bahasa secara berkesan. Dalam hal ini, Zaini et al. (2019) menekankan bahawa kekurangan guru opsyen dan kurangnya pendedahan tenaga pengajar kepada pengalaman industri telah mewujudkan jurang besar antara apa yang diperlukan oleh industri pelancongan dan cara pengajaran yang dilaksanakan di bilik darjah.

Menambahkan kepada dimensi sosiopsikologi cabaran ini, Nawati et al. (2024) menyatakan bahawa masyarakat secara amnya masih mempunyai tanggapan bahawa laluan pendidikan TVET berada pada kedudukan yang lebih rendah berbanding laluan akademik tradisional. Persepsi ini secara tidak langsung mempengaruhi motivasi pelajar dan kecenderungan mereka untuk tidak memilih kursus seperti Bahasa Arab, yang dianggap sebagai tambahan bukan teras, walaupun sebenarnya ia memiliki nilai aplikasi tinggi dalam sektor pelancongan Islam. Tanggapan ini juga menyumbang kepada kegagalan pelajar dalam melihat Bahasa Arab sebagai kemahiran kerjaya, sebaliknya hanya sebagai subjek akademik yang terasing dari realiti pekerjaan.

Sementara itu, Hassan et al. (2021) menyatakan bahawa kekuatan utama dalam pendidikan TVET terletak pada keupayaan institusi dan tenaga pengajar untuk menyesuaikan strategi latihan dengan kehendak industri. Ketidadaan pendekatan berasaskan simulasi industri atau latihan praktikal yang autentik menyebabkan pelajar terus terperangkap dalam ruang pembelajaran yang bersifat teoritikal dan terpisah daripada realiti dunia pekerjaan. Keadaan ini secara langsung menjejaskan tahap kebolehpasaran mereka sebaik sahaja tamat pengajian. Justeru, pembaharuan menyeluruh terhadap kurikulum dan latihan pengajar adalah amat diperlukan bagi memastikan Bahasa Arab tidak hanya diajar sebagai subjek tambahan, tetapi difungsikan secara strategik dalam membina kompetensi pelajar TVET yang bersedia untuk bersaing dalam landskap pelancongan Islam global.

2.3. Sokongan Terhadap Pembelajaran Digital dan Teknologi

Dalam menghadapi cabaran pendidikan abad ke-21, penggunaan teknologi dalam pengajaran Bahasa Arab semakin dilihat sebagai keperluan strategik untuk menyokong keberkesanan pedagogi di institusi TVET. Kajian oleh Tshong & Yasin (2022) mencadangkan agar institusi pendidikan, termasuk politeknik, memperkenalkan kaedah pembelajaran baharu seperti realiti maya (VR), permainan digital (gamifikasi), dan chatbot yang menggunakan kecerdasan buatan (AI) bagi mewujudkan suasana pembelajaran yang lebih menarik dan berkait rapat dengan situasi sebenar. Pendekatan ini bukan sahaja boleh meningkatkan minat pelajar, tetapi turut membantu mereka mengalami latihan dalam suasana kerja sebenar industri pelancongan dengan cara yang lebih praktikal dan realistik.

Penemuan ini selari dengan dapatan Najib et al. (2014) yang menegaskan bahawa penggunaan media sosial, video interaktif, serta bahan digital yang mesra pelajar mampu merangsang motivasi dan keterlibatan pelajar dalam pembelajaran Bahasa Arab. Aplikasi teknologi sedemikian menjadikan pembelajaran lebih praktikal, mudah difahami secara semula jadi, dan selari dengan keperluan sebenar industri pelancongan yang memerlukan kemahiran berkomunikasi dalam pelbagai bahasa dalam persekitaran kerja sebenar. Di samping itu, Hassan et al. (2021) menyatakan bahawa keberkesanan TVET tidak hanya bergantung pada kandungan pengajaran, tetapi turut dipengaruhi oleh kualiti latihan dan kemahiran pedagogi tenaga pengajar dalam mengintegrasikan teknologi secara berkesan. Pensyarah perlu dibimbing untuk menggunakan teknologi bukan hanya sebagai alat bantu, tetapi sebagai medium utama dalam menyampaikan pengalaman linguistik yang lebih berfokus kepada industri.

Dalam konteks pelancongan Islam, Isa et al. (2024) pula menekankan bahawa integrasi elemen budaya Arab melalui pendekatan teknologi juga dapat memperkukuh komunikasi silang budaya antara pelajar dan pelancong. Penggunaan bahan digital seperti dokumentari budaya, permainan peranan (role-play) interaktif, dan modul berasaskan kes dapat membantu pelajar bukan sahaja memahami bahasa, tetapi juga mendalami konteks budaya Timur Tengah yang sangat penting dalam menyampaikan maklumat dengan cara yang memahami dan menghormati latar belakang serta nilai pelanggan. Oleh itu, teknologi perlu dilihat sebagai penghubung antara bilik darjah dan dunia kerja sebenar. Ia bukan hanya memperkayakan pengalaman pembelajaran, tetapi juga mempercepatkan pemindahan kemahiran linguistik ke dalam amalan profesional dalam sektor pelancongan yang semakin bergantung kepada pendekatan digital.

3. METODOLOGI

Kajian ini menggunakan pendekatan kualitatif melalui analisis kandungan literatur untuk memahami keperluan penguasaan Bahasa Arab dalam kalangan pelajar TVET bidang pelancongan dan hubungannya dengan kebolehpasaran graduan. Reka bentuk kajian ini bersifat konseptual dan deskriptif, berasaskan sumber ilmiah seperti artikel jurnal berindeks, laporan dasar kerajaan, buku akademik dan prosiding seminar. Sumber dipilih secara purposif, iaitu berfokus kepada isu berkaitan topik kajian seperti topik Bahasa Arab, TVET dan pelancongan Islam. Analisis tematik digunakan bagi mengenal pasti isu utama dalam literatur, menghasilkan tiga tema utama: (i) kepentingan Bahasa Arab dalam pelancongan Islam, (ii) cabaran pelaksanaan pengajaran Bahasa Arab di institusi TVET, dan (iii) implikasi terhadap kebolehpasaran graduan. Ketiga-tiga tema ini dibincangkan secara sistematik dalam dapatan dan perbincangan bagi memastikan huraian berpaksikan dapatan literatur dan kehendak industri semasa.

4. DAPATAN DAN PERBINCANGAN

4.1. Bahasa Arab Memperkukuh Kebolehpasaran Graduan dalam Sektor Pelancongan Islam

Penguasaan Bahasa Arab dalam kalangan graduan politeknik pelancongan memberi kelebihan strategik dalam memenuhi keperluan industri pelancongan Islam yang semakin berkembang. Hidayat et al. (2022) menegaskan bahawa Bahasa Arab bukan sekadar nilai tambah, sebaliknya menjadi komponen penting dalam meningkatkan kebolehpasaran graduan, terutamanya dalam sektor perkhidmatan

pelanggan berorientasikan syariah seperti perhotelan halal dan agensi umrah. Namun, dapatan Hashim et al. (2013) menunjukkan kekurangan petugas tempatan yang fasih berbahasa Arab telah menjejaskan pengalaman pelancong Timur Tengah di Malaysia, khususnya dalam komunikasi asas di hotel, lapangan terbang, dan pengangkutan awam. Situasi ini menjejaskan tahap kepuasan pelanggan serta imej profesionalisme penyedia perkhidmatan.

Kajian oleh Najib et al. (2014) pula mendapati 90% pelajar IPT mengiktiraf Bahasa Arab pelancongan sebagai kemahiran penting dan mudah diaplikasikan dalam kerjaya. Hal ini menunjukkan bahawa pendekatan pembelajaran yang kontekstual dan berorientasikan industri boleh meningkatkan keyakinan pelajar terhadap kebolehan berbahasa. Menyokong dapatan ini, Barwani dan Azam (2023) menekankan bahawa latihan industri dalam suasana autentik bukan sahaja memperkukuh kecekapan bahasa, tetapi juga meningkatkan kesediaan kerja dan keyakinan sendiri pelajar. Selain itu, Jais (2015) mencadangkan agar program pelancongan di politeknik memberi perhatian kepada kemahiran berkaitan halal, iaitu keupayaan untuk mengurus dan menyampaikan perkhidmatan pelancongan yang mematuhi prinsip Islam. Dalam hal ini, penguasaan Bahasa Arab dilihat sebagai alat penting untuk menjelaskan nilai-nilai syariah kepada pelancong Muslim dengan cara yang lebih tepat dan berkesan. Justeru, graduan yang memiliki gabungan kemahiran teknikal dan linguistik dilihat sebagai aset bernilai bagi industri pelancongan Islam serantau dan global.

4.2. Jurang Kurikulum dan Pengajaran Bahasa Arab dalam TVET

Walaupun Bahasa Arab mempunyai nilai strategik dalam industri pelancongan Islam, ia masih belum diarusperdanakan dalam kurikulum TVET. Zaini et al. (2019) mendapati bahawa Bahasa Arab di politeknik sering ditawarkan sebagai kursus elektif, dengan tumpuan kepada aspek teori seperti nahu dan terjemahan, tanpa penekanan terhadap aplikasi komunikasi sebenar dalam industri. Kekurangan pendedahan kepada konteks kerja menjadikan pelajar kurang yakin menggunakan bahasa tersebut secara profesional. Di samping itu, Ghani et al. (2019) melaporkan bahawa pengajaran yang masih bergantung kepada buku teks tradisional dan kurangnya integrasi teknologi dalam PdP mengurangkan motivasi pelajar. Pelajar tidak terdedah kepada situasi sebenar seperti komunikasi dengan pelancong Arab, sekali gus menjejaskan keupayaan mereka menyesuaikan diri dalam alam pekerjaan. Oleh itu, struktur kurikulum perlu disemak agar lebih berfokus kepada kemahiran komunikasi praktikal serta pembelajaran berasaskan tugas yang menyokong keperluan industri pelancongan Islam. Kekurangan pendekatan kontekstual dan aplikasi industri dalam pengajaran Bahasa Arab akhirnya menjejaskan tahap kesediaan graduan untuk bersaing dalam pasaran kerja pelancongan Islam yang berbahasa Arab.

4.3. Elemen Budaya sebagai Asas Kecekapan Komunikasi

Kecekapan berbahasa Arab dalam konteks pelancongan tidak lengkap tanpa pemahaman budaya Arab yang mendalam. Isa et al. (2024) menekankan bahawa kekurangan pengetahuan mengenai nilai komunikasi, adab pelanggan, dan sensitiviti budaya boleh menyebabkan kesilapan komunikasi yang menjejaskan kepuasan pelancong. Dalam situasi industri, pelajar perlu menguasai bukan sahaja struktur linguistik, tetapi juga norma budaya yang mempengaruhi interaksi pelanggan. Sebagai contoh, kegagalan memahami pentingnya salam, penghormatan, atau etika perbualan dalam budaya Arab boleh mencetuskan kekeliruan atau tanggapan negatif. Justeru, elemen budaya perlu diintegrasikan secara langsung dalam modul pengajaran melalui pendekatan seperti simulasi interaksi pelancong, dialog kontekstual, dan pendedahan kepada sumber autentik. Ini akan membantu pelajar membina kompetensi antara budaya yang lebih holistik, seterusnya meningkatkan keberkesanan komunikasi dan perkhidmatan dalam sektor pelancongan Islam. Tanpa kompetensi budaya yang mencukupi, graduan sukar memenuhi jangkaan majikan dan pelanggan antarabangsa, sekali gus menjejaskan kebolehpasaran mereka di peringkat global.

4.4. Strategi Transformasi Pengajaran Bahasa Arab di TVET

Bagi mengatasi jurang dalam kurikulum dan pengajaran, pelaksanaan strategi pengajaran yang bersepadu dan responsif terhadap keperluan industri amat diperlukan. Tshong dan Yasin (2022)

mencadangkan pendekatan simulasi industri serta penggunaan bahan bantu interaktif sebagai kaedah berkesan untuk meningkatkan penguasaan Bahasa Arab. Pendekatan ini dapat mewujudkan pembelajaran yang lebih aktif, bermakna dan kontekstual. Hassan et al. (2021) pula menekankan kepentingan kolaborasi antara institusi pendidikan TVET dan industri pelancongan dalam membangunkan modul latihan yang autentik. Latihan industri kepada pelajar dan pensyarah bukan sahaja meningkatkan kebolehan teknikal dan linguistik, malah menyelaraskan hasil pembelajaran dengan kehendak sebenar pasaran kerja. Integrasi teknologi digital, seperti aplikasi simulasi pelancongan dan platform pembelajaran maya, juga boleh dimanfaatkan bagi memperkasa keberkesanan Pdp.

Pendekatan pengajaran yang bersifat industri dan berasaskan latihan sebenar berupaya meningkatkan kebolehpasaran graduan dengan melengkapkan mereka dengan kemahiran bahasa dan profesionalisme yang dikehendaki pasaran. Secara keseluruhannya, dapatan kajian ini memperlihatkan bahawa penguasaan Bahasa Arab memainkan peranan strategik dalam meningkatkan kebolehpasaran graduan TVET bidang pelancongan, khususnya dalam memenuhi permintaan sektor pelancongan Islam yang semakin berkembang. Namun begitu, jurang antara kehendak industri dan pendekatan pengajaran semasa masih wujud, terutamanya dari segi kurikulum yang bersifat teoritikal, kurang kontekstual, serta tidak menekankan kompetensi budaya dan komunikasi sebenar. Implikasi daripada kekurangan ini bukan sahaja menjejaskan keyakinan pelajar untuk berkomunikasi secara profesional, tetapi turut memberi kesan terhadap imej dan kredibiliti penyedia perkhidmatan pelancongan di mata pelancong Muslim antarabangsa. Dalam usaha meningkatkan keberkesanan pengajaran Bahasa Arab dalam TVET, strategi seperti integrasi teknologi digital, kerjasama industri, latihan berasaskan tugas, serta pengukuhan elemen budaya perlu dilaksanakan secara sistematik dan bersepadu. Justeru, penguasaan Bahasa Arab yang digabungkan dengan kefahaman budaya dan kemahiran teknikal dilihat sebagai aset penting dalam membentuk graduan yang bukan sahaja berdaya saing, tetapi juga mampu mengangkat kualiti perkhidmatan pelancongan Islam negara ke peringkat global.

5. CADANGAN STRATEGIK

Bagi meningkatkan kompetensi linguistik dan kebolehpasaran graduan dalam program pelancongan TVET, satu kerangka tindakan strategik perlu dibentuk yang berteraskan keperluan industri, keberkesanan pedagogi, dan penguasaan budaya pelanggan. Cadangan-cadangan berikut disusun berasaskan dapatan kajian terdahulu serta realiti cabaran semasa pendidikan politeknik.

5.1. Penggubalan Modul Bahasa Arab Berasaskan Industri

Modul Bahasa Arab sedia ada di politeknik perlu digubal semula agar lebih kontekstual dan berorientasikan keperluan sebenar industri pelancongan Islam. Modul ini harus menekankan aplikasi bahasa dalam situasi kerja sebenar seperti komunikasi pelanggan, penyampaian maklumat mengenai destinasi pelancongan, urusan daftar masuk hotel, serta pengenalan kepada istilah penting berkaitan halal, waktu solat, arah kiblat, dan prosedur perkhidmatan patuh syariah. Imran dan Jaffar (2017) serta Hidayat et al. (2022) menekankan keperluan modul berasaskan latihan simulasi, aktiviti perbualan dua hala, dan tugas berasaskan industri untuk menghasilkan penguasaan yang holistik. Selain itu, Ghani et al. (2020) menyarankan agar modul tersebut turut dikembangkan dalam bentuk kursus dalam talian terbuka (MOOC) bagi menarik minat generasi pelajar TVET yang cenderung kepada pembelajaran digital, interaktif dan fleksibel. Modul berbentuk MOOC ini juga dapat memperluas capaian pembelajaran merentas lokasi dan waktu, selaras dengan aspirasi digitalisasi TVET. Selanjutnya, Jais (2015) mengesyorkan agar politeknik diberi kuasa untuk merangka modul pembelajaran yang menyatukan kemahiran berkaitan perkhidmatan patuh syariah dan penguasaan Bahasa Arab. Modul ini seharusnya merangkumi latihan berdasarkan situasi sebenar dalam industri pelancongan Islam, seperti kemahiran berkomunikasi dengan pelanggan Muslim, pematuhan terhadap garis panduan agama contohnya dalam makanan, penginapan, dan perkhidmatan, serta kefahaman tentang budaya Timur Tengah. Dengan pendekatan ini, graduan akan lebih bersedia menghadapi keperluan sebenar di tempat kerja dan sekali gus meningkatkan reputasi politeknik sebagai institusi yang melahirkan tenaga kerja profesional dalam sektor pelancongan Islam.

5.2. Latihan Profesional Berterusan untuk Pensyarah

Kecekapan pensyarah merupakan faktor utama dalam menjayakan pendekatan berasaskan industri. Oleh itu, latihan profesional yang berterusan perlu disediakan melalui Sangkutan Industri Pensyarah (SIP), latihan sabatikal serta kerjasama penyelidikan bersama agensi pelancongan Islamik seperti Islamic Tourism Centre (ITC). Zaini et al. (2019) serta Hassan et al. (2021) menegaskan bahawa penglibatan langsung pensyarah dalam aktiviti industri akan meningkatkan kefahaman mereka terhadap kehendak semasa pasaran kerja dan memperkukuh pemindahan ilmu kepada pelajar.

5.3. Integrasi Budaya Arab dalam Pengajaran dan Pembelajaran (PdP)

Keberkesanan komunikasi dalam Bahasa Arab tidak hanya bergantung kepada linguistik, tetapi turut melibatkan sensitiviti terhadap nilai, adab, dan norma budaya pelancong dari Timur Tengah. Justeru, integrasi budaya Arab dalam PdP perlu dilaksanakan secara sistematik melalui pendekatan seperti video pembelajaran interaktif, lakonan situasi (role-play), pembelajaran berasaskan kes (case-based learning), dan interaksi maya dengan penutur jati. Isa et al. (2024) serta Imran dan Jaffar (2017) menunjukkan bahawa pendekatan ini bukan sahaja meningkatkan kefahaman pelajar terhadap pelanggan Arab, tetapi juga membina kemahiran komunikasi silang budaya yang amat diperlukan dalam industri pelancongan Islam.

5.4. Bahasa Arab Sebagai Kursus Teras dalam Program Pelancongan

Seiring dengan peningkatan permintaan industri terhadap kemahiran komunikasi pelbagai bahasa, adalah wajar untuk menjadikan Bahasa Arab sebagai kursus teras dalam program Diploma Pengurusan Pelancongan di politeknik. Pelaksanaan kursus wajib ini akan membolehkan pembelajaran yang berstruktur secara berperingkat bermula dengan penguasaan asas mendengar dan bertutur, hingga kepada kemahiran pengucapan profesional dan komunikasi pelanggan dalam konteks industri (Hidayat et al., 2022; Barwani & Azam, 2023). Najib et al. (2014) dan Ghani et al. (2019) menyarankan Bahasa Arab dijadikan kursus teras dalam program pelancongan kerana ia dapat meningkatkan kemahiran menyeluruh pelajar dalam bertutur, mendengar, membaca dan menulis secara profesional. Kecekapan ini lebih berkesan apabila digabungkan dengan simulasi industri, latihan amali dan interaksi langsung dengan pelanggan Arab, bagi melahirkan graduan yang fasih, berbudaya dan profesional. Tambahan pula, Nawi et al. (2024) mencadangkan agar institusi TVET membina imej yang lebih profesional dan berdaya saing melalui penawaran kurikulum yang menonjolkan keunikan tersendiri termasuk kemahiran dalam Bahasa Arab dan kebolehan melaksanakan perkhidmatan halal bertaraf antarabangsa. Pendekatan ini bukan sahaja dapat menarik minat lebih ramai pelajar, malah meningkatkan kebolehpasaran graduan dalam industri pelancongan global yang semakin mencabar dan menitikberatkan nilai-nilai Islam.

5.5. Penerapan Teknologi Pengajaran Interaktif

Strategi pengajaran perlu disesuaikan dengan gaya pembelajaran generasi muda melalui teknologi seperti chatbot AI, perisian pembelajaran sendiri, gamifikasi, dan realiti maya (VR) untuk mensimulasikan persekitaran hotel, lapangan terbang, dan lawatan pelancongan. Kajian oleh Tshong & Yasin (2022) membuktikan bahawa pendekatan ini meningkatkan penglibatan pelajar secara signifikan, di samping memupuk pembelajaran aktif dan kontekstual. Sementara itu, Najib et al. (2014) menegaskan bahawa teknologi digital turut memainkan peranan dalam membina motivasi dan pengukuhan sendiri pelajar, sekali gus mempersiapkan mereka menghadapi cabaran sebenar di tempat kerja.

6. KESIMPULAN

Kajian ini mengukuhkan hujah bahawa penguasaan Bahasa Arab dalam kalangan pelajar politeknik, khususnya dalam program TVET pelancongan, merupakan satu keperluan strategik yang semakin mendesak dalam era globalisasi pelancongan Islam. Bahasa Arab tidak lagi boleh dilihat sekadar sebagai

alat komunikasi, sebaliknya perlu diiktiraf sebagai aset ekonomi dan budaya yang signifikan dalam membentuk graduan yang berdaya saing, serba boleh dan bersedia memenuhi keperluan industri pelancongan patuh syariah di peringkat nasional mahupun antarabangsa (Hashim et al., 2013; Imran & Jaffar, 2017; Isa et al., 2024). Walaupun pelajar menunjukkan tahap motivasi yang tinggi terhadap penguasaan Bahasa Arab (Najib et al., 2014), kelemahan struktur kurikulum, kekurangan pensyarah berpengalaman industri, dan ketiadaan pendekatan pembelajaran yang kontekstual telah menghambat pencapaian sebenar dari sudut kebolehpasaran graduan (Zaini et al., 2019; Hidayat et al., 2022). Selain itu, tanggapan terhadap Bahasa Arab sebagai subjek elektif yang kurang signifikan perlu diubah agar selari dengan keperluan industri pelancongan semasa yang semakin menuntut kemahiran komunikasi pelbagai bahasa. Sehubungan itu, pembelajaran Bahasa Arab dalam konteks TVET perlu mengalami anjakan paradigma menyeluruh yang merangkumi penstrukturan semula kurikulum berteraskan keperluan industri, pemantapan latihan profesional tenaga pengajar, pengintegrasian nilai dan budaya Arab dalam PdP, serta penerapan teknologi pengajaran moden seperti realiti maya (VR) dan chatbot berasaskan kecerdasan buatan (AI) (Tshong & Yasin, 2022; Ghani et al., 2020). Pendekatan ini diyakini mampu memperkukuh literasi linguistik pelajar dan meningkatkan daya saing mereka dalam industri pelancongan Islam global yang semakin kompetitif. Sebagai rumusan, Bahasa Arab dalam pendidikan TVET pelancongan perlu ditransformasikan daripada kedudukan sebagai subjek bahasa asing kepada satu komponen strategik dalam pembangunan modal insan. Langkah ini bukan sahaja menyokong aspirasi Dasar Pelancongan Negara dan Dasar Pendidikan dan Latihan Teknikal dan Vokasional (TVET) Malaysia, malah mampu memperkukuh kedudukan Malaysia sebagai destinasi utama pelancongan Islam bertaraf antarabangsa.

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Keberkesanan Integrasi Steam E-Komik melalui Pembelajaran Berasaskan Projek Terhadap Pencapaian dan Kemahiran Kreativiti Pelajar Prauniversiti

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ABSTRAK

Di peringkat prauniversiti, pencapaian pelajar dalam Biologi khususnya bagi topik pembiakan dan perkembangan manusia adalah rendah. Pelajar sukar memahami topik ini disebabkan banyak proses seperti kitaran ovari dan penghasilan sperma yang perlu diingat. Selain itu, kaedah pengajaran yang berpusatkan guru di peringkat prauniversiti, menghalang pelajar untuk berfikir secara kreatif dan kritis seterusnya menghalang kepada pembentukan kemahiran kreativiti pelajar. Justeru itu, kajian ini bertujuan mengkaji keberkesanan pengintegrasian STEAM e-komik melalui pembelajaran berasaskan projek (PjBL) dalam meningkatkan pencapaian dan kemahiran kreativiti pelajar prauniversiti bagi topik pembiakan dan perkembangan manusia. Sampel yang digunakan dalam kajian ini melibatkan 62 orang pelajar prauniversiti di sebuah kolej. Reka bentuk kajian ini ialah kajian campuran yang menggunakan pendekatan QUAN-qual iaitu reka bentuk kuasi eksperimen digunakan bagi kaedah kuantitatif, manakala rubrik digunakan bagi kaedah kualitatif. Tiga instrumen digunakan bagi data kuantitatif, i) Ujian Pencapaian Pembiakan dan Perkembangan Manusia (Ujian 3PM) manakala bagi data kualitatif ii) rubrik projek dan iii) rubrik kemahiran kreativiti. Hasil analisis ANCOVA menunjukkan terdapat perbezaan yang signifikan antara kumpulan rawatan dan kumpulan kawalan terhadap skor ujian pasca dalam Ujian 3PM. Selain itu, dapatan daripada ujian-t sampel bebas menunjukkan terdapat perbezaan signifikan min skor bagi kumpulan rawatan dan kumpulan kawalan. Berdasarkan rubrik, pengintegrasian STEAM e-komik PjBL meningkatkan kemahiran kreativiti dalam kalangan pelajar prauniversiti. Justeru itu, dapatan kajian mendapati pengintegrasian STEAM e-komik meningkatkan pencapaian pelajar dan kemahiran kreativiti pelajar dalam topik pembiakan dan perkembangan manusia. Secara tidak langsung, mampu melahirkan pelajar berkebolehan dalam berfikir secara kreatif dan kritis, berupaya mengaplikasikan pengetahuan dalam mencipta sesuatu produk dan mempunyai kemahiran insaniah.

Kata kunci: STEAM e-komik, pembelajaran berasaskan projek, kemahiran kreativiti, pencapaian, pembiakan dan perkembangan manusia.

1. PENGENALAN

Bagi mentransformasi sistem pendidikan di Malaysia supaya dapat bersaing di peringkat global, KPM telah meningkatkan kualiti pendidikan STEM dengan merangka semula kurikulum dalam Pelan Pembangunan Pendidikan (Jailani & Mohamad Nasri, 2024; KPM, 2013). Pendekatan STEM merangkumi pemikiran aras tinggi, pembelajaran berasaskan penyiasatan, penyelesaian masalah, pembelajaran kolaboratif dan pembelajaran berasaskan projek (PjBL) (Seo & Ng, 2022). Di peringkat matrikulasi, pendidikan STEM memfokuskan kepada aktiviti pengukuhan dan pengayaan kemahiran STEM melalui aktiviti yang boleh mempamerkan konsep STEM pada peringkat tinggi (Jailani & Mohamad Nasri, 2024; KPM, 2013).

Dalam konteks pengajaran subjek Biologi, topik Pembiakan dan Perkembangan Manusia dalam subjek Biologi di peringkat matrikulasi, menyumbang kepada markah tertinggi dalam peperiksaan. Oleh itu, pelajar prauniversiti, seharusnya mempunyai kefahaman konseptual yang kukuh bagi menguasai topik

ini seterusnya meningkatkan pencapaian akademik. Penggunaan kaedah pengajaran yang berkesan dan bersesuaian bukan sahaja dapat meningkatkan kefahaman pelajar terhadap konsep STEM, malah turut menyumbang kepada pencapaian akademik yang lebih cemerlang (Mohd Salleh et al., 2021). Penggabungan elemen Arts ke dalam STEM (STEAM) pula bertujuan memupuk kemahiran kreativiti dan inovasi pelajar (Gu et al., 2020). Penggunaan PjBL dalam pendekatan STEAM mampu membantu pelajar mengaplikasikan pengetahuan dalam menyelesaikan masalah dunia sebenar serta meningkatkan kemahiran kreativiti dan pencapaian akademik pelajar (Ekayana et al., 2024). Oleh itu, kajian ini bertujuan untuk menilai keberkesanan pengintegrasian STEAM e-komik melalui PjBL terhadap pencapaian dan kemahiran kreativiti pelajar prauniversiti.

1.1. Penyataan Masalah

Subjek Biologi dianggap sukar kerana mengandungi konsep abstrak dan istilah saintifik yang kompleks (Kiat et al., 2020). Kesannya, pelajar menghadapi masalah salah konsep seterusnya menyumbang kepada pencapaian yang rendah. Analisis laporan tahun-tahun lepas tentang prestasi pelajar dalam peperiksaan telah dilaporkan dalam Laporan Kerja Calon (LKC) Peperiksaan Semester Program Matrikulasi (PSPM) Semester I. Berdasarkan LKC, kebanyakan pelajar gagal menjawab soalan kitaran haid dengan baik disebabkan kurang kefahaman dan pengetahuan dalam mengaplikasikan topik yang dipelajari. Selain itu, pelajar tidak dapat membuat hubung kait hormon dengan kitaran haid dan ovari yang berlaku dalam wanita. Perovic et al. (2023) menyatakan, isi kandungan dalam kedua-dua kitaran ini mempunyai subkonsep yang bersifat abstrak dan sukar difahami dalam konteks nyata selain penggunaan istilah saintifik yang sukar dihafal. Kegagalan pelajar dalam menguasai sesuatu konsep dalam Biologi dapat dilihat dengan pencapaian pelajar di peringkat prauniversiti yang kurang memuaskan (Fadzil & Mahmud, 2020).

Selain itu, strategi pengajaran yang konvensional menyumbang ke arah kelemahan pelajar untuk memahami konsep penting disebabkan pelajar kurang terlibat secara aktif dan tidak digalakkan untuk berfikir secara kreatif (Nor Asniza et al., 2021). Tambahan pula, tekanan untuk menghabiskan sukatan pelajaran menyebabkan kreativiti pelajar dalam pembelajaran Biologi masih rendah sedangkan kemahiran ini diperlukan dalam menghadapi Revolusi Industri 4.0. Strategi pengajaran dan pembelajaran yang inovatif perlu dilaksanakan di peringkat prauniversiti, bagi memberikan perubahan yang positif kepada pembelajaran pelajar supaya pencapaian dan kemahiran kreativiti pelajar dipertingkatkan. Topik pembiakan dan perkembangan manusia antara topik abstrak yang memerlukan pelajar untuk bervisualisasi bagi memahami proses-proses yang terdapat dalam topik tersebut (Albeitawi et al., 2024). Justeru itu, pengintegrasian STEAM melalui PjBL merupakan satu pendekatan pengajaran sesuai dilaksanakan bagi mengaplikasikan pengetahuan ke dalam bentuk produk dalam meningkatkan pencapaian dan kreativiti pelajar prauniversiti.

1.2. Objektif dan Soalan Kajian

1.2.1. Objektif Kajian

Terdapat dua objektif dalam kajian ini iaitu:

- i. Mengkaji perbezaan skor min pada ujian pasca terhadap pencapaian pelajar prauniversiti bagi topik Pembiakan dan Perkembangan Manusia antara kumpulan rawatan dan kumpulan kawalan selepas pendekatan pengintegrasian STEAM e-komik melalui pembelajaran berasaskan projek dan kaedah konvensional, dengan mengawal praujian.
- ii. Mengkaji kesan pengintegrasian STEAM e-komik berasaskan pembelajaran berasaskan projek dalam meningkatkan kemahiran kreativiti pelajar prauniversiti bagi topik Pembiakan dan Perkembangan Manusia antara kumpulan rawatan dan kumpulan kawalan.

1.2.2. Soalan Kajian

Kajian ini akan menjawab persoalan kajian yang berikut iaitu:

- i. Adakah terdapat perbezaan yang signifikan dalam skor min ujian pasca terhadap pencapaian pelajar prauniversiti dalam topik Pembiakan dan Perkembangan Manusia antara kumpulan

- rawatan dan kumpulan kawalan selepas pendekatan pengintegrasian STEAM e-komik melalui pembelajaran berasaskan projek dan kaedah konvensional, dengan mengawal praujian?
- ii. Adakah kesan pengintegrasian STEAM e-komik berasaskan PjBL meningkatkan kemahiran kreativiti pelajar prauniversiti bagi topik Pembiakan dan Perkembangan Manusia?

1.3. Hipotesis Kajian

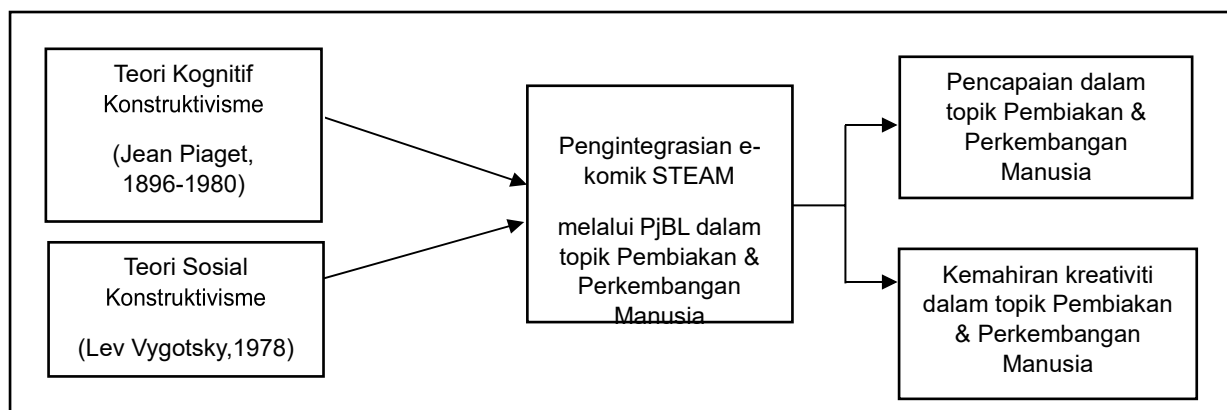
Dalam kajian ini, terdapat satu hipotesis kajian yang dikaji mengikut persoalan kajian 1 iaitu:

- a. H01: Tidak terdapat perbezaan yang signifikan dalam skor min pada ujian pasca terhadap pencapaian pelajar prauniversiti dalam topik Pembiakan dan Perkembangan Manusia antara kumpulan rawatan dan kumpulan kawalan selepas pengintegrasian STEAM melalui pembelajaran berasaskan projek dan kaedah konvensional, dengan mengawal praujian.

1.4. Kepentingan Kajian

Kajian ini dilaksanakan bagi mengkaji keberkesanan pengintegrasian STEAM e-komik melalui PjBL dalam meningkatkan pencapaian dan kemahiran kreativiti pelajar prauniversiti bagi topik pembiakan dan perkembangan manusia. Kajian ini bertujuan memperkukuh pelajar terhadap proses dalam sistem reproduktif serta mengurangkan salah konsep, seterusnya meningkatkan pencapaian pelajar. Di samping itu, pengintegrasian STEAM e-komik melalui PjBL mendorong pensyarah beralih daripada kaedah konvensional kepada pendekatan abad ke-21 yang menekankan pemikiran kritis, kreativiti, kolaborasi dan komunikasi.

1.5. Kerangka Teori



Rajah 1.1: Kerangka Teori Kajian

2. TINJAUAN LITERATUR

2.1. Topik Pembiakan dan Perkembangan Manusia

Pada peringkat prauniversiti, Biologi merupakan subjek yang memerlukan banyak hafalan dan pemahaman konsep (Nor Asniza et al., 2021). Topik pembiakan dan perkembangan manusia penting kerana berkait langsung dengan fisiologi badan manusia, seperti kitaran haid, persenyawaan dan kehamilan (Perovic et al., (2023). Menurut Taufiq et al., (2020) pelajar mengalami salah konsep dan kekurangan pengetahuan dalam topik pembiakan dan perkembangan manusia. Proses dalaman seperti kitaran haid, kitaran ovari dan persenyawaan merupakan proses yang abstrak dan sukar divisualisasikan (Kiat et al., 2020). Pengetahuan dan pemahaman yang sedikit mengenai sistem reproduktif manusia akan menyebabkan pelajar sukar untuk membuat hubung kait dengan kehidupan sebenar (Albeitawi et al., 2024). Pelajar menganggap topik ini susah berikutan banyak proses dan pembacaan perlu dilakukan bagi memahami sesuatu konsep.

2.2. Pencapaian Pelajar dalam Topik Pembiakan dan Perkembangan Manusia

Kesukaran pelajar untuk memahami topik ini akan menyebabkan salah konsep seterusnya memberi kesan kepada pencapaian pelajar. Kajian oleh Kiat et al., (2020) menunjukkan pencapaian akademik pelajar dalam topik pembiakan dan perkembangan manusia rendah disebabkan kaedah pembelajaran yang konvensional menghadkan pelajar untuk melibatkan diri dalam pembelajaran secara aktif, pelajar tidak dapat membuat visualisasi dengan baik dan penggunaan istilah saintifik yang sukar dihafal. Menurut Esendemir dan Geban (2020), pelajar tidak dapat membuat visualisasi dengan lebih jelas mengenai konsep yang terdapat dalam sistem reproduktif manusia. Tanpa penggunaan media dalam proses pembelajaran, pelajar mungkin menghadapi kesukaran untuk mengingat maklumat dalam jangka masa panjang memandangkan rangsangan deria seperti pendengaran dan penglihatan tidak dimanfaatkan sepenuhnya. Akibatnya, keberkesanan pembelajaran tidak dapat dicapai secara optimum.

2.3. Kemahiran Kreativiti

Berdasarkan tinjauan terhadap beberapa kajian lepas, didapati bahawa PjBL berupaya meningkatkan kemahiran kreativiti pelajar. Kajian oleh Noor Fadzilah Aris et al. (2021) menunjukkan bahawa pendekatan PISTEM Forensik memberi kesan signifikan terhadap kemahiran kreativiti pelajar melalui penglibatan aktif dan pembelajaran berasaskan situasi dunia sebenar. Fitri et al. (2022) pula mendapati bahawa PjBL meningkatkan kreativiti pelajar dalam Biologi melalui penyelesaian masalah dan penghasilan produk yang pelbagai. Kajian Esendemir dan Geban (2020) menekankan penggunaan multimedia dalam pembelajaran berasaskan inkuiri turut merangsang pembelajaran aktif dan kemahiran kreativiti pelajar. Namun begitu, didapati bahawa kajian mengenai kemahiran kreativiti dalam topik pembiakan dan perkembangan manusia masih kurang dijalankan. Oleh itu, kajian ini bertujuan untuk meneroka kemahiran kreativiti pelajar secara khusus dalam topik tersebut.

2.4. Teori Pembelajaran

Teori Kognitif Konstruktivisme yang diguna pakai dalam kajian adalah bagi mengkaji keberkesanan pengintegrasian STEAM dalam meningkatkan pencapaian pelajar. Bagi membentuk pengetahuan yang baharu berdasarkan pengetahuan sedia ada dan pengalaman, pendekatan pengajaran yang disediakan pensyarah lebih mudah difahami pelajar supaya pelajar dapat menguasai sesuatu topik dengan baik. Aplikasi teori dalam kajian ini melibatkan pengintegrasian pendekatan STEAM untuk meningkatkan pencapaian pelajar melalui penggunaan media bagi membantu pelajar memahami konsep abstrak. Dengan itu, pendekatan pengajaran yang sejajar dengan teori ini diharap dapat mengoptimumkan potensi kognitif pelajar dalam menguasai topik biologi yang kompleks. Kajian ini berteraskan Teori Konstruktivisme Sosial oleh Vygotsky (1978) yang menekankan kepentingan interaksi sosial dalam pembentukan kognitif pelajar. Dua konsep utama dalam teori ini ialah Zone of Proximal Development (ZPD) dan Scaffolding menekankan pembelajaran melalui bantuan rakan atau guru, serta sokongan berperingkat hingga pelajar berdikari. Pelaksanaan PjBL menerusi penghasilan e-komik dalam topik pembiakan dan perkembangan manusia menjadi aplikasi utama teori ini, yang menuntut pelajar untuk berkolaborasi, berdiskusi, dan membina pemahaman secara aktif. Kajian ini turut menjawab isu pembelajaran sehalu di peringkat prauniversiti, dengan memperkenalkan kaedah kolaboratif yang menjadikan pensyarah sebagai fasilitator, bukan sekadar penyampai ilmu.

3. METODOLOGI

3.1. Reka Bentuk Kajian

Reka bentuk yang digunakan dalam kajian ini adalah pendekatan 'QUAN-Qual' iaitu kaedah kuantitatif adalah lebih dominan berbanding kaedah kualitatif. Kajian ini menggunakan reka bentuk kajian campuran eksperimental (*mixed method experimental*). Kajian ini menggunakan reka bentuk kuasi-eksperimen iaitu reka bentuk praujian-pasca bagi kumpulan tidak seimbang (*non-equivalent groups pre-post test design*). Dalam kajian ini, kumpulan kawalan dan kumpulan rawatan diberi praujian sebelum pelaksanaan intervensi. Kumpulan rawatan telah diberikan intervensi pengintegrasian STEAM e-komik melalui PjBL dalam topik pembiakan dan perkembangan manusia.

3.2. Populasi Sampel dan Teknik Pensampelan

Populasi dan sampel bagi kajian ini adalah pelajar prauniversiti program matrikulasi di negeri Pulau Pinang. Populasi terdiri daripada 1334 orang pelajar Jurusan Sains (Sistem Dua Semester), 408 orang pelajar Jurusan Perakaunan dan 231 orang pelajar Jurusan Sains (Sistem Empat Semester).

3.3. Instrumen

Kajian ini menggunakan pendekatan kuantitatif dan kualitatif dengan instrumen yang telah disesuaikan untuk mengukur pencapaian serta maklum balas pelajar dalam topik pembiakan dan perkembangan manusia. Untuk kajian kuantitatif, instrumen yang digunakan ialah Ujian Pencapaian Pembiakan dan Perkembangan Manusia (Ujian 3PM) yang terdiri daripada 30 soalan objektif berdasarkan taksonomi Bloom (aras Mengingat, Memahami dan Aplikasi). Sementara itu, instrumen kualitatif terdiri daripada: Rubrik Kemahiran Kreativiti (berdasarkan model Torrance, 1988) yang menilai aspek kelancaran, fleksibiliti, keaslian dan kejelasan dan Rubrik PjBL (diadaptasi daripada Buck, 2015) yang menilai lima dimensi iaitu reka bentuk, proses, aplikasi, pengetahuan dan persembahan projek pelajar.

3.4. Prosedur Kajian dan Pengumpulan Data

Kajian ini dilaksanakan dalam tempoh masa enam minggu. Pada minggu pertama, pelajar diberi pengenalan kepada topik pembiakan dan perkembangan dan objektif kajian. Seterusnya, pelajar telah diberikan Praujian 3PM bagi mengenal pasti pengetahuan sedia ada pelajar. Pelajar telah diperkenalkan dengan masalah dan diberikan masa enam minggu untuk menghasilkan satu e-komik yang berkaitan dengan topik pembiakan dan perkembangan manusia. Selepas intervensi, Ujian Pasca 3PM telah diberikan kepada kumpulan rawatan bagi mengukur keberkesanan pengintegrasian STEAM e-komik melalui PjBL. Masa yang diberikan untuk menjawab Ujian Pasca 3PM adalah satu jam dan merupakan soalan yang sama seperti praujian namun kedudukan soalan telah diubah.

3.5. Teknik Analisis Data

Data deskriptif yang dikumpul dan dianalisis menggunakan *Statistical Package for the Social Sciences* (SPSS) versi 27.0. Nilai alfa yang ditetapkan untuk menguji hipotesis nul adalah aras signifikan .05 (95% selang keyakinan). Justeru itu, nul hipotesis ditolak jika nilai alfa < .05. Kajian ini akan menggunakan deskriptif statistik bagi menganalisis data. Dalam kajian ini, analisis ANCOVA digunakan bagi menganalisis pencapaian pelajar. Teknik ini digunakan bagi mengkaji perbezaan signifikan dalam min skor terhadap pencapaian pelajar dalam topik pembiakan dan perkembangan manusia. Terdapat beberapa andaian yang perlu dipatuhi sebelum analisis ANCOVA iaitu 1) normaliti, 2) kemohogenan varians, 3) lineariti dan 4) kemohogenan kecerunan regresi. Kesemua andaian bagi ujian ANCOVA telah dipenuhi dan disertakan di lampiran. Markah praujian diselaraskan untuk mengawal perbezaan sedia ada antara kumpulan.

4. DAPATAN KAJIAN

4.1. Dapatan Kajian Objektif Kajian 1

Ujian-t sampel bebas telah dilaksanakan bagi membuat perbandingan antara min skor pencapaian Praujian 3PM antara kumpulan rawatan dan kumpulan kawalan. Ujian ANCOVA hanya boleh diteruskan jika min skor antara dua kumpulan adalah signifikan. Jadual 4.2 menunjukkan min dan sisihan piawai bagi Praujian 3PM bagi kumpulan rawatan ($M = 18.29$, $SP = 2.87$) dan kumpulan kawalan ($M = 15.19$, $SP = 3.72$). Dapatan praujian menunjukkan terdapat perbezaan min skor Praujian 3PM antara kumpulan rawatan dan kumpulan kawalan.

Jadual 4.1: Deskriptif statistik Praujian 3PM

Kumpulan		<i>N</i>	<i>M</i>	<i>SP</i>
Prauajian 3PM	Rawatan	31	18.29	2.87
	Kawalan	31	15.19	3.72

Jadual 4.1 menunjukkan min dan sisihan piawai bagi Praujian 3PM bagi kumpulan rawatan ($M = 18.29$, $SP = 2.87$) dan kumpulan kawalan ($M = 15.19$, $SP = 3.72$). Dapatan ujian-pra menunjukkan terdapat perbezaan min skor Praujian 3PM antara kumpulan rawatan dan kumpulan kawalan.

Jadual 4.2: Ujian-t sampel bebas bagi Praujian 3PM

		Ujian Levene					Ujian-t			
		F	p	t	df	p	Beza min	Beza ralat piawai	95% Sela Keyakinan	
									Had bawah	Had atas
Praujian 3PM	Andaian Kesetaraan Varians	1.47	.23	3.67	60	.001	3.10	.84	1.41	4.78

Ujian-t sampel bebas telah dilaksanakan bagi membandingkan min skor Praujian 3PM antara kumpulan rawatan dan kumpulan kawalan. Berdasarkan Jadual 4.2, keputusan menunjukkan min skor bagi Praujian 3PM bagi kumpulan rawatan ($M = 18.29$, $SD = 2.87$) dan kumpulan kawalan ($M = 15.19$, $SD = 3.72$) adalah signifikan $t(60) = 3.67$, $p < .05$. Analisis dapatan mendapati Praujian 3PM bagi kumpulan rawatan dan kawalan adalah berbeza. Justeru, praujian bertindak sebagai kovariat. Maka, analisis ANCOVA diteruskan bagi mengesahkan keberkesanan pengintegrasian STEAM e-komik melalui PjBL.

Jadual 4.3: Analisis Kovarians (ANCOVA) bagi Ujian Pasca 3PM

Sumber	Jumlah Kuasa dua Jenis III	df	Kuasadua Min	F	p	η^2
Model Diperbetul	401.54	2	200.77	50.59	.001	.63
Intercept	381.86	1	381.86	96.23	.001	.62
Praujian	184.51	1	184.51	46.50	.001	.44
Kumpulan	56.13	1	56.13	14.15	.001	.19
Ralat	234.13	59	3.97			
Jumlah	30118.00	62				
Jumlah Diperbetul	635.68	61				

R Squared = .632 (Adjusted R Squared = .619)

Analisis ANCOVA dilaksanakan bagi membuat perbandingan keberkesanan pengintegrasian STEAM e-komik dalam pencapaian pelajar. Skor pelajar dalam Praujian 3PM sebelum intervensi digunakan sebagai kovariat dalam analisis kajian ini. Selepas pelarasan Praujian 3PM, terdapat perbezaan yang signifikan antara kedua-dua kumpulan terhadap skor ujian pasca dalam Praujian 3PM, $F(1,59) = 14.15$, $p = .01$, kuasa dua eta separa = .19. Justeru itu, hipotesis nol ditolak. Terdapat perbezaan yang signifikan dalam skor min ujian pasca terhadap pencapaian pelajar prauniversiti dalam topik pembiakan dan perkembangan manusia antara kumpulan rawatan dan kumpulan kawalan selepas pendekatan pengintegrasian STEAM e-komik melalui PjBL dan kaedah konvensional, dengan mengawal ujian-pra.

Jadual 4.5: Anggaran Min Marginal

Kumpulan	Min	Std. Error
Rawatan	22.86 ^a	.38
Kawalan	20.75 ^a	.38

Jadual 4.5 menunjukkan anggaran min marginal iaitu min yang diselaraskan pada pemboleh ubah bersandar dalam setiap kumpulan. Penyelarasan (*Adjusted*) bermaksud kesan kovariat telah disingkirkan secara statistik. Berdasarkan Jadual 4.5, nilai min yang diselaraskan bagi kumpulan rawatan ($M = 22.86$, $SEM = 0.38$) lebih baik berbanding kumpulan kawalan ($M = 20.75$, $SEM = 0.38$) dalam ujian 3PM. Kesimpulannya, pengintegrasian STEAM e-komik melalui PjBL meningkatkan pencapaian dalam topik pembiakan dan perkembangan manusia dalam kalangan pelajar prauniversiti.

4.2. Dapatan Kajian Objektif Kajian 2

Dalam kajian ini, analisis secara kualitatif telah dilaksanakan dengan menggunakan rubrik penilaian projek dan rubrik kreativiti mengikut kriteria yang telah ditetapkan mengikut skala 1 hingga 5 (1 = Lemah, 2 = Sederhana, 3 = Memuaskan, 4 = Baik, 5 = Cemerlang).

Jadual 4.6: Skor Penilaian Projek

No.	Kriteria	Galapagos Founder	Kumpulan Kapla Lutut	4flat	Powerpuff Cream	The Boys	Kapibara
1	Reka bentuk	5	5	3	5	5	3
2	Proses	4	5	4	5	5	4
3	Aplikasi	5	5	4	5	5	4
4	Pengetahuan	5	5	5	5	5	5
5	Persembahan	5	5	3	5	5	4
	Skor Keseluruhan	24	25	19	25	25	20

Jadual 4.6 menunjukkan skor penilaian projek e-komik yang diperolehi daripada setiap kumpulan berdasarkan lima kriteria. Berdasarkan Jadual 4.6, tiga kumpulan mendapat markah penuh bagi penilaian projek ini kumpulan tersebut memenuhi setiap kriteria dalam rubrik. Bagi kriteria pengetahuan, kesemua kumpulan dapat menerangkan konsep dan proses dalam topik pembiakan dan perkembangan manusia dengan baik namun reka bentuk dan persembahan yang kurang menarik menyebabkan beberapa kumpulan kehilangan markah. Kesalahan ejaan seperti *Sertoli Cell* dan *progesterone* menjadi punca kehilangan markah kepada kumpulan 4flat dan Kapibara. Proses penilaian sepanjang projek berlangsung bukan sahaja diukur dengan kefahaman pelajar dalam topik tersebut, malah kebolehan penyelesaian masalah, penggunaan teknologi dan kerjasama dalam kumpulan. Berdasarkan pemerhatian, tahap penglibatan pelajar dalam menyiapkan projek ini adalah tinggi. Pelajar yang pasif menunjukkan minat dan menyumbang idea dalam proses perbincangan dalam kumpulan. Secara keseluruhan, analisis dapatan melalui penilaian projek STEAM e-komik yang dihasilkan oleh pelajar berada pada tahap yang baik dan cemerlang.

Analisis secara kualitatif menggunakan rubrik telah dilaksanakan bagi menilai kesan pengintegrasian STEAM e-komik berasaskan PjBL dalam kemahiran kreativiti pelajar pelajar prauniversiti bagi topik pembiakan dan perkembangan manusia. Jadual 4.7 menunjukkan skor penilaian kemahiran kreativiti bagi setiap kumpulan.

No.	Kriteria	Kumpulan					
		Galapagos Founder	Kumpulan Kapla Lutut	4flat	Powerpuff Cream	The Boys	Kapibara
1	Kelancaran (fluency)	5	5	4	5	5	4
2	Fleksibiliti (Flexibility)	5	5	3	5	5	4
3	Keaslian (Originality)	5	5	3	5	5	3
4	Penghuraian (Elaboration)	5	5	4	5	5	5
	Skor Keseluruhan	20	20	14	20	20	16

Jadual 4.7 menunjukkan skor penilaian rubrik kemahiran kreativiti berdasarkan empat kriteria iaitu kelancaran, fleksibiliti, keaslian dan penghuraian yang diadaptasi daripada *Torrance*. Keseluruhannya, semua kumpulan mampu mengaplikasikan pengetahuan dalam topik pembiakan dan perkembangan manusia dan mengembangkan idea dalam lakaran yang dilukis. Selain itu, terdapat kumpulan yang berjaya menghasilkan idea yang unik dan asli berbeza dengan e-komik yang sedia ada. Contohnya, kumpulan *Powerpuff Cream* menjelaskan tiga peranan sel *Sertoli* dalam membantu pembentukan sperma seperti Rajah 2.



Rajah 2: Contoh e-komik bagi peranan sel Sertoli

5. PERBINCANGAN DAN CADANGAN

Pengintegrasian STEAM melalui Pembelajaran Berasaskan Projek (PjBL) menggunakan e-komik telah terbukti berkesan dalam meningkatkan pencapaian pelajar prauniversiti dalam topik Pembiakan dan Perkembangan Manusia. Dapatan ini disokong dengan kajian oleh Ekayana et al. (2024) yang mendapati pendekatan STEAM melalui PjBL membantu dalam meningkatkan pencapaian pelajar. Kajian ini menunjukkan bahawa pendekatan ini membantu pelajar memahami konsep kompleks melalui visualisasi kreatif dan interaktif, sekaligus mengaktifkan fungsi otak kiri dan kanan. Penglibatan kedua-dua hemisfera otak dalam pembelajaran memberi kesan kepada tahap kognitif pelajar seterusnya mempengaruhi pencapaian pelajar. Selain itu, penggunaan teknologi seperti *Canva*, *Anyflip* dan *Heyzine* dalam penghasilan e-komik bukan sahaja menarik minat pelajar generasi digital, malah meningkatkan kefahaman, daya ingatan dan menggalakkan pembelajaran aktif. Hal ini disokong dengan kajian oleh Baga et al., (2021) juga mendapati pengintegrasian teknologi digital dalam PjBL meningkatkan penglibatan aktif pelajar yang membantu dalam peningkatan pencapaian akademik.

Pendekatan ini juga seiring dengan Teori Kognitif Konstruktivisme yang menekankan pembelajaran berasaskan pengalaman dan kolaborasi. Selain itu, teori ini menyokong kaedah PjBL yang berpusatkan pelajar dan pensyarah bertindak sebagai fasilitator supaya pelajar dapat membina kemahiran menyelesaikan masalah dan berfikir secara kritis dan kreatif. Melalui pelaksanaan PjBL dalam menghasilkan e-komik, pelajar dapat membina kemahiran abad ke-21 yang semakin kurang dalam kalangan pelajar. Penggunaan grafik dalam PjBL juga membantu meningkatkan kemahiran komunikasi, kemahiran menggunakan teknologi maklumat dan kemahiran bekerja dalam kumpulan. Kajian menunjukkan bahawa penghasilan projek e-komik berasaskan pendekatan STEAM melalui PjBL berjaya meningkatkan kemahiran kreativiti pelajar dalam topik pembiakan dan perkembangan manusia. Penilaian menggunakan rubrik berdasarkan teori kreativiti Torrance mendapati terdapat peningkatan dalam empat aspek utama kreativiti: kelancaran, fleksibiliti, keaslian dan kejelasan. Penghasilan e-komik juga mendorong pelajar mengaplikasikan kemahiran berfikir aras tinggi (KBAT), membuat hubungan antara konsep biologi seperti sistem reproduktif dan persenyawaan, serta menyampaikan maklumat dalam bentuk visual yang menarik dan mudah difahami (Muhlisin et al. 2023). Kajian ini juga membuktikan bahawa penggunaan rubrik penilaian projek yang merangkumi reka bentuk, proses, aplikasi, pengetahuan dan persembahan membantu menilai penguasaan pelajar secara menyeluruh.

Pendekatan STEAM melalui PjBL menggunakan e-komik didapati berkesan dalam meningkatkan pencapaian dan kemahiran kreativiti pelajar prauniversiti dalam topik pembiakan dan perkembangan manusia. Pelajar lebih mudah memahami konsep yang kompleks melalui pembacaan ringkas, gambar menarik dan visualisasi interaktif. E-komik yang menekankan elemen visual membantu meningkatkan pemahaman pelajar serta mengukuhkan daya ingatan mereka terhadap isi pelajaran (Firnanda et al., 2021). Selain itu, pelajar menunjukkan peningkatan dalam penghasilan idea, grafik, watak dan jalan cerita yang kreatif serta berupaya menyampaikan konsep biologi dengan jelas. Melalui aktiviti ini, pelajar juga dapat membina kemahiran menyelesaikan masalah, berfikir secara kritis dan kreatif, serta bekerja dalam kumpulan. Pelaksanaan PjBL ini turut membantu pelajar mengaplikasikan pembelajaran dalam situasi dunia sebenar dan memperkukuh kemahiran abad ke-21.

6. KESIMPULAN

Secara keseluruhan, hasil analisis kajian ini menunjukkan objektif-objektif bagi kajian ini tercapai. Analisis kajian mendapati pengintegrasian STEAM e-komik melalui PjBL berkesan dalam meningkatkan pencapaian dan kemahiran kreativiti pelajar prauniversiti bagi topik pembiakan dan perkembangan manusia. Kaedah pembelajaran yang inovatif dan kreatif menggalakkan penglibatan aktif pelajar seterusnya berupaya meningkatkan pencapaian pelajar. Melalui pengintegrasian STEAM e-komik melalui PjBL, diharap kaedah pembelajaran di peringkat prauniversiti dapat ditransformasikan daripada pembelajaran melalui hafalan (rote learning) kepada pembelajaran yang berpusatkan pelajar. Selain itu, kaedah pembelajaran kolaboratif juga meningkatkan kemahiran insaniah pelajar yang semakin kurang dalam kalangan pelajar masa kini. Intervensi ini juga memupuk kemahiran kreativiti dalam kalangan pelajar seterusnya berupaya menyelesaikan masalah ke dalam konteks dunia sebenar.

Pengintegrasian STEM dan STEAM dalam pembelajaran harus dipraktikkan di peringkat sekolah, prauniversiti dan universiti bagi memastikan pelajar mempunyai pengetahuan dan kemahiran yang diperlukan pada abad ke-21. Secara tidak langsung, dapat membekalkan tenaga kerja profesional dalam meningkatkan pembangunan ekonomi negara. Hasil dapatan kajian juga ini dapat mengenal pasti kaedah pendekatan pengajaran yang berkesan bagi topik pembiakan dan perkembangan manusia malah pendekatan ini dapat digunakan bagi topik Biologi yang lain. Justeru itu, melalui kajian ini dapat disimpulkan bahawa kaedah pengintegrasian STEAM e-komik melalui PjBL berupaya memberikan kesan yang positif bukan sahaja terhadap pelajar tetapi juga kepada pensyarah dan juga pelajar prauniversiti.

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Reka Bentuk Sinematografi Naratif dalam menggabungkan *Live Action* dan Animasi 2D: Kajian Terhadap Pelajar Semester 3 Diploma Teknologi Kreatif Digital Animasi

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ABSTRAK

Perkembangan teknologi dalam bidang animasi digital telah membuka ruang kepada pendekatan pengajaran yang lebih imersif dan interaktif, terutamanya melalui integrasi antara live action dan animasi 2D. Gabungan media ini menuntut bukan sahaja kemahiran teknikal, tetapi juga penguasaan naratif visual yang mantap, kreatif dan berstruktur. Namun demikian, dalam konteks pendidikan tinggi, khususnya di peringkat diploma, masih kurang kajian yang menilai secara sistematik keberkesanan aplikasi pendekatan ini dalam penghasilan projek pelajar. Objektif utama kajian ini adalah untuk: (1) mengenal pasti dan menganalisis penggunaan elemen sinematografi naratif dalam gabungan live action dan animasi 2D oleh pelajar; (2) menilai keberkesanan proses penghasilan kandungan berasaskan model ADDIE; dan (3) meneliti impak pendekatan ini terhadap penguasaan teknikal, kreativiti serta penyampaian mesej patriotik dalam projek pelajar. Kajian ini memberi tumpuan kepada pelajar semester 3 Diploma Teknologi Kreatif Digital Animasi di Politeknik Ibrahim Sultan, melibatkan lima kumpulan projek akhir bertema Hari Kebangsaan yang dipilih melalui kaedah snowball sampling. Pendekatan kualitatif digunakan, disokong oleh kerangka reka bentuk pengajaran ADDIE. Data dikumpul melalui dokumentasi proses (skrip, papan cerita, animatik, video siap) dan temu bual separa berstruktur. Kajian turut menggunakan hierarki struktur naratif visual untuk menilai kekuatan emosi dan aliran cerita yang dibina. Dapatan menunjukkan pelajar berjaya membina struktur penceritaan yang tersusun dan menarik, dengan penggunaan teknik sinematografi seperti low-angle, pencahayaan dramatik dan voice-over. Integrasi animasi 2D pula berjaya memperkukuh mesej dan nilai patriotik dalam live action. Secara keseluruhan, pendekatan sinematografi naratif melalui gabungan visual hibrid ini telah meningkatkan kefahaman pelajar terhadap aspek teknikal dan naratif. Kajian ini mencadangkan agar pendekatan ini diperluas dalam kursus lain berkaitan produksi visual sebagai sebahagian daripada pembangunan pedagogi kontemporari yang lebih holistik dan bersesuaian dengan keperluan industri kreatif semasa.

Kata kunci: Sinematografi Naratif, Animasi 2D, Live Action, Model ADDIE, Snowball Sampling

1. PENDAHULUAN

1.1. Pengenalan

Dalam landskap pendidikan digital yang berkembang pesat, keupayaan untuk menghasilkan kandungan visual yang mengintegrasikan elemen estetika, teknikal dan naratif menjadi keperluan utama dalam pengajian animasi kontemporari. Evolusi teknologi media telah merintis jalan ke arah penghasilan karya visual hibrid yang menggabungkan teknik *live action* dan animasi 2D, sekali gus memperkaya pendekatan penceritaan dan memberikan pengalaman visual yang lebih mendalam serta signifikan kepada khalayak. Gabungan dua medium ini tidak sekadar memperluas ruang ekspresi seni, malah mencerminkan keupayaan pelajar dalam menguasai proses produksi yang kompleks dan berlapis. Dalam konteks pengajian di institusi pendidikan tinggi seperti politeknik, pendekatan ini menawarkan platform pedagogi berasaskan amalan (*practice-based pedagogy*) yang menekankan pembelajaran berasaskan projek (*project-based learning*) dan pemikiran reflektif terhadap aplikasi teknologi dalam konteks naratif visual. Sebahagian daripada kurikulum Diploma Teknologi Kreatif Digital Animasi,

pelajar Semester 3 didedahkan kepada modul *Cinematografi for Animation*, yang menuntut penerokaan terhadap teknik rakaman dan penyuntingan visual dalam bentuk yang lebih sofistikated. Projek akhir yang dibangunkan bertemakan Hari Kebangsaan dipilih bukan secara arbitrari, sebaliknya sebagai strategi pembelajaran yang bersifat transformatif dalam usaha menanam nilai patriotisme dan kesedaran sivik dalam kalangan pelajar melalui medium visual. Penekanan terhadap tema ini membolehkan pelajar menterjemah identiti nasional, nilai sejarah, dan kepelbagaian budaya Malaysia dalam bentuk naratif visual yang segar dan berdaya saing.

Projek ini melibatkan keseluruhan proses produksi, merangkumi fasa pra-produksi, produksi dan pasca-produksi, di mana pelajar diberi autonomi untuk memilih genre yang bersesuaian seperti cerita pendek, iklan televisyen (TVC), atau pesanan khidmat masyarakat (PSA). Menerusi integrasi elemen *live action* dan animasi 2D, pelajar bukan sahaja diasah dari aspek kemahiran teknikal dan sinematografi, malah dilatih untuk mengaplikasikan prinsip reka bentuk naratif, komposisi visual, kesan peralihan, serta strategi penyampaian mesej secara efektif dan menyeluruh. Dalam konteks yang lebih luas, inisiatif ini turut mencerminkan kecenderungan pedagogi moden yang mengangkat visual sebagai wahana utama dalam penyampaian nilai, dalam masa yang sama memupuk kecekapan digital yang selari dengan kehendak industri kreatif semasa, serta mempersiapkan pelajar untuk menjadi pencipta kandungan (*content creators*) yang bukan sahaja mahir secara teknikal, tetapi juga memiliki kepekaan terhadap konteks budaya dan masyarakat.

1.2. Penyataan Masalah

Walaupun penggabungan antara *live action* dan animasi 2D semakin meluas dalam industri kreatif, aplikasinya dalam konteks pendidikan masih belum mencapai tahap optimum. Pelajar animasi sering menghadapi kesukaran dalam membina aplikasi visual hibrid yang efektif terutamanya dari aspek struktur penceritaan, perancangan visual, serta penerapan teknik sinematografi yang sesuai (Yusof et al., 2020; Lim & Rahman, 2022).

Pelajar animasi menghadapi kesukaran dalam membina naratif secara visual serta kurang mahir dalam sinematik dengan mengaplikasikan pergerakan kamera, mengawal pencahayaan dan menghasilkan penyuntingan yang baik. Tambahan pula, integrasi animasi 2D dalam *live action* sering kali tidak harmoni, menjadikan naratif sukar difahami dan kurang menarik dari segi dramatik (Kamarudin & Mat Zin, 2023).

Terdapat keperluan kritikal untuk menilai bagaimana pendekatan sinematografi naratif dan penggunaan model penghasilan seperti ADDIE boleh menyokong penghasilan kandungan yang lebih tersusun, kreatif dan teknikal. Oleh itu, kajian ini dijalankan untuk mengenal pasti proses kerja pelajar serta menilai keberkesanan penggabungan visual hibrid dalam menghasilkan kandungan yang memenuhi standard industri semasa.

1.3. Objektif Kajian

Kajian ini dijalankan bagi mencapai objektif-objektif berikut:

- i. Menenal pasti pendekatan sinematografi naratif yang diaplikasikan oleh pelajar dalam penghasilan kandungan visual menggunakan gabungan *live action* dan animasi 2D.
- ii. Menilai tahap keberkesanan integrasi elemen *live action* dan animasi 2D dalam menyampaikan naratif visual yang tersusun, dramatik dan relevan dengan tema Hari Kebangsaan.
- iii. Menganalisis kekuatan dan cabaran teknikal serta kreatif yang dihadapi oleh pelajar sepanjang proses penghasilan video, merangkumi peringkat pra-produksi, produksi dan pasca-produksi.

1.4. Skop Kajian

Kajian ini memfokuskan kepada pelajar semester 3 Diploma Teknologi Kreatif Digital Animasi di Politeknik Ibrahim Sultan yang terlibat dalam penghasilan projek video pendek bertemakan Hari Kebangsaan, dengan menggabungkan teknik *live action* dan animasi 2D secara bersepadu. Fokus utama

diberikan kepada proses pra-produksi, produksi dan pasca-produksi yang dilalui pelajar, serta bagaimana mereka menerapkan pendekatan sinematografi naratif dalam membina struktur cerita yang efektif dan menarik. Kajian ini merangkumi penilaian terhadap elemen naratif visual, termasuk perancangan skrip, *storyboard*, animatik, teknik sinematografi, serta penyuntingan visual yang membentuk integrasi visual hibrid. Penekanan turut diberikan kepada kreativiti pelajar dalam menyampaikan mesej patriotik secara dramatik dan berimpak tinggi melalui media gabungan ini. Skop kajian ini juga melibatkan penilaian terhadap kekuatan dan cabaran teknikal yang dihadapi pelajar sepanjang proses penghasilan karya, termasuk aspek pergerakan kamera, kawalan pencahayaan, transisi antara dua medium visual, serta penggunaan perisian suntingan digital.

Selain itu, kajian ini bertujuan untuk menyediakan gambaran yang jelas mengenai tahap penguasaan pelajar dalam menerapkan pendekatan sinematografi naratif secara praktikal. Oleh yang demikian, pendekatan ini juga pelajar melontarkan idea-idea segar yang dapat memberi nafas baharu dalam dunia animasi yang sebenar. Kajian ini juga penting dalam menilai sejauh mana pelajar mampu menggabungkan dua bentuk visual utama dalam menghasilkan naratif patriotik yang berkesan dan kreatif. Kreativiti dan corak penyampaian dapat dilihat melalui karya-karya pelajar yang dipersembah. Dapatan kajian dijangka dapat membantu pendidik menilai keberkesanan kaedah pengajaran semasa serta membangunkan modul pembelajaran dan bengkel kemahiran yang lebih relevan dengan kehendak industri kreatif semasa.

2. KAJIAN LITERATUR

Kajian ini berpaksikan kepada beberapa konsep utama seperti sinematografi naratif, integrasi teknik *live action* dan animasi 2D, reka bentuk pembelajaran melalui model ADDIE, serta penggunaan pendekatan *project-based learning* dalam pendidikan animasi. Sorotan ini membentuk asas teori yang menyokong objektif dan metodologi kajian. Sinematografi naratif merujuk kepada penggunaan sudut kamera, pencahayaan, pergerakan kamera, dan komposisi visual sebagai alat penyampai cerita (Arijon, 1976; Bordwell & Thompson, 2008). Dalam konteks pendidikan politeknik, kemahiran ini penting untuk membantu pelajar mengartikulasi emosi dan naratif melalui bahasa visual. Penggunaan teknik sinematik seperti *establishing shot*, *close-up*, serta pergerakan dinamik kamera meningkatkan kesan dramatik dalam penceritaan pelajar. Di samping itu juga teknik pengendalian kamera serta pencahayaan juga perlu diberi penekatan yang tinggi dalam proses penghasilan video.

Gabungan antara *live action* dan animasi 2D pula membuka ruang kepada naratif visual hibrid yang bersifat kreatif dan interaktif (Wells, 1998; Lee, 2018). Ia menuntut kemahiran dalam mengurus dua medium yang berbeza secara teknikal dan estetika. Kajian Chai & Neo (2020) menunjukkan bahawa pelajar lebih mudah memahami prinsip animasi apabila diaplikasikan dalam konteks projek sebenar seperti iklan TV atau PSA. Model reka bentuk pembelajaran ADDIE digunakan untuk menstruktur proses pembangunan projek pelajar dari analisis hingga penilaian. Menurut Branch (2009) dan Gustafson & Branch (2002), model ini sesuai dalam konteks penghasilan kandungan digital kerana ia membantu pelajar memahami aliran kerja secara sistematik.

Dalam aspek pensampelan, teknik *snowball* digunakan untuk mengenal pasti pelajar yang menghasilkan projek berkualiti, dengan rujukan dari rakan sekumpulan atau pensyarah (Naderifar et al., 2017). Ini penting dalam kajian kualitatif berskala kecil seperti di institusi politeknik. Akhirnya, kajian oleh Zainuddin & Mohamad (2019) menyokong bahawa projek bertemakan nilai kebangsaan memberi peluang kepada pelajar untuk mengekspresikan mesej patriotik secara visual. Sinematografi berperanan penting dalam menonjolkan elemen perpaduan, identiti dan kepelbagaian budaya negara.

3. METODOLOGI KAJIAN

Kajian ini dilaksanakan bagi menilai secara holistik proses dan keberkesanan reka bentuk sinematografi naratif dalam penghasilan video bertemakan Hari Kebangsaan oleh pelajar semester 3, Diploma Teknologi Kreatif Digital Animasi di Politeknik Ibrahim Sultan. Kajian ini menggunakan pendekatan Reka Bentuk Berasaskan Kajian (Design-Based Research – DBR) yang menggabungkan Model

Instruksional ADDIE sebagai kerangka analisis dan kaedah *Snowball Sampling* sebagai teknik pemilihan peserta.

3.1. Reka Bentuk Kajian

Pendekatan kualitatif deskriptif digunakan kerana ia membolehkan pemahaman mendalam terhadap proses kreatif pelajar merentasi keseluruhan fasa pra-produksi, produksi dan pasca-produksi. DBR dipilih kerana pendekatan ini bersifat praktikal dan kontekstual, sesuai untuk menilai pembelajaran dalam situasi dunia sebenar (Barab & Squire, 2004). Selain itu, ia membolehkan pengkaji dan pelajar berinteraksi dalam membina pengetahuan secara berulang dan reflektif.

3.2. Model Reka Bentuk ADDIE

Jadual 1: Model Reka bentuk ADDIE

Fasa ADDIE	Pelaksanaan dalam Kajian Pelajar
<i>Analyze</i>	Kenal pasti objektif pembelajaran, keperluan teknikal dan tema kebangsaan.
<i>Design</i>	Merancang skrip, <i>storyboard</i> dan struktur naratif visual.
<i>Develop</i>	Penghasilan <i>footage live action</i> , animasi 2D, audio dan grafik sokongan.
<i>Implement</i>	Pelaksanaan penggambaran, integrasi animasi, penyuntingan video akhir.
<i>Evaluate</i>	Penilaian akhir melalui refleksi, dokumentasi dan keberkesanan persembahan.

Model ADDIE ini berfungsi sebagai panduan penghasilan kandungan dan juga kerangka analisis untuk menilai perkembangan kemahiran pelajar dalam menghasilkan kandungan sinematografi.

3.3. Kaedah Persampelan

Kajian ini menggunakan kaedah *snowball sampling* yang dikenali berkesan dalam kajian kualitatif berfokus, terutama dalam populasi kecil dan berstruktur (Naderifar et al., 2017). Seramai 20 orang pelajar nisbah 4 orang dalam 1 kumpulan telah mengikuti kursus *Cinematography for Animation* dan jumlah kumpulan yang dinilai adalah 5 kumpulan. Berdasarkan kriteria kualiti projek akhir mereka, sampel ini dianggap sesuai kerana setiap kumpulan pelajar menghasilkan projek unik dengan pendekatan naratif berbeza. Setiap kumpulan akan membangunkan proses kerja dan setiap pelajar akan menyertai penghasilan proses kerja itu. Pemilihan awal dilakukan oleh pensyarah dan disokong oleh cadangan rakan sekumpulan yang turut aktif. Saiz sampel kecil memberi peluang kepada analisis mendalam dan pemerhatian terperinci terhadap proses penghasilan kandungan.

3.4. Lokasi Kajian

Kajian dijalankan di Politeknik Ibrahim Sultan, Jabatan Rekabentuk dan Komunikasi Visual, dengan akses langsung kepada studio dan 3D *lab* animasi serta penggunaan fasiliti pengajaran yang menyokong aktiviti produksi pelajar.

3.5. Instrumen Kajian

Jadual 2: Instrumen Kajian

Instrumen	Peranan dan Justifikasi
Pemerhatian	Memantau proses kerja pelajar secara langsung dalam kelas dan bengkel.
Dokumentasi	Mengumpul bahan sokongan seperti <i>storyboard</i> , skrip dan video.
Temu bual Separa Berstruktur	Mengumpul data reflektif dan pengalaman pelajar secara berkumpulan.

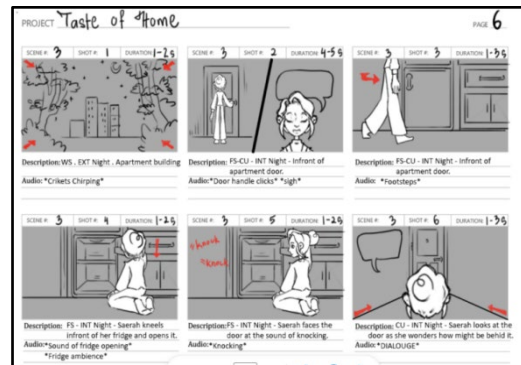
3.6. Teknik Analisis Data

Analisis data dijalankan secara tematik dan berasaskan kandungan visual. Visual akhir dianalisis dari aspek:

- Reka bentuk sinematografi (komposisi shot, pergerakan kamera, pencahayaan).
- Keberkesanan naratif (struktur cerita, dramatik, penyampaian mesej patriotik).

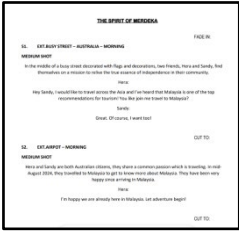


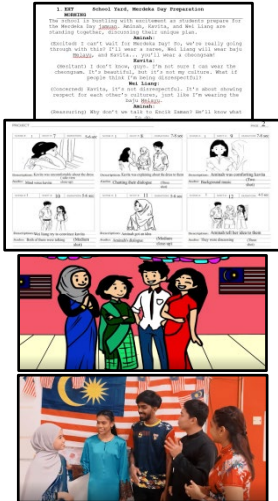
Gambar Rajah 2: Penulisan Skrip



Gambar Rajah 3: Papan Cerita

Jadual 3: Berdasarkan Hasil Kerja Pelajar *Snowball Sampling*

No	Tema Projek	Pendekatan Sinematografi Skrip/ Storyboard/ Video Akhir	Kekuatan	Cabaran
1.	<i>The Spirit of Merdeka</i>	 	Gabungan Teknikal yang Berjaya: Pelajar berjaya menggunakan teknik green screen (chroma key) dengan berkesan, membolehkan integrasi antara <i>live action</i> dan elemen animasi 2D berlaku secara lancar. Visual yang Kreatif dan Informatif: Poster digital dimasukkan sebagai elemen latar memberi impak visual tambahan dan memperkukuh mesej patriotik dalam penceritaan.	Kekangan Teknikal: Penggunaan green screen memerlukan pencahayaan sekata, tetapi berlaku bayang-bayang kasar yang menyukarkan proses <i>compositing</i> semasa penyuntingan. Kekurangan Gabungan Animasi: Terdapat sedikit kemahiran dalam menggabungkan kualiti animasi seperti karakter dalam hasil ini. Penggunaan Voice Over: Beberapa bahagian suara latar kurang jelas dan tiada penyuntingan bunyi tambahan (<i>sound effects</i> atau <i>background music</i>) yang boleh menyokong suasana.
2.	Satu Hati, Satu Jiwa	 	Pemilihan Lokasi Live Action yang Realistik: Elemen <i>live action</i> dirakam di tapak sebenar seperti kawasan luar atau bangunan, memberi sentuhan realistik dan emosi terhadap tema kebangsaan. Reka Bentuk Visual Animasi yang Bermakna: Dua karakter animasi 2D serta mural patriotik animasi berjaya disampaikan dalam bentuk visual yang menarik dan menyokong jalan cerita secara berkesan.	Tiada Integrasi Serentak dalam Satu Babak: Gabungan <i>live action</i> dan animasi tidak berlaku dalam satu frame/babak, sebaliknya berlaku secara berselang babak, menjadikan interaksi visual kurang sinematik. Keterbatasan Teknik Komposit Lanjutan: Kumpulan ini tidak gunakan teknik <i>layering</i> atau <i>rotoscoping</i> gabungan elemen animasi ke dalam <i>live action</i> (contoh: watak animasi berdiri di sebelah pelakon).

3 Warna - Warni Merdeka		Integrasi Visual Hibrid yang Berkesan Gabungan live action dan animasi 2D dipersembahkan dengan bersepadu, menunjukkan tahap kefahaman pelajar terhadap konsep penggabungan media secara teknikal dan artistik. Lokasi Live Action yang Realistik dan Bermakna. Pemilihan ruang galeria sebenar sebagai latar telah menambahkan keaslian suasana dan memperkukuh nilai simbolik berkaitan tema patriotik. Reka Bentuk Watak dan Visual Animasi yang Menyokong Naratif Penggunaan dua watak animasi utama serta lukisan patriotik animasi memberikan kekuatan visual yang menambah impak.	Ketidakseimbangan Dominasi Visual Walaupun terdapat integrasi, elemen <i>live action</i> agak kurang menonjol seperti penggunaan <i>close up</i> di antara manusia dan karakter perlu ditonjolkan untuk kelihatan lebih menarik.
4 Nasi Perpaduan		Idea dan Konsep Menarik Konsep projek adalah unik dan relevan dengan tema yang ditetapkan (contohnya tema Hari Kebangsaan), menunjukkan keaslian pemikiran dan kreativiti pelajar. Pemilihan Lokasi yang Autentik Lakonan di lokasi sebenar menambah nilai realisme dan menyokong suasana cerita yang cuba dibina.	Pergerakan Kamera yang Lemah Terdapat kelemahan dalam pengendalian kamera, terutamanya dari segi <i>camera movement</i> yang statik atau kurang dinamik, menjejaskan momentum visual. Kuantiti dan Fungsi Animasi yang Terhad Watak animasi tidak banyak diketengahkan, menjadikan peranan animasi kurang dominan.
5 Harmony In Heritage		Jalan Cerita yang Kreatif dan Tersusun Naratif yang dibina menunjukkan struktur cerita yang berkesan, dengan elemen permulaan, konflik, dan penyelesaian yang jelas. Integrasi Visual yang Efektif Penggunaan elemen grafik digital seperti karakter animasi dan visual tambahan disusun dengan komposisi yang menarik dan tidak mengganggu naratif utama.	Ketepatan Penyesuaian Animasi dan Footage Walaupun gabungan dilakukan, sinkronisasi antara animasi dan <i>live action</i> masih boleh diperbaiki, khususnya dari segi pencahayaan dan bayangan. Kekangan dalam Mengekspresikan Emosi Visual Penyampaian ekspresi karakter animasi dan pelakon kurang menyokong emosi cerita secara keseluruhan, menyebabkan naratif kurang mendalam.

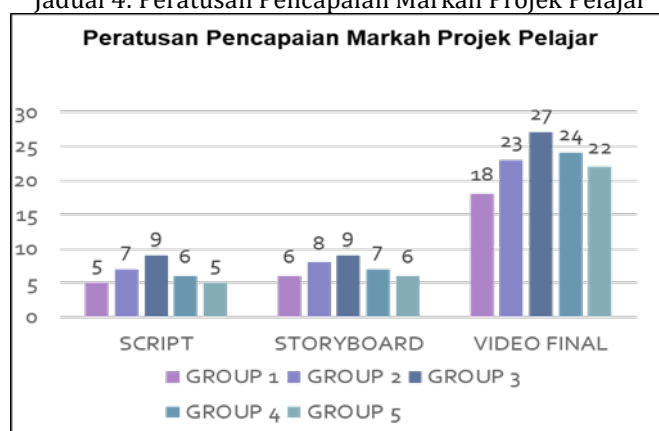
Kajian ini membuktikan bahawa pendekatan pembelajaran berasaskan projek yang mengintegrasikan teknik *live action* dan animasi 2D telah berjaya meningkatkan kompetensi teknikal dan naratif dalam kalangan pelajar Diploma Teknologi Kreatif Digital Animasi. Melalui teknik *snowball sampling*, lima kumpulan pelajar dipilih berdasarkan kualiti karya yang menampilkan struktur naratif mantap dan integrasi visual yang kreatif.

Dapatan utama menunjukkan bahawa pelajar berjaya membina naratif sinematik yang kukuh dengan penggunaan teknik seperti *voice-over*, *flashback*, dan metafora visual yang menyampaikan mesej

patriotik secara berkesan. Integrasi visual antara *live action* dan animasi 2D dicapai menerusi kaedah seperti *motion tracking*, *green screen compositing*, dan *layered animation*, sekali gus membuktikan penguasaan terhadap teknik hibrid dalam produksi digital. Namun begitu, cabaran yang signifikan termasuklah isu ketidaksepadanan pencahayaan, kekangan masa untuk *compositing* berlapis, serta kesukaran mengekalkan keseragaman pergerakan animasi dengan aksi sebenar. Walaupun demikian, pelajar menunjukkan keupayaan menyelesaikan masalah secara kreatif melalui manipulasi digital, penstrukturan semula babak, dan kolaborasi teknikal yang efektif.

Impak pembelajaran jelas ditunjukkan melalui peningkatan kefahaman terhadap aliran kerja produksi sebenar, keyakinan dalam penggunaan perisian pasca-produksi seperti *Adobe After Effects* dan *Premiere Pro*, serta kepekaan terhadap penyisipan elemen budaya nasional secara visual. Kajian ini mengesahkan bahawa pendekatan sinematografi naratif yang menggabungkan medium visual hibrid berpotensi tinggi untuk membentuk pengalaman pembelajaran yang reflektif, kontekstual dan relevan dengan kehendak industri kreatif masa kini.

Jadual 4: Peratusan Pencapaian Markah Projek Pelajar



Jadual 4 menunjukkan perbandingan pencapaian lima kumpulan pelajar dalam tiga fasa utama penghasilan projek video iaitu *Script*, *Storyboard*, dan *Video Final*. Kajian ini bertujuan menilai tahap penguasaan pelajar dalam aspek pra-produksi, produksi dan produksi akhir berdasarkan tugas yang diberikan. Fasa penulisan *Script*, markah kumpulan dalam fasa ini berada antara 5 hingga 9, menunjukkan pelajar berada di aras asas kefahaman naratif, khususnya dari aspek idea, struktur penceritaan, dan skrip teknikal. Ini menandakan pelajar masih berada di tahap pemahaman awal aras 1–2 Bloom. Fasa penghasilan *Storyboard*, markah pelajar meningkat sedikit antara 6 hingga 9 dalam fasa ini. Ini menunjukkan pelajar mula mengaplikasikan kefahaman naratif secara visual. Beberapa kumpulan seperti Group 2 dan 3 menunjukkan penguasaan storyboard yang lebih baik. Di sini, pelajar mula mencapai aras aplikasi dan organisasi visual. Fasa penghasilan *Video Final* menunjukkan lonjakan prestasi paling ketara. Group 3 mencapai markah tertinggi (27/30), diikuti Group 2 (24) dan Group 1 (22). Ini membuktikan bahawa pelajar lebih cemerlang apabila terlibat secara aktif dalam fasa penggabungan kemahiran teknikal Video dan animasi 2D. Aras kefahaman mereka kini mencapai analisis dan sintesis aras 4–5 Bloom.

5. KESIMPULAN

Kajian ini mengesahkan bahawa penerapan Model ADDIE menyokong penghasilan kandungan digital pelajar secara sistematik, selaras dengan pendekatan pengajaran reka bentuk kreatif (Gustafson & Branch, 2002). Dari sudut naratif, pelajar menunjukkan keupayaan membina struktur cerita yang mantap melalui teknik sinematografi seperti *low-angle*, pencahayaan dramatik dan *voice-over*, menyokong teori Arijon (1991). Namun, cabaran dalam pengurusan masa, teknikal pasca-produksi tetapi harus di pertingkatkan. Pendekatan sinematografi naratif hibrid ini terbukti memperkasa kemahiran teknikal, visual dan daya komunikasi pelajar, serta memperkukuh kebolehpasaran mereka dalam industri kreatif digital. Implikasi, kajian mencadangkan penyelidikan lanjutan juga disaran bagi meneroka aplikasinya dalam bidang seperti *immersive storytelling* dan pembangunan kandungan

patriotik digital, ke arah pembinaan kurikulum yang lebih adaptif dan berorientasikan industri masa hadapan.

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Empowering Communities Through Free Education: Factors Affecting Participation in Short Courses at Southern Zone Community Colleges

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ABSTRAK

This study aims to identify factors that influence community involvement in free short courses offered by Community Colleges in the Southern Zone. These short courses are a government initiative to improve the skills of local communities and support human development. However, community involvement has not yet reached an ideal level. This study uses a quantitative approach by distributing questionnaires to communities living near Community Colleges in Johor and Melaka. The three main factors studied are promotion, perceptions of course quality, and personal motivation. The data collected was analysed with statistical software to find the relationship between these factors and the level of community involvement. It is hoped that the findings will help Community Colleges and the Ministry of Higher Education create better strategies to increase community participation in free short courses.

Keywords: Community involvement, free short courses, skill development.

1. INTRODUCTION

Lifelong education is a vital part of developing human capital, especially with the rapid changes in technology and the global economy. In Malaysia, the Ministry of Higher Education (KPT) has played a significant role through Community Colleges by offering free short course programs under the Lifelong Education (PSH) initiative. The main goal is to empower communities by improving skills, marketability, and living standards (KPT, 2021). This program targets all levels of society, regardless of age, employment status, or educational background. However, implementing these free short courses faces challenges due to uneven levels of community engagement. Past studies show that although the courses have the potential to benefit the community, participation rates are low in some areas, especially rural ones (Haliza & Ahmad, 2022). This raises concerns about how these programs are promoted and implemented, as well as how relevant the course content is to local needs.

Community engagement in PSH programs is affected by several factors. Awareness of the course existence, access to the location, social support, and perceived benefits all play a role Zulkifli Salleh, & Ramli (2021). Furthermore, demographic and job-related factors, such as time constraints and family responsibilities, also serve as significant barriers to participation Mohd Fauzi, Hassan & Yusof, (2020). Therefore, it is essential to conduct thorough research to find the key factors that either encourage or prevent communities from engaging in these free short courses. This study focuses on community engagement in the Southern zone of Malaysia, which includes the states of Johor and Melaka. This area was chosen for its diverse socio-economic backgrounds and community structures, providing a clearer picture of the challenges and opportunities in implementing free short courses at Community Colleges.

2. PROBLEM STATEMENT

Lifelong education is a vital part of developing human capital, especially with the rapid changes in technology and the global economy. In Malaysia, the Ministry of Higher Education (KPT) has played a significant role through Community Colleges by offering free short course programs under the Lifelong Education (PSH) initiative. The main goal is to empower communities by improving skills, marketability, and living standards (KPT, 2021). This program targets all levels of society, regardless of age, employment status, or educational background. However, implementing these free short courses faces challenges due to uneven levels of community engagement. Past studies show that although the courses have the potential to benefit the community, participation rates are low in some areas, especially rural ones (Haliza & Ahmad, 2022). This raises concerns about how these programs are promoted and implemented, as well as how relevant the course content is to local needs.

Community engagement in PSH programs is affected by several factors. Awareness of the course existence, access to the location, social support, and perceived benefits all play a role Zulkifli Salleh, & Ramli (2021). Furthermore, demographic and job-related factors, such as time constraints and family responsibilities, also serve as significant barriers to participation Mohd Fauzi, Hassan & Yusof, (2020). Therefore, it is essential to conduct thorough research to find the key factors that either encourage or prevent communities from engaging in these free short courses. This study focuses on community engagement in the Southern zone of Malaysia, which includes the states of Johor and Melaka. This area was chosen for its diverse socio-economic backgrounds and community structures, providing a clearer picture of the challenges and opportunities in implementing free short courses at Community Colleges.

3. OBJECTIVES OF THE STUDY

This study was conducted to achieve the following objectives:

- i. Identify the level of community involvement in free short courses at Community Colleges in the Southern zone.
- ii. Identify the factors that influence community involvement in the course.

4. IMPORTANCE OF THE STUDY

This study has significant importance in various aspects, including institutions, local communities, policy makers and future researchers. Overall, this study is expected to contribute to improving the implementation of Lifelong Education (LPE) programs, especially free short courses offered by Community Colleges.

- i. This study is important for community colleges and the Ministry of Higher Education (KPT) as they work to improve free short course programs. The findings identify factors that influence community involvement. With this information, the institution can create new strategies for promotion, course content, teaching methods, and selecting more accessible locations. This will help increase participation rates and ensure the courses meet the needs and interests of the local community.
- ii. The study benefits the community, especially the B40 group, housewives, retirees, and those with limited formal education opportunities. Understanding the barriers and motivations for participating in short courses allows for targeted interventions. This ensures that more individuals can improve their skills and knowledge. Increasing participation can directly enhance the community's standard of living and job opportunities.
- iii. From the perspective of policy makers, this study serves as a valuable resource for creating policies related to vocational education and skills training. The data and analysis can support the development of PSH programs that are more inclusive, responsive, and sustainable. This aligns with the Malaysian Education Blueprint and the goals of a Social Malaysia, which focuses on empowering people through knowledge and skills.
- iv. From an academic and research angle, this study adds to the existing literature in community education and vocational training. It also opens the door for further research in other contexts,

such as comparing different areas or studying the long-term impact of PSH programs on participants' lives.

Overall, this study not only answers academic questions, but also brings high practical value to various stakeholders. The results and recommendations of this study are expected to strengthen the role of Community Colleges as catalysts for lifelong learning among Malaysians.

5. SCOPE OF THE STUDY

This study focuses on community colleges in Southern Malaysia, specifically in Johor and Melaka. The respondents are local community members who are alumni of free PSH short courses offered by Jasin Community College, Bukit Beruang Community College, Tangga Batu Community College, and Muar Community College. This study looks at the free short courses offered in the past three years.

6. STUDY HIGHLIGHTS

Lifelong learning (LLL) has become an important part of building a knowledgeable and skilled society, keeping up with the needs of the digital economy and the changing demands of the global community. In Malaysia, the LLL program offers free short courses through Community Colleges. This initiative aims to provide learning opportunities to various segments of society, especially those who cannot access formal education. Recent studies show that this program has a positive effect, but factors influencing community involvement still need more research. A study by Zulkifli, Salleh, and Ramli (2021) looked into the motivations and challenges of community involvement in short-term skills training programs. They discovered that the desire to participate in courses was closely linked to the need to improve living standards, enhance job opportunities, and acquire new skills. However, barriers such as time constraints, lack of information, and beliefs that the courses were irrelevant hindered participation. This points to the need for better promotional strategies and tailored course content that consider the backgrounds and needs of the local community.

Additionally, a study by Haliza and Ahmad (2022) indicated that the effectiveness of PSH short courses in rural areas is heavily influenced by the teaching approach and social support. They stressed that interactive teaching methods and locations near participants' homes can boost participation. The courses should also address the real needs of the community to have a more significant impact. From a demographic viewpoint, Mohd Fauzi, Hassan, and Yusof (2020) pointed out that factors like age, education level, employment status, and income affect participation in short courses. Full-time workers often struggle to join due to time limitations, while senior citizens and housewives are more inclined to participate if the courses are easily accessible and do not require a long-term commitment. This suggests that flexible scheduling and a micro-course format could attract more participants.

A study by Yahya and Hidayat (2023) examined the effectiveness of using technology to promote PSH and found that social media, WhatsApp, and other digital platforms effectively raised awareness of the program. However, the digital divide remains an issue in rural areas. This highlights the need for a multi-channel communication strategy to share information with the community. In summary, the study shows that factors affecting community involvement in free short courses come from a mix of internal aspects motivation, personal needs, external influences social support, easy access, and institutional elements teaching methods, promotional strategies. However, there is still a gap in research focused specifically on the context of Community Colleges in the Southern zone of Malaysia, which includes the states of Johor and Melaka. Therefore, this study was conducted to address that gap by focusing on a more specific and holistic local context.

7. STUDY METHODOLOGY

The study used a descriptive and inferential sample survey method to examine factors that influence community involvement in free short courses at the Southern Zone Community College. According to Sabitha Marican (2005), a questionnaire is a tool designed to collect information for analysis to answer

research questions. Sherri L. Jackson (2006) also noted that it involves an in-depth study of one or more individuals to uncover the truth. The study included local community members who were alumni of free PSH short courses offered by Jasin Community College, Bukit Beruang Community College, Tangga Batu Community College, and Muar Community College. The sample consisted of free PSH course participants who completed the course in the last three years.

Since this study is social research, the development of the questionnaire was conducted with the assistance of artificial intelligence (AI) however, its design, structure, and content were firmly guided by the predetermined research objectives to ensure validity and alignment with the purpose of the study. The questionnaire has five parts. Part A includes demographic information of the respondents. Part B has questions about the level of involvement in the PSH course. Part C addresses factors that encourage participation in the free short courses. Part D focuses on factors that hinder participation in the free short courses. Part E offers questions about suggestions to attract participants to attend the course. The Likert scale is well-suited for this survey study. It allows the researcher to account for biased responses. The scale ranges from Strongly Disagree (SD) to Strongly Agree (SA), with scores from 1 to 5 (Table 1).

Table 1: Likert Scale

Scale	Interpretation
1	Strongly disagree
2	Disagree
3	Not Sure
4	Agree
5	Strongly agree

All respondents involved filled out the questionnaire through the google form link that was provided along with a clear explanation regarding the purpose of the study. Descriptive statistical analysis was used to obtain the mean using SPSS version 23 software. In this study, the researcher used the interpretation of the mean score to answer questions one, two and three using the questionnaire as the instrument for the question. The interpretation of the findings from the questionnaire was analyzed as (Table 2).

Table 2: Interpretation of mean scores

Group	Range	Level of inclination
1	1.00 – 2.33	Low
2	2.34 – 3.67	Medium
3	3.68 – 5.00	High

(Source: Adapted from Landell, 1997)

7.1. Study Design

This study uses a descriptive quantitative approach to identify and describe the factors that influence community participation in free short courses organized by Community Colleges in the Southern Zone of Malaysia. The research adopts this quantitative approach because it allows systematic and large-scale data collection through tools like questionnaires, enabling statistical analysis to uncover relationships between the studied variables. This descriptive design is appropriate when researchers want to get a clear picture of the phenomena present in a population without altering the variables. In this study, the researcher aims to explore how factors such as demographics, awareness, motivation, social support, and access to learning facilities affect the community's decision to participate in free short courses. The study population consists of adults who have taken part in or have the potential to take part in free short courses offered by Community Colleges in three Southern states: Johor and Melaka. The study sample will be selected through stratified or simple random sampling techniques, depending on data availability, to ensure balanced representation based on state, gender, age, and educational background. The main tool for this study is a structured questionnaire developed from relevant literature reviews and conceptual frameworks. The questionnaire will have a section on the respondent's background and items that measure various factors that might influence participation in short courses. The items will use a five-point Likert scale to make quantitative analysis easier. Researchers will analyze the collected

data using statistical software like the Statistical Package for the Social Sciences (SPSS). Descriptive analysis, such as mean, percentage, and standard deviation, will describe the data distribution, while inferential analysis like correlation and multiple regression will identify relationships between variables and their influence on community involvement. Overall, this study design allows researchers to collect structured, objective, and generalizable information, providing a clearer understanding of the factors that encourage or hinder communities from participating in the Lifelong Education program offered for free.

8. RESEARCH FINDINGS

Based on the analysis of questionnaire data from 52 respondents, it was found that most participants in this study were women. A total of 34 respondents, or 65.4%, were female, while the remaining 18, or 34.6%, were male. This indicates that more women participate in free short courses at the Southern Zone Community College than men.

In terms of age, the largest group consists of individuals aged 36 to 45 years, with 22 people (42.3%). This is followed by those aged 46 and above (26.9%), 26 to 35 years (17.3%), and only 13.5% were aged between 18 and 25 years. This finding suggests that middle-aged and older adults are more likely to engage in free short courses, possibly because they want to improve their skills or have an interest in lifelong learning. Regarding race, most respondents were Malay, making up 49 people (94.2%). The rest included Indians (1.9%) and other races (3.8%). This reflects the typical racial makeup in the study area and highlights the prevalence of Malays participating in the courses offered by Community Colleges. In terms of education level, over half of the respondents had completed their SPM, totaling 29 people (55.8%). This group was followed by those with STPM or diploma qualifications (21.2%) and degrees (21.2%). Only one respondent (1.9%) had a PMR/PT3 qualification. This shows that free short courses at Community Colleges attract individuals from various educational backgrounds, especially those with secondary education. For employment status, the largest group consisted of full-time workers, totaling 23 people (44.2%). Additionally, there were housewives (30.8%), part-time workers (9.6%), retirees (5.8%), students (7.7%), and one unemployed respondent (1.9%). This indicates that the free short course appeals to people from different work backgrounds, including housewives and retirees who may take the course for self-improvement or leisure.

Finally, regarding the distance from home to the Community College, 40.4% of respondents lived more than 20 kilometers away, while 26.9% lived within 5 to 10 kilometers. Twelve respondents (23.1%) lived less than 5 kilometers away, and only 9.6% lived within 11 to 20 kilometers. This suggests that even though many respondents live far from the college, they still show interest in participating in the courses, likely due to the course's appeal, the relevance of the content, or their willingness to travel for learning. Overall, these demographic findings indicate that the Southern Zone Community College's free short course program has attracted a diverse group of individuals with different backgrounds in gender, age, education, and occupation. This data is essential for understanding the participant profile and can help guide more targeted promotional strategies and course offerings in the future.

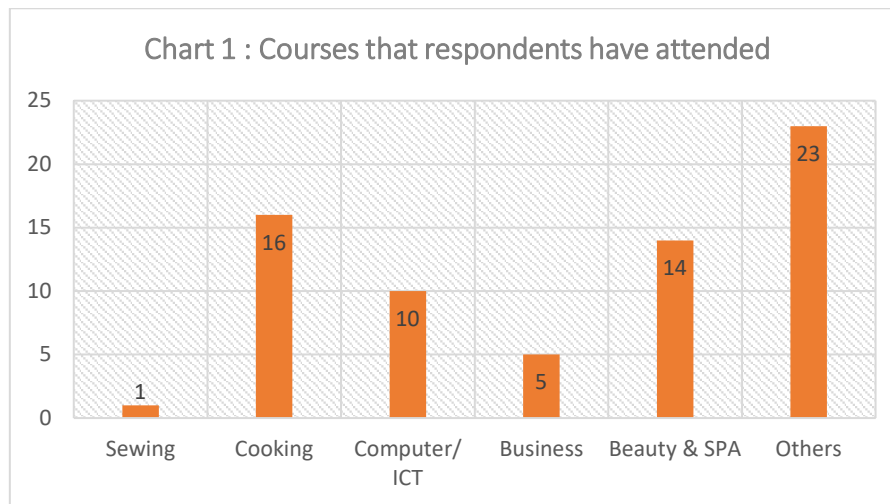
Table 3 shows that the level of community involvement in the free short courses is low. The average number of course participations is 1.423, with a standard deviation of .6670. The average response to the intention to participate in future courses is 1.115, with a standard deviation of .4709. Both values indicate that community involvement in these courses remains unsatisfactory.

Based on Chart 1, the most frequently attended course was in the other category, with 23 participants. This demonstrates that the community has varied interests and needs that may not align with the courses typically offered by community colleges. The Other category likely includes courses such as agriculture, technology, creative arts, and other vocational skills. The second most popular course was Cooking, attended by 16 participants. This indicates strong interest in the culinary field, likely related to daily needs and potential income opportunities in the food business. The Beauty/SPA course also received a decent response, with 14 attendees. This course can provide job opportunities or extra income, especially for women. In the Computer/ICT course, 10 respondents attended, showing interest

in digital skills that are increasingly important in today's technological era. The Business course had 5 participants, reflecting a moderate interest in entrepreneurship within the community. Conversely, the Sewing course had the least participation, with only one respondent attending. This may suggest a lack of interest or need for sewing skills among the participants. Overall, these findings reveal that the community is more inclined to participate in courses that offer practical value in daily life or have income-generating potential. Therefore, community colleges should continue offering courses that are relevant and meet the current needs and interests of the community to attract more participants.

Table 3: Level of Involvement in PSH Free Courses

No.	Items	Mean	Standard Deviation	Level
1	Number of free short course (PSH) participations	1.423	.6670	Low
2	Do you plan to join other courses in the future?	1.115	.4709	Low



Although participation was low, the study identified several factors that could encourage community involvement. Table 4 shows that all studied factors ranked high. The most significant factor attracting interest was that the course was free, with a mean of 4.769 and a standard deviation of .4693. Additionally, flexible course times (mean 4.577), course content that matched participants' interests and needs (mean 4.635), and easily accessible locations (mean 4.385) also encouraged participation. Family support (mean 4.500), course information obtained through social media or local communities (mean 4.481), instructor qualifications (mean 4.615), and incentives like participation certificates (mean 4.577) were identified as key motivating factors. These findings suggest that convenience, quality of delivery, and rewards are crucial in increasing community interest in participating.

Table 4: Factors that Encourage Participation in Free Short Courses

No.	Items	Mean	Standard Deviation	Level
1	I am interested in participating because the course is offered for free.	4.769	.4693	High
2	The flexible course times make it easy for me to attend.	4.577	.6054	High
3	The course content suits my interests and needs.	4.635	.4862	High
4	The location of the course is easily accessible from my home	4.385	.7182	High
5	My family members supported me in joining the course.	4.500	.5774	High
6	I get course information through social media or local communities	4.481	.5770	High
7	Experienced instructors interest me.	4.615	.4913	High
8	The participation certificate motivated me to attend the course.	4.577	.5367	High

This study also looked at the factors that hindered community participation. Table 5 shows that all the barriers were low. The identified factors included a lack of information about the course (mean 2.288),

course times that didn't fit with participants' responsibilities (mean 2.288), and transportation issues (mean 2.269). Additionally, a lack of self-confidence (mean 2.000), a lack of interest in the courses offered (mean 1.750), a preference for studying alone (mean 1.731), and the course duration being inadequate (mean 2.115) also played a role in the lack of participation. While the level of these barriers was low, it is still important to highlight them. These factors can influence the community's willingness to engage in the course.

Table 5: Factors hindering participant engagement

No.	Items	Mean	Standard Deviation	Level
1	I did not get information about the courses offered.	2.288	.8708	Low
2	Course times do not fit in with work hours or family responsibilities	2.288	.9147	Low
3	Transportation problems make it difficult for me to attend class.	2.269	.9100	Low
4	I am not confident in my ability to follow the course	2.000	.6860	Low
5	I am not interested in the courses offered.	1.750	.5899	Low
6	I am more comfortable studying on my own than attending a course.	1.731	.5641	Low
7	The course duration is too short or too long for my commitment	2.115	.8553	Low

To increase community participation, this study also presented several recommendations as found in Table 6. Among the suggestions that received high scores were increasing the number of course options that suit the community's interests (mean 4.442), providing a more flexible course schedule (mean 4.058), and expanding course promotion through social media and the local community (mean 4.346). In addition, industry-recognized course certification (mean 4.385) and providing incentives to participants who successfully complete the course (mean 4.192) were also suggested as measures to increase participation. Meanwhile, aspects such as course duration (mean 3.750), improving the skills of instructors (mean 3.385), and improving learning facilities (mean 3.558) were also given attention as supporting strategies.

Table 6: Suggestions for Attracting Participant Interest

No.	Items	Mean	Standard Deviation	Level
1	I would like more short course options to be offered according to community interests	4.442	.5392	High
2	Short course schedules need to be more flexible	4.058	.6076	High
3	The duration of the short course needs to be extended to be more in-depth	3.750	.9471	High
4	Teachers need to be given additional training to improve delivery effectiveness.	3.385	.9932	Medium
5	Learning facilities such as lecture rooms and equipment need to be improved.	3.558	.8725	Medium
6	Promotion of short courses needs to be expanded through social media and local communities	4.346	.6533	High
7	Short course certification needs to be recognized by the industry	4.385	.6310	High
8	I recommend that the college provide incentives for participants who complete the course.	4.192	.7679	High

Overall, the findings of the study show that although the level of participation in free short courses is still low, there are many factors that have the potential to increase community interest and participation. Colleges need to refine the factors that encourage and overcome existing barriers by introducing appropriate recommendations. This step is believed to be able to increase the involvement of the local community in the programs offered, in line with the government's desire to empower lifelong education.

9. DISCUSSION AND CONCLUSION

This study explored community involvement in free short courses at Southern Zone Community Colleges, identifying both motivating factors and barriers to participation. The demographic analysis showed that most participants were women, particularly middle-aged and older adults, with secondary education backgrounds. Despite some participants living far from the colleges, their willingness to attend indicates strong perceived value in the courses offered.

However, the overall level of involvement was found to be low, with limited course participation and low intention to re-join. Courses in practical and income-generating fields such as cooking, beauty/spa, and ICT were more popular, while traditional courses like sewing received minimal interest, suggesting a need to diversify offerings based on current community interests. Encouraging factors included the courses being free, flexible in scheduling, relevant in content, easily accessible, and supported by social and family networks. Meanwhile, barriers though generally low such as lack of information, inconvenient timing, and transportation issues, still need to be addressed. Low self-confidence and disinterest in some courses also contributed to reduced participation. Recommendations from participants emphasized the need to expand course options, provide industry recognized certifications, improve promotion strategies, and enhance learning facilities and instructor quality.

In conclusion, while the current level of involvement in free short courses is modest, the study highlights a promising potential for growth. The insights gained are essential for community colleges to refine their strategies in promoting lifelong learning. To maximize impact, implementers must proactively address the barriers identified, enhance motivating factors, and align course offerings with the real needs and aspirations of the community. Moreover, strategic collaboration with industry, government agencies, and local organizations is crucial to ensure these programs remain inclusive, sustainable, and impactful. Ultimately, the success of the Lifelong Learning program depends on a deep understanding of the target community and a strong commitment to continuous improvement in both planning and execution.

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Kesediaan, Persepsi Kegunaan dan Integriti Akademik Guru Pelatih dalam Penggunaan ChatGPT

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ABSTRAK

Kemunculan teknologi kecerdasan buatan generatif (AI) seperti ChatGPT telah membawa perubahan ketara dalam landskap pendidikan tinggi, terutamanya dalam kalangan pelatih guru. Walaupun teknologi ini menawarkan potensi besar dalam memperkasa proses pembelajaran, ia turut menimbulkan kebimbangan berkaitan isu etika, khususnya berkaitan integriti akademik. Kajian ini bertujuan untuk menilai tahap kesediaan, persepsi kegunaan dan integriti akademik dalam kalangan pelatih guru terhadap penggunaan ChatGPT. Pendekatan kajian berbentuk tinjauan kuantitatif telah digunakan, melibatkan seramai 504 pelatih guru dari institusi pendidikan guru di Malaysia. Data dikumpul melalui borang soal selidik yang telah disahkan dan dianalisis menggunakan perisian SPSS bagi analisis deskriptif. Dapatan kajian menunjukkan guru pelatih berada pada tahap sederhana tinggi dari segi kesediaan ($M = 3.19$, $SP = 0.407$) dan persepsi kegunaan ($M = 3.22$, $SP = 0.474$), manakala integriti akademik ($M = 3.47$, $SP = 0.415$) pelajar berada pada tahap tinggi. Dapatan ini mencadangkan keperluan untuk mengintegrasikan literasi AI dan amalan digital beretika dalam kurikulum pendidikan guru bagi memastikan penggunaan teknologi AI secara bertanggungjawab dalam kalangan pendidik masa depan.

Kata kunci: ChatGPT, pelatih guru, kesediaan, persepsi kegunaan, integriti akademik

1. PENDAHULUAN

Penggunaan teknologi kecerdasan buatan (AI) dalam bidang pendidikan semakin pesat berkembang, terutamanya dengan kemunculan alat AI generatif seperti ChatGPT. Teknologi ini menawarkan pelbagai potensi dalam meningkatkan penglibatan pembelajaran, menyampaikan kandungan secara adaptif dan sesuai mengikut keperluan pelajar serta menyokong penulisan akademik dan pemikiran aras tinggi (Wang & Fan, 2025; Zawacki-Richter et al., 2019). Namun begitu, penggunaan meluas AI juga menimbulkan cabaran, khususnya berkaitan kesediaan teknologi dan penggunaan beretika dalam kalangan pelajar, terutamanya dalam kalangan guru pelatih. Di Malaysia, usaha ke arah pendigitalan pendidikan selaras dengan inisiatif Pelan Pembangunan Pendidikan Malaysia (PPPM) dan Pendidikan Digital di bawah Kementerian Pendidikan Malaysia (KPM). Ini menunjukkan komitmen terhadap pengintegrasian teknologi baharu dalam kurikulum dan pedagogi, termasuklah AI generatif. Dalam kalangan guru pelatih, penggunaan teknologi ini boleh menjadi batu loncatan ke arah pembelajaran yang lebih aktif, sendiri dan reflektif, terutamanya apabila digunakan dengan bimbingan yang beretika dan terarah. Namun begitu, penggunaan ChatGPT juga menimbulkan persoalan baharu, khususnya berkaitan kesediaan pengguna, persepsi terhadap kegunaan sebenar teknologi tersebut dan tahap pematuhan terhadap integriti akademik.

Kajian ini dijalankan bagi meneroka ketiga-tiga elemen ini secara deskriptif dalam kalangan guru pelatih. Fokus utama diberikan kepada tahap kesediaan menggunakan ChatGPT, sejauh mana mereka melihat teknologi ini berguna dalam konteks pembelajaran, serta sejauh mana mereka mengekalkan integriti akademik ketika menggunakan bantuan teknologi AI. Melalui pemahaman corak penggunaan ini, institusi pendidikan guru boleh merangka strategi dan garis panduan yang lebih kukuh bagi memupuk penggunaan AI secara beretika di bilik darjah masa hadapan.

1.1. Penyataan Masalah

Walaupun Model Penerimaan Teknologi (TAM) (Davis, 1989) dan Indeks Kesediaan Teknologi (TRI) (Parasuraman, 2000) telah banyak digunakan dalam kajian terdahulu untuk menilai penerimaan teknologi dalam kalangan pelajar, masih terdapat kekurangan kajian yang meneliti secara khusus tahap kesediaan, persepsi terhadap kegunaan, dan integriti akademik dalam konteks penggunaan teknologi AI generatif. Di samping itu, penyelidikan yang memfokuskan kepada guru pelatih sebagai populasi kajian juga masih terhad, sedangkan golongan ini bakal memainkan peranan penting dalam menerapkan amalan pedagogi beretika di masa hadapan. Oleh itu, kajian yang meneroka corak penggunaan dan tahap pemahaman pelatih guru terhadap ChatGPT adalah penting sebagai asas kepada penyelidikan lanjutan yang lebih mendalam berkaitan penggunaan AI secara bertanggungjawab dalam pendidikan.

1.2. Tujuan Kajian

Kajian ini bertujuan untuk mengenal pasti dan menerangkan tahap kesediaan, persepsi kegunaan serta integriti akademik dalam kalangan guru pelatih terhadap penggunaan ChatGPT dalam konteks akademik.

1.3. Objektif Kajian

Objektif penyelidikan ini adalah:

- i. Mengetahui tahap kesediaan guru pelatih terhadap penggunaan ChatGPT.
- ii. Menilai tahap persepsi kegunaan ChatGPT dalam kalangan guru pelatih.
- iii. Menentukan tahap integriti akademik guru pelatih semasa menggunakan ChatGPT.

1.4. Soalan Kajian

- i. Adakah tahap kesediaan guru pelatih terhadap penggunaan ChatGPT?
- ii. Adakah tahap persepsi kegunaan ChatGPT dalam kalangan guru pelatih?
- iii. Adakah tahap integriti guru pelatih semasa menggunakan ChatGPT?

2. KEPENTINGAN KAJIAN

Kajian ini memberi sumbangan yang signifikan dalam memahami corak penggunaan ChatGPT dalam kalangan guru pelatih di Malaysia. Melalui hasil kajian deskriptif ini, institusi pendidikan guru dapat mengenal pasti keperluan latihan dan sokongan terhadap penggunaan AI yang beretika. Selain itu, kajian ini dapat menjadi asas kepada kajian-kajian lanjutan yang meneliti hubungan antara pemboleh ubah atau pembangunan modul latihan teknologi AI dalam konteks pendidikan guru. Penekanan terhadap integriti akademik juga penting bagi memastikan guru pelatih bukan sahaja celik teknologi, tetapi turut mempunyai kesedaran etika yang tinggi dalam amalan profesional mereka. Hal ini sejajar dengan peranan guru pelatih sebagai kumpulan penting yang akan membentuk landskap digital pendidikan masa hadapan. Justeru, memahami tahap kesediaan dan sikap mereka terhadap alat AI adalah penting untuk membina kewarganegaraan digital yang bertanggungjawab.

3. KAJIAN LITERATUR

Kajian lepas menunjukkan bahawa teknologi kecerdasan buatan seperti ChatGPT memberi impak yang signifikan terhadap proses pembelajaran. Menurut Wang dan Fan (2025), penggunaan ChatGPT mampu meningkatkan prestasi pelajar, persepsi terhadap pembelajaran dan pemikiran aras tinggi. Sementara itu, Zawacki-Richter et al. (2019) pula menegaskan bahawa AI menyumbang kepada pembelajaran tersuai (personalized learning) dan maklum balas segera yang bermanfaat untuk pelajar. Model Penerimaan Teknologi (TAM) yang diperkenalkan oleh Davis (1989) menekankan dua faktor utama yang mempengaruhi sikap terhadap teknologi, iaitu persepsi terhadap kegunaan dan kemudahan penggunaan. Dalam konteks guru pelatih, persepsi terhadap keberkesanan ChatGPT memainkan

peranan penting dalam menentukan kesediaan mereka untuk menggunakannya secara berterusan sebagai alat bantu pembelajaran.

Indeks Kesediaan Teknologi (TRI) oleh Parasuraman (2000) pula merangkumi empat dimensi iaitu optimisme, inovasi, ketidakselesaian dan ketidakpercayaan. Kajian oleh Alshamy et al. (2025) menunjukkan bahawa tahap kesediaan teknologi pelajar boleh mempengaruhi cara mereka menggunakan teknologi AI secara beretika dan bertanggungjawab. Selain itu, isu integriti akademik dalam penggunaan ChatGPT semakin mendapat perhatian. Kajian oleh Chuah dan Sumintono (2024) mendapati bahawa walaupun pelajar menggunakan ChatGPT untuk membantu pembelajaran, wujud kebimbangan terhadap potensi pelanggaran etika seperti peniruan dan kebergantungan. Oleh itu, integriti akademik merupakan aspek penting yang perlu dinilai khususnya dalam kalangan bakal guru.

Secara keseluruhannya, kajian ini mengisi jurang penyelidikan dari segi pemetaan tahap kesediaan, persepsi dan integriti akademik dalam penggunaan ChatGPT, yang masih kurang diberikan perhatian dalam konteks guru pelatih di Malaysia.

4. METODOLOGI KAJIAN

Kajian ini menggunakan pendekatan kuantitatif berbentuk kajian deskriptif. Instrumen kajian merupakan soal selidik berstruktur yang mengandungi tiga bahagian utama iaitu kesediaan teknologi, persepsi kegunaan dan integriti akademik dalam penggunaan ChatGPT. Ketiga-tiga konstruk dan item soal selidik telah diadaptasi daripada kajian oleh Chuah dan Sumintono (2024) yang memfokuskan kepada tahap kesediaan serta amalan etika dalam kalangan pelajar universiti ketika menggunakan ChatGPT dan teknologi AI lain bagi menyiapkan tugas akademik. Instrumen asal kajian tersebut telah diuji dan disahkan dari segi kesahihan (validiti) dan kebolehpercayaan (reliabiliti). Untuk memastikan kesesuaian dengan konteks tempatan, penyesuaian telah dilakukan secara berhati-hati agar selaras dengan latar belakang, budaya, dan pengalaman pelatih guru di Institut Pendidikan Guru (IPG) di Malaysia.

Analisis kebolehpercayaan instrumen soal selidik telah dijalankan bagi menentukan konsistensi dalaman item-item yang membentuk setiap konstruk utama kajian, iaitu kesediaan, persepsi kegunaan, dan integriti akademik. Analisis ini menggunakan pekali Alpha Cronbach, iaitu kaedah statistik standard yang lazim digunakan untuk menilai kebolehpercayaan item-item berskala Likert.

Jadual 1: Kebolehpercayaan Instrumen Soal Selidik

Konstruk	Alfa Cronbach, α
Kesediaan	0.864
Persepsi Kegunaan	0.925
Integriti Akademik	0.926

Menurut Hair et al. (2019), nilai Alpha Cronbach melebihi 0.70 menunjukkan kebolehpercayaan yang baik, manakala nilai melebihi 0.90 dianggap sebagai sangat tinggi dan cemerlang. Berdasarkan nilai-nilai ini, dapat disimpulkan bahawa ketiga-tiga konstruk dalam soal selidik adalah sangat boleh dipercayai dan mempunyai konsistensi dalaman yang kukuh. Dapatan ini juga menyokong kesesuaian instrumen yang diadaptasi daripada kajian terdahulu oleh Chuah dan Sumintono (2024), membuktikan bahawa adaptasi kepada konteks pelatih guru di Malaysia tidak menjejaskan kestabilan konstruk. Justeru, soal selidik yang digunakan adalah sesuai untuk meneroka corak dan persepsi pelatih guru terhadap penggunaan ChatGPT dalam konteks pembelajaran dan penulisan akademik.

Seramai 504 orang guru pelatih Institut Pendidikan Guru (IPG) di Malaysia telah terlibat sebagai responden kajian melalui kaedah persampelan bertujuan, dengan mengambil kira kriteria pendedahan dan pengalaman dalam penggunaan ChatGPT bagi tugas akademik. Saiz sampel ini adalah mencukupi bagi kajian berasaskan pendekatan kuantitatif, khususnya bagi analisis deskriptif dan korelasi. Justifikasi ini adalah sejajar dengan cadangan Hair et al. (2019), yang mencadangkan minimum 200 responden untuk memastikan kestabilan dan kebolehpercayaan dalam analisis multivariat, serta Krejcie

dan Morgan (1970) yang mengesyorkan saiz sampel melebihi 384 individu bagi populasi berskala besar. Data dianalisis menggunakan statistik deskriptif melalui perisian IBM SPSS (Versi 27), yang melibatkan pengiraan min, sisihan piawai dan peratusan bagi menggambarkan corak taburan dan tahap setiap pemboleh ubah kajian. Kajian ini menggunakan skala empat mata bagi menilai tahap kesediaan, persepsi kegunaan dan integriti akademik guru pelatih dalam penggunaan ChatGPT. Skala ini diadaptasi daripada Mohamad Ariffin Abu Bakar dan Norulhuda Ismail (2020) dan telah digunakan dalam pelbagai kajian berkaitan penilaian sikap, pengetahuan dan amalan pendidik. Jadual 2 menunjukkan julat interpretasi bagi skor min berdasarkan skala tersebut:

Jadual 2: Interpretasi Skor Min Skala Likert Empat Mata

Skor Min	Interpretasi
1.00 – 1.74	Rendah
1.75 – 2.49	Sederhana - Rendah
2.50 – 3.24	Sederhana - Tinggi
3.25 – 4.00	Tinggi

Sumber: Mohamad Ariffin Abu Bakar dan Norulhuda Ismail (2020)

5. DAPATAN KAJIAN & PERBINCANGAN

5.1. Demografi Responden dan Corak Penggunaan ChatGPT

Jadual 3 menunjukkan taburan demografi responden berdasarkan jantina dan kekerapan penggunaan ChatGPT. Seramai 504 orang guru pelatih terlibat dalam kajian ini, yang terdiri daripada 165 orang lelaki (32.7%) dan 339 orang perempuan (67.3%). Dari aspek kekerapan penggunaan ChatGPT, majoriti responden iaitu 272 orang (54.0%) melaporkan menggunakan ChatGPT lebih daripada sekali seminggu. Ini diikuti oleh 191 orang (37.9%) yang menggunakannya setiap hari. Hanya 26 orang (5.2%) menggunakan aplikasi ini sekali seminggu, manakala 13 orang (2.6%) melaporkan penggunaannya kurang daripada sekali seminggu. Hanya 2 orang responden (0.4%) menyatakan mereka tidak pernah menggunakan ChatGPT.

Corak penggunaan ini menunjukkan bahawa sebanyak 91.9% responden menggunakan ChatGPT secara aktif, sama ada setiap hari atau lebih daripada sekali seminggu. Dapatan ini memberi gambaran bahawa AI generatif seperti ChatGPT semakin diterima dan menjadi sebahagian daripada ekosistem pembelajaran dalam kalangan guru pelatih. Penggunaan yang tinggi ini berkemungkinan dipengaruhi oleh keupayaan ChatGPT untuk menjana idea, merumus kandungan dan membantu dalam tugas akademik, sebagaimana yang dilaporkan dalam kajian Hasan et al. (2023) dan Chuah dan Sumintono (2024). Namun demikian, tahap penggunaan yang tinggi juga membawa implikasi penting terhadap keperluan membangunkan garis panduan penggunaan beretika, terutamanya dalam aspek integriti akademik. Ini penting bagi memastikan teknologi seperti ChatGPT digunakan sebagai alat bantu pembelajaran dan bukannya menggantikan proses pemikiran kritikal dan penulisan asli dalam kalangan pelatih guru. Langkah ini penting dalam memastikan teknologi dimanfaatkan secara bertanggungjawab dalam ekosistem pendidikan yang beretika dan mampan.

Jadual 3: Demografi Responden

Demografi		Frekuensi (n)	Peratus (%)
Jantina	Lelaki	165	32.7
	Perempuan	339	67.3
Kekerapan Penggunaan ChatGPT	Kurang daripada sekali seminggu	13	2.6
	Lebih daripada sekali seminggu	272	54.0
	Sekali seminggu	26	5.2
	Setiap hari	191	37.9
	Tidak pernah	2	.4

5.2. Tahap Kesiediaan Terhadap Penggunaan ChatGPT

Min keseluruhan bagi konstruk kesiediaan adalah 3.19 dengan sisihan piawai 0.407, menunjukkan tahap kesiediaan yang berada pada tahap sederhana tinggi. Ini menunjukkan bahawa majoriti guru pelatih bersikap positif terhadap penerokaan teknologi baharu seperti ChatGPT, namun mungkin masih memerlukan latihan atau bimbingan lanjut untuk menguasainya sepenuhnya. Ini selaras dengan dapatan Wang dan Fan (2025) yang menyatakan bahawa pelajar memerlukan bimbingan dalam menggunakan AI secara strategik dalam pembelajaran. Tambahan pula, tahap kesiediaan yang sederhana tinggi ini dapat dikaitkan dengan pengalaman guru pelatih dalam menggunakan pelbagai aplikasi digital sebelum ini, yang secara tidak langsung membina kemahiran asas dan keyakinan mereka terhadap penerokaan teknologi baharu seperti ChatGPT. Dapatan ini turut selari dengan dapatan Chuah dan Sumintono (2024) yang menunjukkan bahawa pelajar institusi pengajian tinggi menunjukkan tahap kesiediaan yang positif apabila diberi pendedahan dan sokongan yang mencukupi terhadap penggunaan teknologi baharu.

5.3. Tahap Persepsi Terhadap Kegunaan ChatGPT

Konstruk persepsi terhadap kegunaan ChatGPT menunjukkan min 3.22 ($SP = 0.474$), juga berada pada tahap sederhana tinggi. Ini menunjukkan bahawa guru pelatih melihat ChatGPT sebagai alat yang membantu dalam pembelajaran seperti penjanaan idea, menyediakan draf penulisan, dan pengukuhan kefahaman. Dapatan ini sejajar dengan hasil kajian Hasan et al. (2023) yang melaporkan bahawa pelajar universiti cenderung menggunakan AI generatif sebagai alat bantu menyiapkan tugas dan meningkatkan kecekapan akademik mereka. Walau bagaimanapun, dapatan ini juga mencerminkan bahawa terdapat kebimbangan terhadap batasan teknologi ini seperti ketepatan fakta dan kebolehan AI memahami konteks pembelajaran yang kompleks. Persepsi ini penting untuk difahami agar institusi pendidikan dapat memberi pendedahan yang seimbang antara potensi dan risiko penggunaan teknologi AI dalam akademik.

5.4. Tahap Integriti Akademik dalam Penggunaan ChatGPT

Sementara itu, konstruk integriti akademik mencatatkan nilai min tertinggi iaitu 3.47 ($SP = 0.415$), yang juga berada pada tahap tinggi. Dapatan ini sangat memberangsangkan kerana ia menunjukkan bahawa walaupun guru pelatih menggunakan ChatGPT secara aktif, mereka masih mengekalkan nilai dan amalan integriti akademik. Ini mungkin berpunca daripada kesedaran etika yang dipupuk dalam latihan profesional perguruan, selain kefahaman mengenai implikasi akademik dan profesional sekiranya berlaku pelanggaran etika. Pendidikan awal mengenai etika penggunaan AI generatif terbukti memainkan peranan penting dalam memupuk tanggungjawab akademik kalangan pengguna. Sebagai contoh, Hill & Hargis (2024) melaporkan bahawa modul latihan berdurasi tiga jam yang direka bentuk bagi menggabungkan prinsip integriti akademik dengan aplikasi Generative AI telah meningkatkan kefahaman dan tanggapan etika pelajar terhadap penggunaan teknologi tersebut secara signifikan. Ini menunjukkan bahawa intervensi bersasar dalam bentuk latihan berstruktur mampu membina kesedaran dan pematuhan terhadap norma etika digital.

Tambahan pula, dapatan kajian oleh Johnston et al. (2024) yang melibatkan pelajar institusi pengajian tinggi mendapati bahawa sebahagian besar responden menyokong perlunya garis panduan rasmi universiti berkaitan penggunaan AI. Ini menunjukkan bahawa pelajar, termasuk guru pelatih, menghargai kejelasan dan batasan dalam penggunaan teknologi seperti ChatGPT. Sokongan ini sekali gus memperkukuh idea bahawa pemahaman tentang etika penggunaan AI bukan sahaja dapat mencegah salah guna, tetapi turut memupuk budaya akademik yang bertanggungjawab. Dalam konteks ini, dapat dirumuskan bahawa tahap integriti akademik yang tinggi dalam kalangan guru pelatih yang ditunjukkan dalam kajian ini adalah selari dengan keperluan pendidikan berterusan berkaitan etika digital, justeru memperkukuh keperluan pelaksanaan sistematik modul literasi AI dan kod etika penggunaan AI di institusi pendidikan guru.

Jadual 4. Statistik Deskriptif

Pemboleh ubah	Min	SP	Tahap
Kesediaan	3.19	0.407	Sederhana tinggi
Persepsi Kegunaan	3.22	0.474	Sederhana tinggi
Integriti Akademik	3.47	0.415	Tinggi

6. KESIMPULAN

Kajian ini telah memberikan gambaran yang menyeluruh mengenai tahap kesediaan, persepsi kegunaan, dan integriti akademik dalam kalangan pelatih guru terhadap penggunaan teknologi kecerdasan buatan generatif seperti ChatGPT. Dapatan kajian menunjukkan bahawa guru pelatih berada pada tahap sederhana tinggi dalam kesediaan dan persepsi kegunaan, manakala tahap integriti akademik dalam penggunaan ChatGPT adalah tinggi. Ini memberi petunjuk bahawa sebahagian besar pelatih guru mempunyai asas yang kukuh untuk menerapkan teknologi baharu secara bertanggungjawab dan beretika. Dapatan ini mengesahkan bahawa guru pelatih bukan sahaja bersedia untuk memanfaatkan teknologi AI dalam pembelajaran dan tugas akademik, malah mereka juga menunjukkan komitmen terhadap amalan integriti akademik yang tinggi. Hal ini amat penting kerana sebagai pendidik masa depan, mereka akan memainkan peranan penting dalam mendidik generasi yang celik teknologi serta bertanggungjawab dari segi etika digital.

Selain itu, impak kajian ini adalah signifikan kepada institusi pendidikan guru kerana ia memberi petunjuk awal kepada keperluan intervensi dalam bentuk latihan literasi AI dan pendidikan etika digital yang lebih sistematik. Justeru, kurikulum latihan guru wajar menekankan elemen kesedaran etika, kebertanggungjawaban dalam penggunaan teknologi, serta pembangunan kemahiran reflektif dalam menangani dilema penggunaan AI. Latihan seperti ini mampu membina pendidik yang bukan sahaja mahir teknologi, tetapi juga berpegang pada nilai profesionalisme dan etika pendidikan yang tinggi.

Dari sudut teoritikal, kajian ini menyumbang kepada pengembangan Model Penerimaan Teknologi (TAM) dengan mengintegrasikan dimensi etika akademik sebagai hasil (outcome) yang relevan dalam konteks penggunaan AI dalam pendidikan tinggi. Kajian ini menunjukkan bahawa faktor kognitif seperti kesediaan dan persepsi kegunaan tidak hanya mempengaruhi penerimaan teknologi, tetapi juga berkaitan dengan amalan etika penggunaannya.

Sebagai cadangan untuk kajian lanjutan, penyelidik disarankan untuk meneroka faktor-faktor lain seperti pengaruh norma subjektif, kawalan tingkah laku terancang, dan kepercayaan terhadap teknologi dalam membentuk amalan integriti digital dalam kalangan guru pelatih. Kajian kualitatif juga wajar dijalankan untuk mendapatkan kefahaman mendalam tentang justifikasi etika dan proses membuat keputusan dalam penggunaan AI dalam kalangan guru pelatih. Secara keseluruhan, dapatan kajian ini menegaskan bahawa pengintegrasian AI dalam pendidikan guru tidak seharusnya dilihat semata-mata sebagai isu teknikal atau inovasi pedagogi, tetapi harus dilihat sebagai satu cabaran moral dan profesional yang memerlukan pendekatan holistik dan menyeluruh.

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Kesediaan Pensyarah Jabatan Pengajian Am Politeknik Ibrahim Sultan dalam Pembangunan Platform Pentauliah-Mikro (Micro-credential)

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ABSTRAK

Perkembangan teknologi digital berteraskan Revolusi Industri 4.0 telah membuka ruang kepada pendekatan pembelajaran baharu yang lebih fleksibel dan lestari, termasuk pelaksanaan Pentauliah-Mikro (Micro-credential, MC) dalam sistem pendidikan politeknik. Pendekatan MC ini berupaya memberi peluang kepada pelajar memperoleh pensijilan berskala kecil secara modular, selaras dengan tuntutan pembelajaran sepanjang hayat dan kebolehpasaran graduan. Namun, kejayaan pelaksanaan MC bergantung kepada tahap kesediaan pensyarah dari segi pengetahuan, kemahiran teknologi, pedagogi serta sikap terhadap inisiatif ini. Kajian ini dijalankan bertujuan meneliti tahap kesediaan pensyarah Jabatan Pengajian Am Politeknik Ibrahim Sultan dalam pembangunan dan pelaksanaan MC sebagai salah satu pendekatan PdP alternatif. Kajian menggunakan reka bentuk tinjauan kuantitatif dengan edaran soal selidik berasaskan skala Likert lima mata melibatkan keseluruhan populasi seramai 24 orang pensyarah. Analisis data menggunakan perisian SPSS versi 27. Dapatan menunjukkan tahap pengetahuan pensyarah terhadap MC adalah tinggi (min 4.17–4.58), manakala tahap kesediaan teknologi dan kemahiran pedagogi juga berada pada tahap tinggi (min 3.54–4.00). Dari segi sikap, pensyarah menunjukkan pandangan positif terhadap MC dengan skor min yang tinggi (3.67–4.38), selain menerima sokongan institusi yang memberangsangkan. Walau bagaimanapun, dapatan turut mengenal pasti keperluan latihan dan bimbingan berterusan bagi meningkatkan keyakinan serta kemahiran membangunkan kandungan MC secara lebih berkesan. Secara keseluruhan, kajian ini membuktikan bahawa pensyarah Jabatan Pengajian Am di Politeknik Ibrahim Sultan mempunyai tahap kesediaan yang baik untuk melaksanakan MC, namun masih memerlukan usaha penambahbaikan berterusan dalam aspek latihan dan sokongan teknikal agar inisiatif MC dapat direalisasikan dengan optimum selaras dengan aspirasi pendidikan masa hadapan.

Keywords: mMicrocredential, kesediaan pensyarah, politeknik

1. PENGENALAN

Perkembangan Revolusi Industri 4.0 telah memberi kesan yang signifikan terhadap pelbagai sektor, termasuk bidang pendidikan, memandangkan ia berperanan penting dalam membentuk tenaga kerja masa hadapan. Perubahan pesat ini menuntut penilaian semula secara menyeluruh terhadap sistem pendidikan sedia ada, di samping mendorong pelaksanaan pendekatan baharu berteraskan teknologi digital yang lebih interaktif, fleksibel dan lestari. Ekosistem pembelajaran yang bersifat anjal semakin diperluas agar proses pengajaran dan pembelajaran (PdP) tidak lagi terhad kepada kaedah bersemuka di bilik kuliah semata-mata, bahkan turut merangkumi pembelajaran digital yang dinamik, berskala global, serta boleh dilaksanakan pada bila-bila masa. Transformasi PdP secara dalam talian melalui teknologi komunikasi moden telah membuka peluang kepada pelbagai bentuk inovasi pendidikan yang menyokong pembelajaran sepanjang hayat (PSH).

Selaras dengan perubahan ini, Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) telah memperkenalkan konsep Pentauliah-Mikro (Micro-credential, MC) sebagai inisiatif memperluas akses pendidikan (Politeknik dan Kolej Komuniti, 2023). Pendekatan ini membolehkan individu mengikuti komponen pembelajaran berskala kecil (mikro) dan memperoleh Lencana Digital atau Sijil

Mikro sebagai pengiktirafan terhadap pengetahuan, kemahiran atau kecekapan yang dicapai. MC ditawarkan secara fleksibel, berpusatkan pelajar; tidak terikat kepada masa dan lokasi, serta pada kos yang lebih rendah. Seterusnya, koleksi MC yang diperoleh boleh dikompilasikan untuk kelayakan rasmi pada tahap Sijil, Diploma atau Ijazah Sarjana Muda secara kerja kursus, sesuai dengan keperluan semasa industri dan pasaran kerja. Dalam menghadapi perubahan ini, tahap kesediaan pensyarah memainkan peranan penting untuk memastikan keberkesanan pelaksanaan MC di institusi politeknik. Kesediaan ini merangkumi aspek pengetahuan, kemahiran teknikal dan sikap yang positif, agar mereka mampu menyesuaikan pendekatan PdP daripada kaedah tradisional kepada bentuk yang lebih fleksibel dan digital. Pensyarah perlu mempersiapkan diri secara menyeluruh dan tidak tergesa-gesa dalam menghadapi transformasi pendidikan supaya tidak berlaku impak negatif terhadap matlamat asal PdP.

Walaupun sistem PdP konvensional masih menjadi pilihan utama dalam menyampaikan kurikulum politeknik, keupayaan pensyarah untuk menerima dan melaksanakan MC secara optimum menuntut sokongan dan latihan berterusan. Hal ini penting bagi memastikan proses perubahan yang dilaksanakan dapat berjalan dengan lancar dan berkualiti, selari dengan kehendak Revolusi Industri 4.0 serta aspirasi pembelajaran sepanjang hayat. Justeru, kajian ini dijalankan untuk meneliti tahap kesediaan pensyarah Jabatan Pengajian Am di Politeknik Ibrahim Sultan dari aspek pengetahuan, kemahiran dan sikap dalam membangunkan dan melaksanakan *micro-credential* sebagai salah satu pendekatan PdP masa kini.

1.1. Objektif Kajian

Kajian ini mempunyai tiga (3) objektif utama seperti berikut:

- i. Mengenal pasti tahap pengetahuan pensyarah Jabatan Pengajian Am di Politeknik Ibrahim Sultan tentang konsep *micro-credential*.
- ii. Menilai tahap kesediaan teknologi dan kemahiran pedagogi pensyarah dalam membangunkan serta melaksanakan *micro-credential* sebagai pendekatan PdP alternatif.
- iii. Menganalisis sikap pensyarah terhadap pelaksanaan *micro-credential* serta tahap sokongan institusi

2. KAJIAN LITERATUR

Pandemik COVID-19 telah mempercepatkan penggunaan teknologi dalam pendidikan, terutamanya melalui pembelajaran dalam talian dan pendekatan *micro-credential* (MC). MC semakin mendapat perhatian dalam kalangan institusi pendidikan tinggi di seluruh dunia, termasuk Malaysia dan khususnya Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK), kerana keupayaannya menyediakan pembelajaran yang fleksibel, mudah diakses, dan selari dengan keperluan pembangunan lestari untuk pendidikan berkualiti.

Komitmen institusi dan tahap kesiapsiagaan dari aspek sumber manusia, kemahiran teknologi, serta sokongan infrastruktur menjadi antara faktor penentu kejayaan pelaksanaan *micro-credential*. Menurut Che Ahmat, Bashir, Razali, dan Kasolang (2021), pelaksanaan *micro-credential* memerlukan kesediaan menyeluruh daripada pihak institusi, termasuk keupayaan tenaga pengajar dalam mengadaptasi teknologi, kemudahan platform digital yang stabil, serta dasar sokongan institusi yang jelas agar dapat menjamin keberkesanan program MC. Kajian mereka turut menekankan bahawa tanpa sokongan holistik daripada pihak pengurusan, usaha membangunkan MC berpotensi berdepan halangan seperti tahap kefahaman yang rendah dalam kalangan pensyarah dan kurangnya latihan profesional berkaitan penyediaan kandungan digital yang berkualiti.

Kajian yang dijalankan oleh bin Sahrir et al. (2024) bertujuan meneliti tahap kesediaan pensyarah terhadap penggunaan m-pembelajaran dalam sistem TVET di Kolej Komuniti Lahad Datu (KKLD). Dapatan kajian menunjukkan bahawa tahap kesediaan pensyarah dari segi pengetahuan, kemahiran dan sikap terhadap pelaksanaan m-pembelajaran masih berada pada tahap sederhana rendah. Implikasi hasil kajian ini memperlihatkan keperluan untuk meningkatkan pendedahan pensyarah berkaitan penggunaan m-pembelajaran, sama ada melalui inisiatif individu, program anjuran institusi atau jabatan

seperti seminar, bengkel atau latihan yang sesuai, bagi memastikan transformasi PdP dalam sistem TVET dapat dijalankan dengan lebih efektif dan selaras dengan kehendak pendidikan abad ke-21.

Menurut Abu Hassan et al. (2021), di Kolej Komuniti Hulu Langat (KKHL), pembelajaran dan pengajaran dalam talian (e-pembelajaran) telah dilaksanakan sebagai alternatif kepada kaedah pembelajaran bersemuka bagi memastikan kelangsungan proses PdP. Kajian yang dijalankan bagi menilai tahap keberkesanan serta halangan e-pembelajaran mendapati keberkesanan kaedah ini berada pada tahap tinggi. Dapatan ini menunjukkan bahawa pelajar bersedia mengaplikasikan mod pembelajaran yang berbeza daripada kaedah konvensional. Sehubungan itu, pelaksanaan *micro-credential* (MC) boleh dianggap sebagai satu lagi alternatif PdP yang berpotensi. Maka, tahap kesediaan pensyarah untuk melaksanakan MC adalah satu perkara yang relevan dan wajar diberi perhatian.

Menurut Abd Manaf et al. (2024), kajian ke atas 164 orang pensyarah Biologi di kolej matrikulasi Malaysia mendapati tahap kesediaan pensyarah terhadap penggunaan pembelajaran mudah alih (m-Learning) adalah sederhana tinggi dari segi pengetahuan, kemahiran dan sikap. Pensyarah dilaporkan memahami kelebihan m-Learning berbanding kaedah konvensional, namun pengetahuan teori tentang konsep m-Learning masih kurang kukuh. Dari segi kemahiran, pensyarah mampu menyediakan bahan pengajaran dan melaksanakan strategi m-Learning secara asas, tetapi masih belum menguasai kemahiran lanjutan untuk mengoptimumkan penggunaannya. Sikap pensyarah juga positif, menunjukkan kesediaan menghadapi cabaran dan minat menggunakan m-Learning, walaupun perkongsian strategi dengan rakan sejawat masih terhad. Kesimpulannya, tahap kesediaan pensyarah berada pada tahap sederhana, dan penambahbaikan diperlukan melalui latihan bersasar, peningkatan sokongan institusi, serta kajian lanjut untuk memenuhi keperluan khusus dalam pendidikan Biologi.

Pihak Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK) telah mengambil inisiatif merancang dan menyediakan sokongan bagi membantu pensyarah dalam membangunkan platform *micro-credential* (MC). Sebagai langkah menyokong pelaksanaan ini, satu dokumen rasmi iaitu Garis Panduan Pelaksanaan Pentauliahian-Mikro (*Micro-credentials*) telah diterbitkan oleh Politeknik dan Kolej Komuniti, Kementerian Pendidikan Tinggi Malaysia pada tahun 2023. Garis panduan ini menjadi rujukan penting kepada para pensyarah untuk merancang, membangun dan melaksanakan modul pengajaran melalui platform MC secara lebih sistematik. Inisiatif ini jelas mencerminkan komitmen institusi dalam menyediakan sokongan serta galakan kepada pensyarah bagi memperkasa PdP berasaskan teknologi dan fleksibiliti pembelajaran sepanjang hayat.

3. METODOLOGI KAJIAN

3.1. Reka Bentuk Kajian

Kajian ini menggunakan pendekatan kuantitatif dengan kaedah tinjauan soal selidik. Pendekatan ini dipilih kerana membolehkan data dikumpulkan secara sistematik dan terancang berkaitan tahap pengetahuan, tahap kesediaan teknologi dan kemahiran pedagogi serta sikap pensyarah dan sokongan institusi. Soal selidik yang digunakan berformat Skala Likert lima mata yang memerlukan responden untuk menyatakan tahap persetujuan mereka bermula daripada “Sangat Tidak Setuju” (1) hingga “Sangat Setuju” (5). Soal selidik ini diedarkan secara dalam talian bagi memudahkan proses pengumpulan data. Data kajian dianalisis menggunakan perisian *Statistical Package for the Social Sciences* (SPSS) versi 27.

3.2. Populasi dan Persampelan

Populasi kajian terdiri daripada semua pensyarah di Jabatan Pengajian Am, Politeknik Ibrahim Sultan, yang terlibat atau berpotensi terlibat dalam pembangunan kandungan *micro-credential*. Jumlah keseluruhan populasi ialah 24 orang, dan kesemua mereka dipilih sebagai responden kajian ini. Oleh kerana saiz populasi adalah kecil dan dapat diakses sepenuhnya, kajian ini menggunakan kaedah pensampelan menyeluruh (*total population sampling*). Pendekatan ini dianggap sesuai kerana setiap individu dalam populasi mempunyai kaitan langsung dengan topik kajian, sekali gus memastikan

dapatan kajian adalah bebas daripada kesilapan pensampelan (*sampling error*) dan mewakili keseluruhan populasi secara langsung.

3.3. Justifikasi Saiz Sampel

Walaupun jumlah responden hanya 24 orang, jumlah ini merangkumi keseluruhan populasi pensyarah Jabatan Pengajian Am di Politeknik Ibrahim Sultan. Justeru, pemilihan saiz sampel tidak hanya berdasarkan pertimbangan statistik minimum, tetapi turut mengambil kira kepentingan konteks dan kandungan kajian. Tambahan pula, kajian ini tidak bertujuan membuat generalisasi kepada semua politeknik di Malaysia, sebaliknya memfokuskan penilaian dalaman di peringkat jabatan sahaja. Oleh itu, dapatan kajian ini masih sah dan relevan untuk tujuan penambahbaikan dalaman.

3.4. Kesahan dan Kebolehpercayaan

Instrumen soal selidik yang dibangunkan telah melalui proses semakan kesahan dan kebolehpercayaan. Bagi memastikan kesahan kandungan, instrumen dikemukakan kepada dua orang pakar, iaitu seorang pensyarah kanan Jabatan Pengajian Am dan seorang *master trainer* pembangunan platform MC di Politeknik Ibrahim Sultan. Pandangan pakar-pakar ini digunakan untuk menambah baik bahasa, memastikan kejelasan makna, dan menilai kesesuaian kandungan instrumen. Bagi menentukan kebolehpercayaan instrumen soal selidik, nilai kebolehpercayaan telah diukur menggunakan pekali Cronbach's Alpha. Analisis menunjukkan nilai Cronbach's Alpha adalah 0.884 bagi keseluruhan 15 item yang diuji, seperti ditunjukkan dalam Jadual 1. Nilai ini melepasi tahap minimum kebolehpercayaan 0.70 yang dicadangkan oleh Nunally dan Bernstein (1994), menunjukkan bahawa instrumen ini mempunyai tahap kebolehpercayaan dalaman yang tinggi serta konsisten untuk digunakan dalam kajian ini. Nilai ini sekali gus mengesahkan bahawa semua item dalam soal selidik adalah serasi dan boleh dipercayai untuk mengukur konstruk berkaitan kesediaan pensyarah Jabatan Pengajian Am terhadap pembangunan *micro-credential* di Politeknik Ibrahim Sultan.

Jadual 1: Statistik Kebolehpercayaan Instrumen

Statistik Kebolehpercayaan	Nilai
Cronbach's Alpha	0.884
Bilangan Item	15

Data kuantitatif yang dikumpulkan dianalisis menggunakan SPSS versi 27. Interpretasi skor min adalah berdasarkan skala Bahman dan Turiman (1999) serta disokong oleh saranan Nunally dan Bernstein (1994), seperti dalam Jadual 2 berikut:

Jadual 2. Interpretasi Skala Min

Skala Min	Interpretasi
1.00 hingga 2.00	Rendah
2.01 hingga 3.00	Sederhana
3.01 hingga 4.00	Tinggi
4.01 hingga 5.00	Sangat Tinggi

4. DAPATAN KAJIAN & PERBINCANGAN

Dapatan kajian ini dibahagikan kepada empat bahagian iaitu profil pensyarah, tahap pengetahuan pensyarah berkaitan *microcredential*, tahap kesediaan teknologi dan kemahiran pedagogi serta sikap pensyarah dan sokongan institusi.

4.1. Profil Pensyarah

Jadual 3: Profil Responden Kajian

Perkara	Klasifikasi	Kekerapan	Peratus (%)
Jantina	Lelaki	7	29.1%
	Perempuan	17	70.8%

Umur	30 hingga 40 tahun	10	41.6%
	41 hingga 50 tahun	12	50%
	51 tahun ke atas	2	8.3%
Pengalaman Mengajar	Kurang daripada 10 tahun	0	0%
	10 hingga 20 tahun	20	83.3%
	Lebih daripada 20 tahun	4	16.6%
Tahap Pendidikan	Ijazah Sarjana Muda	11	45.8%
	Sarjana	10	41.6%
	Doktor Falsafah (PhD)	3	12.5%

Melalui aspek jantina, majoriti responden merupakan pensyarah perempuan iaitu seramai 17 orang (70.8%), manakala pensyarah lelaki berjumlah 7 orang (29.1%). Berdasarkan kategori umur, sebahagian besar responden berada dalam lingkungan 41 hingga 50 tahun iaitu seramai 12 orang (50%), diikuti oleh 10 orang (41.6%) dalam lingkungan umur 30 hingga 40 tahun, dan hanya 2 orang (8.3%) berumur 51 tahun ke atas.

Merujuk kepada pengalaman mengajar, didapati majoriti pensyarah mempunyai pengalaman mengajar antara 10 hingga 20 tahun iaitu seramai 20 orang (83.3%), manakala selebihnya 4 orang (16.6%) mempunyai pengalaman lebih daripada 20 tahun. Tiada pensyarah yang mempunyai pengalaman mengajar kurang daripada 10 tahun, menunjukkan kesemua responden berpengalaman luas dalam bidang pengajaran. Dari segi tahap pendidikan, seramai 11 orang (45.8%) memiliki kelulusan Ijazah Sarjana Muda, diikuti 10 orang (41.6%) berkelulusan Sarjana, manakala hanya 3 orang (12.5%) mempunyai kelulusan Doktor Falsafah (PhD). Secara keseluruhannya, profil responden kajian ini menunjukkan kepelbagaian dari aspek jantina, umur, pengalaman, dan kelayakan akademik. Hal ini memberikan gambaran holistik terhadap kumpulan pensyarah di Jabatan Pengajian Am, Politeknik Ibrahim Sultan, sekali gus memperkukuhkan kesahan dapatan kajian ini.

4.2. Tahap Pengetahuan berkaitan *Microcredential*

Jadual 4 memperincikan skor min bagi setiap item yang berkaitan dengan tahap pengetahuan pensyarah terhadap *micro-credential* (MC) di Jabatan Pengajian Am. Secara keseluruhan, semua item menunjukkan tahap pengetahuan yang tinggi, dengan nilai min berada dalam julat antara 4.17 hingga 4.58.

Jadual 4: Tahap Pengetahuan Pensyarah Terhadap *Micro-credential* (MC)

Bil.	Item	Min	Interpetasi
B1	Saya tahu maksud dan konsep <i>micro-credential</i> (MC).	4.17	Tinggi
B2	Saya tahu perbezaan antara <i>micro-credential</i> (MC) dan kursus konvensional.	4.17	Tinggi
B3	Saya tahu bahawa <i>micro-credential</i> (MC) boleh ditawarkan secara mandiri atau ekstrak kursus.	4.17	Tinggi
B4	Saya tahu <i>micro-credential</i> (MC) menyokong pembelajaran fleksibel dan sendiri serta salah satu pendekatan pembelajaran sepanjang hayat.	4.58	Tinggi
B5	Saya tahu terdapat garis panduan pembangunan MC yang disediakan oleh Bahagian Instruksional dan Pembelajaran Digital (BIPD), JPPKK	4.50	Tinggi

Hasil analisis Jadual 4 menunjukkan bahawa tahap pengetahuan pensyarah terhadap *micro-credential* adalah tinggi secara keseluruhan, dengan min bagi semua item berada dalam julat 4.17 hingga 4.58.

Item B4, iaitu “Saya tahu *micro-credential* (MC) menyokong pembelajaran fleksibel dan sendiri serta salah satu pendekatan pembelajaran sepanjang hayat” merekodkan skor min tertinggi sebanyak 4.58. Hal ini menunjukkan bahawa pensyarah sangat memahami konsep MC sebagai satu pendekatan pembelajaran yang fleksibel dan menyokong pembelajaran sepanjang hayat, selari dengan perkembangan sistem pendidikan masa kini. Item B5 “Saya tahu terdapat garis panduan pembangunan MC yang disediakan oleh Bahagian Instruksional dan Pembelajaran Digital (BIPD), JPPKK” turut mencatatkan skor min yang tinggi iaitu 4.50, mencerminkan tahap kesedaran pensyarah terhadap kewujudan panduan rasmi pembangunan MC di peringkat institusi.

Sementara itu, item B1, B2, dan B3 masing-masing memperoleh skor min yang sama iaitu 4.17, juga berada pada tahap tinggi. Dapatan ini menunjukkan bahawa pensyarah mempunyai kefahaman asas yang baik tentang definisi MC, perbezaannya dengan kursus konvensional, serta konsep penawaran MC secara mandiri atau ekstrak kursus. Secara ringkasnya, dapatan ini memperkukuhkan bahawa pensyarah di Politeknik Ibrahim Sultan memiliki tahap pengetahuan yang baik terhadap konsep, garis panduan, dan potensi MC sebagai salah satu inovasi dalam pembelajaran abad ke-21. Pengetahuan ini berpotensi menjadi asas penting untuk diterjemahkan dalam bentuk pembangunan dan pelaksanaan MC di peringkat jabatan dan institusi.

4.3. Tahap Kesediaan Teknologi dan Kemahiran Pedagogi

Jadual 5 memperincikan skor min bagi setiap item yang berkaitan dengan tahap kesediaan teknologi dan kemahiran pedagogi pensyarah terhadap pembangunan *micro-credential* (MC) di Jabatan Pengajian Am, Politeknik Ibrahim Sultan. Secara keseluruhan, semua item menunjukkan tahap kesediaan yang tinggi dengan nilai min antara 3.54 hingga 4.00.

Jadual 5: Tahap Kesediaan Teknologi dan Kemahiran Pedagogi

Bil.	Item	Min	Interpetasi
C1	Saya mampu membina bahan pengajaran digital seperti video, podcast atau e-kuiz.	4.00	Tinggi
C2	Saya mahir mereka bentuk aktiviti PdP yang selaras dengan hasil pembelajaran MC.	3.58	Tinggi
C3	Saya tahu cara menguruskan kandungan dalam platform MC (contoh: Forum, Lesson, H5P).	3.54	Tinggi
C4	Saya bersedia mengubah suai bahan sedia ada kepada bentuk MC.	3.83	Tinggi
C5	Saya yakin dengan kebolehan diri untuk membangunkan platform MC.	3.83	Tinggi

Hasil analisis Jadual 5 menunjukkan bahawa tahap kesediaan teknologi dan kemahiran pedagogi pensyarah berada pada tahap tinggi secara keseluruhan, dengan nilai min bagi semua item melebihi 3.5.

Item C1, iaitu “Saya mampu membina bahan pengajaran digital seperti video, podcast atau e-kuiz” merekodkan skor min tertinggi sebanyak 4.00. Hal ini memberi petunjuk bahawa kebanyakan pensyarah yakin dan berkeupayaan menghasilkan bahan PdP digital secara sendiri, yang menjadi salah satu kemahiran penting dalam pembangunan MC. Item C4 “Saya bersedia mengubah suai bahan sedia ada kepada bentuk MC” dan C5 “Saya yakin dengan kebolehan diri untuk membangunkan platform MC” masing-masing mencatatkan min 3.83, mencerminkan tahap kesediaan pensyarah yang tinggi untuk menyesuaikan bahan sedia ada dan membangunkan MC dengan lebih yakin.

Sementara itu, item C2 “Saya mahir mereka bentuk aktiviti PdP yang selaras dengan hasil pembelajaran MC” dan C3 “Saya tahu cara menguruskan kandungan dalam platform MC” mencatatkan skor min sedikit lebih rendah iaitu 3.58 dan 3.54, namun masih dalam kategori tinggi. Ini menunjukkan wujud ruang untuk meningkatkan lagi kemahiran reka bentuk aktiviti dan pengurusan kandungan MC, terutama dari segi teknikal penggunaan platform digital. Secara keseluruhannya, dapatan ini memperkukuhkan bahawa pensyarah di Politeknik Ibrahim Sultan mempunyai kesediaan teknologi dan kemahiran pedagogi yang baik sebagai asas untuk melaksanakan MC dengan lebih berkesan. Tahap kesediaan ini dapat dipertingkatkan melalui sokongan latihan khusus serta pendedahan berterusan kepada teknologi pengajaran digital semasa.

4.4. Sikap Pensyarah dan Sokongan Institusi

Jadual 6 memperincikan skor min bagi setiap item yang berkaitan dengan sikap pensyarah serta tahap sokongan institusi terhadap pelaksanaan *micro-credential* (MC) di Politeknik Ibrahim Sultan. Secara keseluruhan, kesemua item menunjukkan tahap yang tinggi dengan nilai min berada antara 3.67 hingga 4.38.

Jadual 6: Sikap Pensyarah dan Sokongan Institusi

Bil.	Item	Min	Interpetasi
D1	Saya berminat untuk membangunkan kursus dalam MC.	3.67	Tinggi
D2	Saya melihat MC sebagai kaedah berkesan untuk menyampaikan ilmu.	4.25	Tinggi
D3	Saya percaya MC berpotensi meningkatkan kebolehpasaran pelajar	4.17	Tinggi
D4	Saya mendapat sokongan daripada pihak pengurusan untuk melaksanakan MC.	4.17	Tinggi
D5	Saya memerlukan bimbingan dan latihan untuk membangunkan MC.	4.38	Tinggi

Hasil analisis Jadual 6 menunjukkan bahawa sikap pensyarah terhadap MC adalah positif dan tahap sokongan institusi juga tinggi secara keseluruhan.

Item D5, “Saya memerlukan bimbingan dan latihan untuk membangunkan MC”, mencatatkan skor min tertinggi iaitu 4.38. Dapatan ini menekankan keperluan sokongan berterusan dalam bentuk latihan atau bimbingan bagi memastikan pensyarah dapat membangunkan kursus MC dengan lebih yakin dan berkesan. Item D2 “Saya melihat MC sebagai kaedah berkesan untuk menyampaikan ilmu” juga memperoleh skor min yang tinggi iaitu 4.25. Ini menunjukkan bahawa pensyarah mengiktiraf MC sebagai satu pendekatan PdP yang relevan, fleksibel dan mampu meningkatkan keberkesanan penyampaian ilmu, selaras dengan keperluan pembelajaran abad ke-21.

Selain itu, item D3 dan D4 masing-masing memperoleh min 4.17, menonjolkan keyakinan pensyarah terhadap potensi MC dalam meningkatkan kebolehpasaran graduan serta adanya sokongan institusi dari pihak pengurusan dalam usaha pelaksanaan MC. Sokongan ini penting bagi memastikan kejayaan sesuatu inisiatif baharu di peringkat organisasi. Item D1 “Saya berminat untuk membangunkan kursus dalam MC” mencatatkan min 3.67, iaitu skor paling rendah berbanding item-item lain dalam konstruk ini, namun masih dalam kategori tinggi. Nilai min yang sedikit lebih rendah ini berkemungkinan disumbangkan oleh beberapa faktor, antaranya kurangnya pendedahan mendalam berkaitan reka bentuk dan struktur kursus MC yang sebenar, kekangan masa pensyarah untuk melibatkan diri dalam pembangunan bahan digital, serta ketidakyakinan terhadap keupayaan sendiri dalam menghasilkan kandungan yang memenuhi spesifikasi MC.

Tambahan pula, proses pembangunan MC memerlukan pensyarah memahami pelantar teknologi tertentu seperti H5P, Lesson, atau Forum, yang mungkin masih belum dikuasai sepenuhnya oleh semua responden. Hal ini turut disokong oleh dapatan dalam item C2 dan C3 yang menunjukkan skor min sedikit lebih rendah dalam aspek kemahiran teknikal. Justeru, walaupun minat terhadap MC itu wujud, tahap kesediaan sebenar untuk menghasilkan kursus MC mungkin masih dipengaruhi oleh halangan praktikal dan teknikal. Namun begitu, skor 3.67 tetap menunjukkan bahawa pensyarah mempunyai minat positif terhadap pelaksanaan MC, yang boleh digilap lagi melalui pendedahan yang lebih menyeluruh, latihan *hands-on*, serta galakan institusi dalam bentuk insentif atau pengiktirafan bagi pembangunan kandungan digital. Pendekatan ini mampu merangsang penglibatan aktif pensyarah dalam inisiatif MC secara lebih meluas dan berkualiti. Secara keseluruhannya, dapatan ini mengesahkan bahawa pensyarah di Politeknik Ibrahim Sultan bersikap terbuka dan positif terhadap penggunaan MC sebagai inovasi PdP, dengan keperluan utama yang dikenalpasti adalah sokongan latihan dan bimbingan secara berterusan.

5. KESIMPULAN

Kajian ini secara keseluruhan menunjukkan bahawa pensyarah Jabatan Pengajian Am di Politeknik Ibrahim Sultan berada pada tahap kesediaan yang baik untuk membangunkan dan melaksanakan *micro-credential* (MC) sebagai pendekatan PdP alternatif. Tahap pengetahuan mereka mengenai konsep MC, garis panduan pembangunan, serta kaitan MC dengan pembelajaran fleksibel dan pembelajaran sepanjang hayat adalah tinggi, menepati aspirasi transformasi pendidikan berasaskan Revolusi Industri 4.0. Dari segi kemahiran teknologi dan pedagogi, pensyarah menunjukkan keupayaan yang memberangsangkan dalam menghasilkan bahan PdP digital serta kesediaan menyesuaikan kandungan sedia ada kepada format MC. Walaupun demikian, kajian mendapati masih terdapat keperluan sokongan latihan dan bimbingan secara berterusan untuk meningkatkan kemahiran teknikal khususnya dalam

pengurusan platform MC serta reka bentuk aktiviti pembelajaran yang lebih interaktif dan berfokus hasil pembelajaran.

Sikap pensyarah terhadap MC juga positif dengan sokongan institusi yang baik, sekali gus mencerminkan komitmen organisasi untuk menggerakkan inovasi PdP melalui MC. Dapatan ini selari dengan hasil kajian lepas (contohnya Che Ahmat et al., 2021; bin Sahrir et al., 2024) yang menekankan kepentingan sokongan holistik daripada pihak institusi dalam memastikan kejayaan MC. Secara keseluruhan, kajian ini memberi indikasi bahawa pensyarah di Jabatan Pengajian Am sudah bersedia untuk melaksanakan MC dengan berkesan, namun memerlukan penambahbaikan berterusan dari aspek latihan, perkongsian amalan terbaik, dan infrastruktur sokongan. Dengan langkah strategik dan sokongan padu, inisiatif MC berpotensi diperkasa sebagai salah satu pendekatan PdP masa depan yang fleksibel, lestari, dan selari dengan keperluan kebolehpasaran graduan politeknik.

Kajian lanjutan disarankan untuk memperkukuh dapatan ini dengan menganalisis hubungan antara pemboleh ubah pengalaman mengajar dengan tahap kesediaan pensyarah dalam pelaksanaan MC. Analisis korelasi dapat mengenal pasti sama ada pengalaman mempunyai kaitan signifikan dengan kesediaan dari aspek pengetahuan, kemahiran, dan sikap. Selain itu, ujian ANOVA juga boleh dijalankan bagi menilai perbezaan tahap kesediaan berdasarkan latar belakang seperti tahap pendidikan dan kumpulan umur. Dapatan daripada analisis ini akan membolehkan pihak pengurusan institusi merangka strategi latihan dan pembangunan profesional yang lebih disasarkan dan berimpak tinggi, selaras dengan keperluan kumpulan sasaran yang berbeza.

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Assessing Visitor Interest in Museums through the Lens of Digital Tourism

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ABSTRACT

This study explores how digital tourism solutions, such as digital tools, interactive exhibits or gamification, and social media campaigns, can enhance museum visitor attraction and interaction. Focusing on Johor's museums, the research investigates the potential of digital technologies, including virtual reality (VR), augmented reality (AR), mobile applications, and interactive displays, to modernize traditional museum experiences while preserving cultural heritage. The aims are to identify the impact of these technologies can modernizing traditional museum experiences while preserving cultural heritage particularly among young and tech-savvy audiences. Utilizing a quantitative research approach through the distribution of questionnaires to selected museum visitors in Johor, the findings reveal that creative use of technology can significantly improve the attractiveness, relevance, and educational value of museum visits, particularly among younger audiences. SPSS was used to analyze Descriptive Statistics and Correlation analysis between IV and DV. The findings reveal that engaging and interactive technology can improve the interaction and engagement of future visits for visitors. However, challenges such as limited technical expertise, financial constraints, and concerns over cultural authenticity were identified as key limitations. This research contributes to the growing need for digital transformation within the cultural and heritage sector in Johor Chapter. This study also gives recommendations and guidance to existing museums to modernize the establishment without diminishing their commitment to preserving the cultural heritage.

Keywords: Museums, digital technology, digital tourism, visitor engagement, tourism, cultural preservation

1. INTRODUCTION

Many museums nowadays view digital media as a way to reach a wider audience and to increase interest in their exhibits (Giannini et al, 2019). To keep up with this changing pattern of visitor preferences, museums are trying new and creative ways to make their exhibitions more interesting and engaging, especially to attract different types of visitors. This situation will close the gap of younger audiences to feel disconnected from traditional museum formats and suggest educational strategies to increase youth engagement. This digital transformation will become a key focus for engaging the next generation audiences. From static exhibition displays to the digital tools such as virtual reality (VR), augmented reality (AR), interactive touchscreens, and social media campaigns that will give museums the chance to create personalized, interactive experiences that can boost visitor interest and improve the learning value of their exhibits (Trunfio et al., 2022). Particularly in a post-COVID environment where digital presence remains crucial, museums especially must continue to prioritize these engagement strategies to build audience interest. (Falk, J.H., & Dierking, L.D., 2024).

Many museum facilities are discovering that using digital tools is a good way to attract interest from the audience in their exhibits. Technologies not only capture the attention of tech-savvy audiences but also make cultural and historical narratives more accessible and memorable (Qureshi et al., 2020). In response to evolving visitor preferences, museums must adopt innovative strategies to aim and enhance visitor engagement by offering immersive and interactive experiences. In this digital transformation landscape has become a central focus for museums seeking and attracting younger or tech-savvy audiences (Jenny Kidd et al., 2022).

Although digital technology presents clear advantages, there are still constraints such as limited funding, lack of technical skills, and preserving cultural artifacts, which slow down the move towards modern technology on museum facilities (Hanelt, A., et al., 2021). Apart from these challenges, the digital tools themselves are also difficult because museums must carefully balance between using new technology and maintaining their main purpose of protecting cultural heritage. Museums need to make sure that adding technology supports and strengthens their efforts to preserve and sustain cultural values. Using digital tools is not only about upgrading equipment; it also requires the right strategies to make sure technology adds value to the visitor experience without changing the museum's original mission of cultural preservation. Technology-based strategies such as VR, AR, and interactive displays can help museums to connect better with visitors by offering meaningful experiences while still preserving cultural protection (Wynn et al., 2022).

In the end, museums need to find a balance between embracing new technology and preserving tradition and will have the best chance of staying relevant and welcoming to all visitors. By doing so, they can continue to inspire future generations to connect with, understand, and value their shared history and culture in meaningful ways. This research examines how digital tools, interactive exhibits, and the integration of social media campaigns can enhance visitor interest in museum settings.

2. LITERATURE REVIEW

2.1. The Rise of Digital Transformation in Museums

Traditionally, museums have been perceived primarily as institutions for housing and displaying cultural artifacts and historical exhibits (Lee, et al. 2021). This concept is rooted in a static and traditional interpretation of museums, one that remains anchored to the notion of the museum as a passive space where the visitor is not positioned at the center of the cultural experience. However, the role of museums has undergone a significant transformation. It may continue advancements in the digital era and the result, museums are redefining their societal roles, shifting from static format to dynamic ones (Wiastruti et al., 2020). The concept of digital tourism encompasses a range of innovative and digital tools that facilitate connectivity, communication, and automation in the era of Industry 4.0. These include technologies such as big data analytics, the Internet of Things (IoT), and cloud computing (Li Y, et al., 2021). According to Gams et al. (2021), visitors who have access to digital museum experiences are no longer limited by physical location or travel constraints; they now can explore cultural and heritage sites globally by virtual access to exhibitions, artifacts, and educational content from around the world. The COVID-19 pandemic further accelerated digital transformation, forcing institutions to rethink how they connect with audiences remotely and on-site. As a result, museums are rethinking their traditional approaches and increasingly adopting technology-driven strategies to connect with tech-savvy audiences and provide meaningful cultural experiences. (Falk, J.H., & Dierking, L.D., 2024)

In recent years, particularly in the post-COVID-19 era, digital technologies have significantly transformed the hospitality sector. These technologies have enhanced not only internal operations but also reshaped visitor experiences by offering more interactive, personalized, and accessible engagement. Technological advancements continue to offer greater comfort, convenience, and efficiency for both service providers and visitors (Gams et al., 2021). In the context of the hospitality sector, including museums, there has been a notable transition from static displays to more interactive and technology-driven experiences. This shift is aimed at maintaining relevance and appealing to younger, digital-native audiences (Gams et al., 2021). Such developments highlight the increasing significance of digital innovation in delivering personalized, memorable, and immersive experiences across both cultural and hospitality environments.

2.2. Digital Tools Used in Museums

Digital tools refer to electronic devices, software applications, and online platforms that utilize digital technologies to facilitate task execution, problem-solving, communication, and service enhancement (Yi et al., 2020). In the context of museum operations, digital tools refer to software applications, platforms, and technologies that enhance visitor experiences, streamline operations, and support the management

and promotion of services. These tools include virtual tours, interactive kiosks, mobile apps, online booking systems, and customer feedback platforms, all of which are integrated into museum facilities to enhance visitor engagement, accessibility, and operational efficiency (Bruno, 2020).

2.2.1. Augmented Reality (AR)

Augmented Reality (AR) refers to a method that overlays digital content over physical exhibits to improve them and create more engaging and instructive experiences (Huang & Lv, 2021). For example, in museum facilities, AR can be used to animate historical artifacts, such as showing a reconstructed 3D model. For example, the Trick-Eye Illusion Museum, Johor. This interactive museum blends art and science, offering multiple themed zones such as AR dinosaurs, fluorescent artworks, and immersive space, where visitors can react to visitors' movements and optical illusion art and AR-enabled exhibits provide stunning 3D visual effects. This will engage visitors through playful interaction & photo-sharing.

2.2.2. Virtual Reality (VR)

Huang and Lv (2021) describe Virtual Reality (VR) as a way to recreate entire environments or historical scenes, allowing museum visitors to immerse themselves in experiences that traditional exhibits. With VR, people can virtually walk through ancient cities, witness key moments in history, or interact with digital versions of delicate artifacts that are too fragile or rare to be displayed in person. The use of VR in museums has become even more widespread in recent years, particularly after the COVID-19 pandemic, museum looked for new and engaging ways to offer rich cultural experiences and bring heritage to life in more interactive ways (Zhang & Li, 2023; Falk & Dierking, 2024). As of now, no traditional museum in Johor has officially implemented VR-based historical storytelling or immersive reconstructions. However, during the COVID-19 pandemic, some institutions and tourism platforms began exploring VR simulations, such as virtual zoo experiences, as alternative ways to engage the public remotely and maintain educational outreach when physical visits were restricted. These VR attractions demonstrate how interactive digital experiences can be effectively utilized as strategies to stimulate visitor interest.

2.2.3. Interactive Exhibits and Gamification

Interactive Exhibits, such as Gamification, offer support for self-guided tours within museum spaces, offering digital maps, exhibit information, language translation, and personalized visitor pathways to cater to diverse audiences. (Rammos & Bratitsis, 2020). According to Wu et al. (2024), the COVID-19 issue significantly influenced how museums' operations interacted with the public, accelerating the adoption of mobile applications as a means to deliver safe, contactless, and engaging experiences. As physical interactions and guided tours became restricted, museum mobile apps provided visitors with contactless alternatives such as digital ticketing, self-guided audio tours, and real-time exhibit information. These apps also supported remote access to virtual exhibitions and educational content, allowing users to explore museum collections from the safety of their homes. This shift not only addressed immediate public health concerns but also accelerated the digital transformation of museum facilities, highlighting the long-term value of mobile applications in enhancing both onsite and remote visitor experiences. (Menezes et al., 2023).

2.2.4. Social Media Camping

Modern visitors increasingly expect to use an integrated social media channel that supports access to essential information before, during, and after their visit, as well as facilitates the sharing and documentation of their experiences. Social media platforms such as Facebook fan Page, Instagram or TikTok play a crucial role in this context by promoting museum content to a wider audience, encouraging user-generated content such as reviews, photos, and personal narratives, and facilitating real-time engagement through interactive features like live streams, polls, and comment sections (Kist, 2020). The importance of social media intensified during the COVID-19 pandemic, when many museums turned to online platforms to maintain public engagement and foster emotional connections with their audiences

(Wu et al., 2024). In the post-pandemic era, social media campaigns have become even more essential. They serve as strategic tools to reignite visitor interest, rebuild public trust, and promote both new exhibitions and enhanced health measures. Furthermore, social media supports hybrid visitor experiences, seamlessly blending physical visits with digital content, an approach that particularly appeals to younger, tech-savvy audiences. Ultimately, well-crafted social media strategies are now central to museums' efforts to maintain relevance, strengthen community ties, and sustain long-term visitor engagement (Zhang & Li, 2023).

2.3. Visitor Interest

Modern museums are increasingly expected to move beyond static displays and offer more engaging, interactive environments. Visitors, particularly younger generations, seek experiences that are not only educational but also immersive, hands-on, and personally meaningful (Falk & Dierking, 2021). As highlighted by Sun and Othman (2025), the rapid advancement of digital technology has become a central strategy for boosting audience engagement. Technologies like Virtual Reality (VR), Augmented Reality (AR), and interactive touchscreens allow museums to deliver immersive and emotionally engaging experiences that traditional exhibits often lack. This shift represents a broader transformation in the museum landscape from being static repositories of artifacts to becoming dynamic, visitor-centered spaces. These digital tools are not just modernizing the way exhibits are presented, they are also reshaping how visitors interact or are interested. By fostering deeper emotional and cognitive engagement, such technologies extend learning opportunities, support personalized experiences, and encourage repeat visits (Zhang & Liu, 2022; Yi et al., 2020). As a result, museums today are evolving into participatory environments where visitors play an active role in their learning journey, making cultural engagement more accessible, relevant, and impactful.

2.4. Research Framework

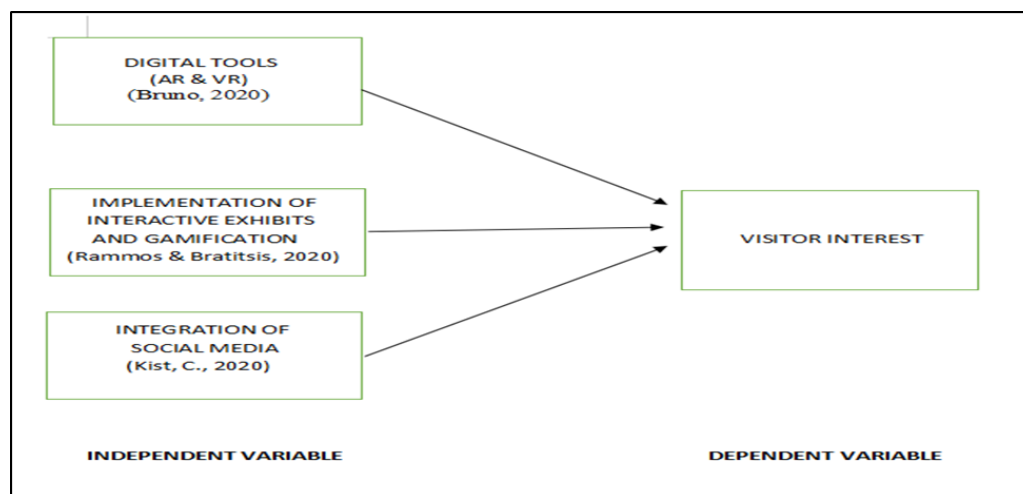


Figure 1

Each Independent Variable on Figure 1, is hypothesized to have a positive influence on visitor interest. The framework guides both the questionnaire design and the data analysis processes to identify which technological interventions are most effective in enhancing visitor engagement in the context of Johor's museums.

3. METHODOLOGY

3.1. Research Design

This study adopted a quantitative research approach to examine the relationship between the use of technology-based solutions (independent variables) and visitor interest or interaction (dependent variables) in museums located in Johor. A descriptive correlational design was employed to describe and analyze the patterns and strength of relationships between the variables. To effectively gather primary

data, a structured Google Form questionnaire was developed and distributed to visitors of selected museums in Johor. The goal of the questionnaire was to explore how digital tools and social media platforms influence visitor interest in a cultural and heritage setting.

3.2. Data Collection Methods

Data for this study were collected using a Google Forms questionnaire, which was distributed exclusively through online platforms, specifically social media channels such as WhatsApp, Telegram, and TikTok. These platforms were selected due to their widespread use among younger, tech-savvy users, aligning with the target demographic of this study. The Google Form questionnaire was designed to measure three main domains related to digital interaction in museum settings:

- a) Visitor perceptions of digital tools
 - Focused on Virtual Reality (VR) and Augmented Reality (AR).
- b) Interaction with exhibits and gamification
 - Evaluated visitor experiences with interactive installations, digital interfaces, and game-based learning tools using a mobile-based application.
- c) The Role of social media in encouraging museum visits
 - Assessed how social media platforms influence museum awareness, visit intention, and content sharing behaviour.

The use of online distribution channels enabled the research team to efficiently reach a broad and diverse audience, particularly tech-savvy and younger respondents, while ensuring ease of access, flexibility, and convenience for participants completing the survey.

4. RESULTS AND DISCUSSIONS

4.1. Descriptive Analysis

The purpose of the descriptive analysis was to explain the respondents' interest towards digital tools, interaction with exhibits and gaming and integration of social media. The percentage, mean, and standard deviation statistical tests were employed.

Table 1: Demographic of respondent

Variables	Category	Percentage (%)
Gender	Male	54
	Female	46
Age	Below 18	10
	18-25	29
	26-35	30
	36-45	23
	46 and above	8
State of Origin	Kuala Lumpur	8
	Melaka	9
	Negeri Sembilan	5
	Putrajaya	8
	Selangor	11
	Kelantan	7
	Terengganu	5
	Pulau Pinang	7
	Kedah	4
	Perlis	3
	Sarawak	6
	Sabah	5
	Pahang	5
	Labuan	4
	Perak	3
	Johor	10

Table 1 shows that 46% of the respondents were female, while 54% were male. Based on age, the group with the highest percentage of respondents is 26-35 (30%) followed by the age group with the second-highest percentage 18-25 (29%) of respondents, 36-45 (23%), below 18 (10%) and the age group with the lowest percentage of respondents 46 and above (8%). For respondents, origin the highest respondent from Selangor (11%), followed by Johor (10%), Melaka (9%), Kuala Lumpur and Putrajaya (8%), Kelantan and Pulau Pinang (7%), Sarawak (6%), Negeri Sembilan, Terengganu, Sabah and Pahang (5%), Kedah and Labuan (4%) and the lowest respondents from Perak and Perlis (3%).

4.2. Reliability Test

The reliability of each item in the instruments was measured using the Cronbach's Alpha Coefficient. As rules of thumb, values which were above 0.6 were considered acceptable, and 0.8 is the most appropriate and acceptable stated by Pallant (2011). Reliability analysis for the variables is shown in the table. The coefficient alpha for the items with a coefficient value of 0.831, which is very good. Therefore, the questionnaire is accurate and can be used for the study.

Table 2: Reliability Coefficient

No. of Items	Items deleted	Cronbach's Alpha
35	0	0.831

4.3. Mean Analysis

In table 3, the questions about visitor interest are recorded using a Likert scale of 5 points. Where 1=Strongly Disagree, 2=Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree. From mean analysis, it is found that the level of visitor interest is 4.15, which falls between 4=Agree and 5=Strongly Agree. Therefore, it appears that the degree of visitor interest in museums located in Johor is high because the digital integration can increase their interest in museums. This suggests that digital strategies not only enhance entertainment but also improve perceived educational value.

Table 3: Mean of Independent Variables and Dependent Variables

	N	Minimum	Maximum	Mean	Std. Deviation
Digital Tools	100	2	5	3.7720	0.83316
Visitor Interest				4.1540	0.81692
Interactive exhibits and gamification	100	2	5	3.9640	0.87172
Visitor Interest				4.1540	0.81692
Integration of Social Media	100	2	5	4.0687	0.82816
Visitor Interest				4.1540	0.81692

4.4. Correlations

Table 4 shows that there is a significant positive relationship between the independent variables (digital tools, interactive exhibits, and gamification, and integration of social media) and the dependent variable (visitor interest). At a beta value of 0.810 in comparison with the other factors, it appears that the interactive exhibits and gamification is currently the most significant independent variable influencing visitor interest. The significant correlation between gamification ($r = 0.871$) and visitor interest suggests that visitors' value hands-on, playful learning experiences. This aligns with findings by (Rammos & Bratitsis, 2020) and support by Wu et al. (2024), who emphasized that gamified museum tours foster emotional engagement, making visits more memorable.

Digital tools ($r = 0.669$, $p < 0.01$) also show a positive and significant relationship with visitor interest. This demonstrates that technologies like Virtual Reality (VR) and Augmented Reality (AR) not only serve as entertainment features but also enrich the educational and cultural value of exhibits by making complex historical narratives more accessible and immersive. This outcome supports previous studies by Bruno, 2020) that highlight the potential of immersive technologies in strengthening visitor engagement.

The correlation between social media integration and visitor interest ($r = 0.744$, $p < 0.01$) emphasizes the vital role of online platforms in shaping visitor perceptions and behaviours. Social media campaigns effectively raise awareness, encourage pre-visit engagement, and foster user-generated content, which increases the likelihood of visits and repeat engagements. This suggests that digital strategies not only enhance entertainment but also improve the perceived educational value of museum experiences, as visitors find the content both informative and enjoyable. As a consequence, the results show that there is a statistically significant correlation between all independent variables and visitor interest.

Table 4: Relationship between digital tools, interactive exhibits and gamification, integration of social media

		Visitor Interest
Digital tools	Pearson Correlation	.669**
	Sig. (2-tailed)	<.001
	N	100
Interactive exhibits and gamification	Pearson Correlation	.810**
	Sig. (2-tailed)	<.001
	N	100
Integration of social media	Pearson Correlation	.744**
	Sig. (2-tailed)	<.001
	N	100

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

5. CONCLUSIONS

This study highlights how digital technologies can breathe new life into museums in Johor. By leveraging tools such as virtual and augmented reality, mobile applications, and interactive exhibits, museums can go beyond traditional displays to offer younger generations more engaging and meaningful experiences. The results indicate that when technology is used creatively, it enhances the attractiveness, relevance, and educational value of museum visits. Findings reveal that interactive exhibits and gamification are most strongly associated with visitor satisfaction and interest. These tools foster active engagement by enabling hands-on participation rather than passive observation, leading to a more memorable and enjoyable experience. Furthermore, visitors are more likely to retain information when they are actively involved in the learning process. Digital tools such as VR and AR also contribute substantially to enhancing the cultural and educational appeal of museums. They provide an immersive learning environment where complex historical contexts can be better understood. This resonates strongly with younger, tech-savvy audiences who prefer interactive, multimedia-rich experiences. Social media integration further extends the museum's reach and influence. Platforms such as Instagram, TikTok, and Facebook help create a digital presence that attracts online audiences, encourages content sharing, and builds anticipation for visits.

However, the transition to digital tourism is a challenging process. Many museums continue to grapple with limited technical expertise, constrained budgets, and the delicate task of balancing technological innovation with the preservation of cultural authenticity. For example, museum operators need to train staff in digital content creation and technology management is essential to overcome technical and financial constraints. Hybrid strategies, like combining onsite digital tools with active social media campaigns, can sustain visitor interest beyond the museum visit and can be implemented. These are significant concerns that require thoughtful and strategic attention. Despite the challenges, this research presents a hopeful outlook. It offers valuable insights and practical recommendations for museums in Johor to adapt and stay relevant in the digital era, while remaining true to their core mission of preserving and celebrating cultural heritage. With the right support and strategic guidance, museums have the potential to evolve into dynamic spaces that not only educate but also inspire and engage contemporary audiences.

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Tahap Kefahaman dan Pengamalan Nilai Moral dalam Kalangan Pelajar Politeknik Ibrahim Sultan melalui Kursus Penghayatan Etika dan Peradaban

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ABSTRAK

Kajian ini bertujuan untuk menilai tahap kefahaman dan pengamalan nilai moral dalam kalangan pelajar Politeknik Ibrahim Sultan yang mengikuti Kursus Penghayatan Etika dan Peradaban (PEP). Kursus ini diwujudkan bagi menyokong aspirasi pendidikan tinggi negara dalam membangunkan graduan yang holistik, beretika dan berintegriti, selaras dengan Pelan Pembangunan Pendidikan Malaysia (Pendidikan Tinggi) 2015–2025. Kajian ini menggunakan reka bentuk tinjauan secara kuantitatif, melibatkan seramai 147 orang pelajar daripada empat jabatan utama politeknik. Data dikumpul melalui borang soal selidik secara dalam talian menggunakan Google Form, yang merangkumi dua konstruk utama iaitu kefahaman nilai moral (8 item) dan pengamalan nilai moral (9 item), diukur berdasarkan skala Likert lima mata. Analisis data dijalankan menggunakan SPSS versi 27, dengan interpretasi tahap berpandukan jadual sela jeda oleh Bahman dan Turiman (1999). Dapatan kajian menunjukkan tahap kefahaman nilai moral pelajar berada pada tahap tinggi dengan min antara 4.42 hingga 4.79, manakala tahap pengamalan nilai moral juga berada pada tahap tinggi dengan min antara 4.59 hingga 4.76. Nilai hormat-menghormati mencatat skor tertinggi dalam konstruk kefahaman, manakala aspek memilih rakan sebaya yang positif mendapat skor tertinggi dalam konstruk pengamalan. Hasil ini membuktikan bahawa peningkatan kefahaman nilai moral melalui kursus PEP mampu menyumbang kepada pengukuhan pengamalan nilai dalam kehidupan seharian pelajar. Secara keseluruhannya, kajian ini mengesahkan keberkesanan Kursus Penghayatan Etika dan Peradaban dalam membentuk pelajar yang berakhlak, beretika dan mempunyai nilai moral yang tinggi. Kajian juga mencadangkan agar pendekatan kolaboratif dan aktiviti berasaskan komuniti diperbanyakkan supaya pelajar bukan sahaja mengamalkan nilai secara individu, malah mampu menyebarkannya dalam masyarakat, selaras dengan matlamat melahirkan warganegara berintegriti, berwawasan dan seimbang dari segi intelek, emosi dan rohani.

Kata kunci: Kefahaman nilai moral, pengamalan nilai moral, PEP

1. PENGENALAN

Pembangunan insan bukan hanya dilihat dari sudut pencapaian akademik atau kemahiran teknikal semata-mata, tetapi turut merangkumi pembangunan rohani, sahsiah dan nilai moral. Nilai moral seperti kejujuran, tanggungjawab, toleransi dan hormat-menghormati menjadi asas penting dalam membentuk individu yang bukan sahaja berpengetahuan, tetapi juga beretika dan berintegriti dalam kehidupan bermasyarakat. Kajian oleh Haridi dan Mat (2017) pula menjelaskan bahawa aspek akhlak dan keluhuran nilai moral perlu menjadi komponen teras dalam sebarang program pembangunan remaja, khususnya dalam program pemulihan remaja bermasalah. Tanpa asas moral yang mantap, pembangunan kemahiran lain dilihat tidak mampu menyumbang kepada kesejahteraan sosial secara holistik.

Menurut Abdullah et al. (2020), pembangunan modal insan dalam konteks pendidikan tinggi menuntut integrasi antara pencapaian intelek dan nilai moral yang tinggi. Penekanan terhadap nilai murni ini adalah penting untuk melahirkan pelajar yang seimbang dari segi emosi, spiritual dan sosial. Dalam

kajian mereka yang menumpukan kepada pelajar UNISEL, mereka membangunkan model pembangunan insan yang meletakkan nilai moral sebagai komponen asas kepada pembentukan jati diri pelajar. Tambahan pula, Zulkifli dan Mustafar (2022) dalam analisis mereka mengenai pembangunan modal insan di Malaysia menegaskan bahawa nilai murni perlu diterapkan sejak awal pendidikan kerana ia memainkan peranan penting dalam membina generasi yang beretika dan bertanggungjawab terhadap pembangunan negara. Kesemua dapatan ini secara jelas menyokong hakikat bahawa nilai moral bukan sahaja penting, tetapi merupakan asas dalam kerangka pembangunan insan, selaras dengan falsafah pendidikan negara dan pelan pembangunan pendidikan tinggi.

Dalam konteks pendidikan tinggi di Malaysia, penekanan terhadap pembentukan sahsiah pelajar telah diterjemahkan melalui pelaksanaan kursus-kursus yang berteraskan etika dan nilai sejagat. Salah satu kursus yang diwujudkan dengan tujuan tersebut ialah *Penghayatan Etika dan Peradaban*, yang diwajibkan kepada pelajar institusi pengajian tinggi awam termasuk politeknik. Kursus *Penghayatan Etika dan Peradaban (PEP)* memainkan peranan yang signifikan dalam menyokong agenda Lonjakan 1 dalam *Pelan Pembangunan Pendidikan Malaysia (Pendidikan Tinggi) 2015–2025*, iaitu melahirkan graduan holistik, berciri keusahawanan dan seimbang. PEP secara langsung menekankan aspek penghayatan nilai moral, etika, dan adab yang merupakan teras kepada pembentukan insan seimbang dari segi intelek, rohani, emosi dan jasmani.

Melalui pendekatan pedagogi yang menekankan pembelajaran reflektif, penghargaan terhadap kepelbagaian peradaban, dan penanaman nilai sejagat, kursus ini memperkukuhkan daya fikir kritis pelajar terhadap isu sosial dan etika kontemporari. Justeru, pelajar tidak hanya memperoleh ilmu secara kognitif, tetapi turut mengaplikasikan nilai-nilai luhur dalam kehidupan seharian dan masa depan sebagai warga profesional. Namun begitu, terdapat keperluan untuk menilai keberkesanan kursus ini dari sudut impaknya terhadap pelajar, khususnya dari segi tahap kefahaman dan pengamalan nilai moral selepas mengikuti kursus ini. Kefahaman terhadap konsep moral tidak semestinya menjamin pengamalan nilai tersebut dalam kehidupan seharian. Oleh itu, kajian ini dijalankan bagi mengenal pasti tahap kefahaman dan pengamalan nilai moral dalam kalangan pelajar Politeknik Ibrahim Sultan melalui kursus Penghayatan Etika dan Peradaban.

Kajian terhadap tahap kefahaman dan pengamalan nilai moral pelajar, khususnya dalam konteks Politeknik Ibrahim Sultan, dapat dijadikan sebagai indikator keberkesanan pelaksanaan kursus PEP dalam menyumbang kepada matlamat pendidikan tinggi negara. Keupayaan pelajar mengamalkan nilai moral dalam tindakan dan keputusan harian menunjukkan bahawa elemen *soft skills* seperti kepimpinan, kebertanggungjawaban, empati dan integriti telah berjaya dibentuk, sejajar dengan aspirasi melahirkan graduan yang holistik dan lestari dalam menyumbang kepada kesejahteraan masyarakat dan pembangunan negara.

1.1. Objektif Kajian

- i. Mengetahui tahap kefahaman pelajar Politeknik Ibrahim Sultan terhadap nilai moral yang diterapkan melalui Kursus Penghayatan Etika dan Peradaban.
- ii. Mengetahui tahap pengamalan nilai moral dalam kalangan pelajar selepas mengikuti Kursus Penghayatan Etika dan Peradaban.

2. KAJIAN LITERATUR

Pembentukan sahsiah pelajar yang holistik merangkumi pencapaian akademik dan penghayatan nilai moral yang tinggi merupakan matlamat utama pendidikan tinggi di Malaysia. Dalam usaha melahirkan graduan yang berintegriti, beretika serta bertanggungjawab kepada diri, masyarakat dan negara, aspek nilai moral perlu diberikan penekanan yang sewajarnya dalam sistem Pendidikan. Hashim dan Langgulung (2008) menyatakan bahawa nilai moral merupakan teras utama dalam pendidikan Islam yang berperanan membentuk sahsiah serta jati diri pelajar. Dalam kajian mereka yang berbentuk kualitatif melalui kaedah analisis dokumen, penulis menegaskan bahawa pendidikan moral bukan sahaja bertujuan untuk membentuk akhlak individu, tetapi juga bagi membina pemikiran yang

seimbang dan beretika dalam kalangan pelajar. Pendidikan yang berteraskan nilai ini dianggap penting dalam usaha melahirkan generasi yang mampu berfikir secara rasional dan bertindak secara berintegriti.

Selari dengan itu, Abdul Rahman (2014) pula melalui kajian berkaitan pendidikan sivik, menekankan bahawa penerapan nilai moral boleh dilaksanakan secara sistematik melalui kurikulum formal. Kajian yang dijalankan dalam konteks pendidikan menengah ini menunjukkan bahawa subjek Sivik dan Kewarganegaraan berupaya menjadi medium yang efektif dalam menyampaikan nilai-nilai murni kepada pelajar. Antara nilai yang ditekankan termasuklah tanggungjawab sosial, hormat-menghormati, dan kesedaran terhadap kepelbagaian budaya serta etika kewarganegaraan. Ini membuktikan bahawa nilai moral boleh dibentuk melalui pendekatan pendidikan yang dirancang dan berstruktur. Kajian oleh Jamar et al. (2020) yang dijalankan di Malaysian Aviation Training Academy (MATA) meneliti tahap penghayatan nilai Islam dan etika dalam kalangan pelajar institusi teknikal melalui pelaksanaan kursus Penghayatan Etika dan Peradaban (PEP). Dapatan menunjukkan bahawa pelajar mempunyai tahap kefahaman yang sederhana hingga tinggi terhadap nilai-nilai etika dan moral yang diterapkan melalui kursus tersebut. Walau bagaimanapun, pengamalan nilai tersebut dalam konteks kehidupan seharian pelajar masih belum menyeluruh, khususnya dalam aspek ketekalan sikap, disiplin diri dan aplikasi nilai secara konsisten.

Kajian oleh Ahmad et al. (2023) di Politeknik Ibrahim Sultan membuktikan bahawa pelajar yang mengikuti kursus PEP menunjukkan tahap penguasaan yang tinggi dalam domain afektif dan kemahiran insaniah, termasuk aspek empati, tanggungjawab sosial, dan disiplin diri. Kajian ini menegaskan bahawa kursus tersebut berjaya menyemai asas moral yang kukuh dalam kalangan pelajar politeknik, khususnya dalam konteks pendidikan teknikal (TVET). Namun, sejauh mana kursus ini mampu menyumbang kepada pencapaian objektif Pelan Pembangunan Pendidikan Malaysia (Pendidikan Tinggi) masih memerlukan kajian empirikal. Oleh itu, kajian ini bertujuan untuk menilai tahap kefahaman dan pengamalan nilai moral dalam kalangan pelajar Politeknik Ibrahim Sultan setelah mengikuti Kursus Penghayatan Etika dan Peradaban. Penilaian ini penting untuk meninjau keberkesanan pelaksanaan kursus tersebut serta mengenal pasti ruang penambahbaikan dalam usaha memperkukuh elemen etika dan nilai dalam kalangan pelajar politeknik, selaras dengan aspirasi negara ke arah sistem pendidikan tinggi yang inklusif, progresif dan berteraskan nilai.

3. METODOLOGI KAJIAN

Kajian ini dijalankan secara kuantitatif menggunakan reka bentuk kajian tinjauan dan data dikumpul melalui borang soal selidik menggunakan platform Google Form. Kajian ini dilaksanakan dalam kalangan pelajar yang mengambil subjek Penghayatan Etika dan Peradaban (PEP) di Politeknik Ibrahim Sultan melangkaui semua jabatan pengajian iaitu Jabatan Kejuruteraan Mekanikal (JKM), Jabatan Kejuruteraan Elektrik (JKE), Jabatan Pelancongan dan Hospitaliti (JPH) dan Jabatan Rekabentuk dan Komunikasi Visual (JRKV). Kaedah persampelan rawak digunakan bagi menentukan sampel kajian yang terdiri daripada 147 responden kajian. Saiz responden kajian ditentukan merujuk kepada jadual penentuan saiz sampel oleh Krejcie dan Morgan (1970).

Kajian ini menggunakan instrumen soal selidik yang diadaptasi daripada kajian Rosli et al. (2023). Instrumen kajian mengandungi 2 konstruk iaitu (a) konstruk kefahaman nilai moral – 8 item dan (b) konstruk pengamalan nilai moral – 9 item. Setiap item yang dibina dinilai menggunakan persetujuan lima skala Likert berdasarkan skala sangat tidak setuju (STS), tidak setuju (TS), tidak pasti (TP), setuju (S) dan sangat setuju (SS).

Maklumat demografi seperti jantina, umur dan jabatan pengajian turut ditanya dalam soal selidik. Data soal selidik dianalisis menggunakan perisian Statistical Package for the Social Science (SPSS) versi 27. Bagi menilai tahap kefahaman nilai moral dan pengamalan nilai moral pelajar, interpretasi dibuat berpanduan jadual pengiraan sela jeda yang dibangunkan oleh Bahman dan Turiman (1999), serta dirumuskan mengikut saranan oleh Nunally (1978) seperti yang ditunjukkan dalam Jadual 1.

Jadual 1: Interpretasi Skala Min

Skala Min	Interpretasi
1.00 hingga 2.00	Rendah
2.01 hingga 3.00	Sederhana
3.01 hingga 4.00	Tinggi
4.01 hingga 5.00	Sangat Tinggi

4. DAPATAN KAJIAN

4.1. Demografi Responden Kajian

Kajian ini melibatkan seramai 147 orang pelajar daripada pelbagai jabatan dan peringkat umur. Jadual 2 menunjukkan perincian profil responden kajian.

Jadual 2. Profil Responden Kajian

Perkara	Klasifikasi	Kekerapan	Peratus (%)
Jantina	Lelaki	93	63.3%
	Perempuan	54	36.7%
Umur	Bawah 20 tahun	137	93.2%
	21 hingga 23 tahun	7	4.8%
	24 tahun ke atas	3	2%
Jabatan	Jabatan Kejuruteraan Mekanikal	71	48.3%
	Jabatan Kejuruteraan Elektrik	2	1.4%
	Jabatan Pelancongan dan Hospitaliti	60	40.8%
	Jabatan Rekabentuk dan Komunikasi Visual	14	9.5%

Daripada aspek jantina, majoriti responden terdiri daripada pelajar lelaki iaitu seramai 93 orang (63.3%), manakala pelajar perempuan adalah seramai 54 orang (36.7%). Manakala daripada aspek umur, kebanyakan responden berada dalam kategori bawah 20 tahun, iaitu seramai 137 orang (93.2%). Seramai 7 orang (4.8%) berumur antara 21 hingga 23 tahun, manakala 3 orang (2%) adalah berumur 24 tahun ke atas. Kajian ini turut melibatkan pelajar dari empat jabatan utama iaitu Jabatan Kejuruteraan Mekanikal seramai 71 orang (48.3%), Jabatan Pelancongan dan Hospitaliti seramai 60 orang (40.8%), Jabatan Rekabentuk dan Komunikasi Visual seramai 14 orang (9.5%) dan Jabatan Kejuruteraan Elektrik seramai 2 orang (1.4%). Secara keseluruhannya, responden kajian ini mewakili pelbagai latar belakang jabatan dan umur, yang memberikan gambaran menyeluruh terhadap populasi pelajar di Politeknik Ibrahim Sultan.

4.2. Tahap Kefahaman Nilai Moral Melalui Kursus Penghayatan Etika dan Peradaban

Jadual 3 menunjukkan nilai min dan sisihan piawai (SP) bagi setiap item berkaitan kefahaman pelajar terhadap nilai moral melalui kursus Penghayatan Etika dan Peradaban. Secara keseluruhan, kesemua item mencatatkan tahap kefahaman yang tinggi, dengan nilai min berada dalam julat 4.42 hingga 4.79. menunjukkan bahawa pelajar berada pada tahap kefahaman yang tinggi terhadap nilai-nilai moral yang diketengahkan dalam kursus ini.

Jadual 3: Tahap Kefahaman Nilai Moral Melalui Kursus Penghayatan Etika dan Peradaban dalam Kalangan Pelajar Politeknik Ibrahim Sultan

Bil.	Item	Min	SP	Interpetasi
B1	Semua ajaran agama menyeru penganut untuk melakukan kebaikan.	4.64	0.67	Tinggi
B2	Sikap hormat-menghormati antara rakyat Malaysia pelbagai kaum boleh mengekalkan keharmonian.	4.79	0.62	Tinggi
B3	Pengamalan nilai ikhlas boleh melahirkan bangsa Malaysia bertamadun tinggi.	4.65	0.60	Tinggi
B4	Pembentukan sahsiah yang mantap boleh menangani fenomena-fenomena negatif yang banyak menular dalam masyarakat Malaysia.	4.42	0.95	Tinggi
B5	Pembelajaran mengenai tamadun dan peradaban mampu membentuk nilai silaturahim para pelajar.	4.51	0.75	Tinggi

B6	Amalan toleransi boleh mengekalkan perpaduan antara kaum.	4.66	0.62	Tinggi
B7	Dialog berterusan antara manusia dalam pelbagai budaya dan tamadun boleh mengekalkan Masyarakat yang berakhlak dan bermoral.	4.49	0.77	Tinggi
B8	Pemahaman terhadap kesedaran kesejagatan dalam tanggungjawab sosial dalam setiap ajaran agama boleh membentuk jiwa yang harmoni.	4.63	0.68	Tinggi

Item dengan min tertinggi ialah B2 (Min = 4.79, SP = 0.62), iaitu “Sikap hormat-menghormati antara rakyat Malaysia pelbagai kaum boleh mengekalkan keharmonian”. Item ini menunjukkan bahawa pelajar Politeknik Ibrahim Sultan mempunyai tahap kefahaman yang sangat tinggi terhadap nilai hormat-menghormati dalam masyarakat berbilang kaum. Dapatan ini selari dengan kajian Ateerah Abdul Razak et al. (2020) yang membuktikan bahawa kursus Penghayatan Etika dan Peradaban (PEP) berjaya meningkatkan kefahaman pelajar terhadap nilai toleransi dan hormat dalam kalangan masyarakat majmuk. Ini membuktikan keberkesanan kursus tersebut dalam membentuk kesedaran pelajar tentang pentingnya nilai ini untuk mengekalkan perpaduan dan kestabilan sosial negara.

Item dengan min terendah ialah B4 (Min = 4.42, SP = 0.95) iaitu “Pembentukan sahsiah yang mantap boleh menangani fenomena-fenomena negatif yang banyak menular dalam masyarakat Malaysia”. Walaupun masih berada pada tahap tinggi, nilai SP yang lebih besar (0.95) menunjukkan wujudnya sedikit variasi dalam tahap persetujuan pelajar terhadap pernyataan ini. Ini kerana kefahaman mereka terhadap mekanisme sahsiah dalam menangani isu sosial masih berbeza-beza. Namun begitu, secara keseluruhannya, hasil kajian ini tetap memperlihatkan bahawa pelajar menunjukkan tahap kefahaman nilai moral yang tinggi, yang menandakan keberkesanan kursus Penghayatan Etika dan Peradaban dalam membina asas nilai yang kukuh dalam diri pelajar. Item B3 (Min=4.65, SP= 0.60) iaitu “Pengamalan nilai ikhlas boleh melahirkan bangsa Malaysia bertamadun tinggi” serta B6 (Min=4.66, SP=0.62) “Amalan toleransi boleh mengekalkan perpaduan antara kaum” juga mencatat skor tinggi. Ini menunjukkan bahawa pelajar memahami bahawa ikhlas dan toleransi adalah asas kepada pembentukan masyarakat yang maju dan beretika.

Secara keseluruhannya, dapatan kajian menunjukkan bahawa pelajar Politeknik Ibrahim Sultan memiliki tahap kefahaman yang tinggi terhadap nilai-nilai moral seperti hormat-menghormati, ikhlas, dan toleransi, yang merupakan asas penting dalam membentuk masyarakat beretika dan bersatu padu sebagaimana dinyatakan oleh Noh et al.(2025) Skor tertinggi bagi item hormat-menghormati membuktikan bahawa pelajar amat peka terhadap kepentingan menjaga hubungan antara kaum demi mengekalkan perpaduan dan keharmonian nasional. Dapatan berkaitan nilai ikhlas dan toleransi juga disokong oleh kajian Min dan Jianjun, (2024) dan Setiawan et.al.(2024), yang menekankan peranan nilai moral dalam menjamin keharmonian masyarakat majmuk. Walaupun terdapat sedikit variasi dalam kefahaman berkaitan pembentukan sahsiah (B4), secara keseluruhan, hasil kajian membuktikan keberkesanan Kursus Penghayatan Etika dan Peradaban dalam membentuk pelajar yang berpegang kepada nilai moral dan kesedaran sosial yang tinggi.

4.3. Tahap Pengamalan Nilai Moral Melalui Kursus Penghayatan Etika dan Peradaban

Jadual 4 di bawah menunjukkan skor min dan sisihan piawai (SP) bagi setiap item yang mengukur tahap pengamalan nilai moral dalam kalangan pelajar. Kesemua item mencatatkan tahap pengamalan yang tinggi, dengan nilai min berada dalam julat 4.59 hingga 4.76. Ini menunjukkan bahawa pelajar mengamalkan nilai moral dalam kehidupan seharian mereka pada tahap yang sangat baik.

Jadual 4: Tahap Pengamalan Nilai Moral Melalui Kursus Penghayatan Etika dan Peradaban dalam Kalangan Pelajar Politeknik Ibrahim Sultan

Bil.	Item	Min	SP	Interpetasi
C1	Saya berusaha mengelakkan diri daripada melakukan perkara-perkara buruk.	4.68	0.58	Tinggi

C2	Saya mengamalkan sikap hormat-menghormati antara rakyat Malaysia pelbagai kaum.	4.72	0.52	Tinggi
C3	Saya melakukan kerja dengan penuh keikhlasan.	4.66	0.59	Tinggi
C4	Saya berusaha ke arah membentuk jati diri yang mantap.	4.66	0.57	Tinggi
C5	Saya menjaga hubungan silaturahim sesama manusia.	4.71	0.51	Tinggi
C6	Saya mengamalkan sikap toleransi dalam mengekalkan perpaduan antara kaum.	4.72	0.60	Tinggi
C7	Saya mengajak rakan-rakan untuk melakukan kerja amal.	4.59	0.60	Tinggi
C8	Saya menghindari percakapan yang menyakitkan hati rakan.	4.63	0.58	Tinggi
C9	Saya suka berkawan dan berinteraksi dengan orang yang dapat membimbing saya ke arah kebaikan.	4.76	0.53	Tinggi

Item dengan min tertinggi ialah C9 (Min = 4.76, SP = 0.53) iaitu “Saya suka berkawan dan berinteraksi dengan orang yang dapat membimbing saya ke arah kebaikan.” Dapatan ini menunjukkan bahawa pelajar amat cenderung mengamalkan nilai sosial positif dan memilih persekitaran rakan sebaya yang baik sebagai sebahagian daripada pengamalan nilai moral. Ini bertepatan dengan hasil kajian oleh Ezarina Zakaria et al. (2022) menyatakan bahawa pengaruh rakan sebaya dan pergaulan sosial yang positif sangat membantu dalam membina jati diri remaja. Remaja yang berkawan dengan individu yang mempunyai nilai moral tinggi lebih cenderung untuk mempraktikkan nilai tersebut dalam kehidupan seharian mereka.

Manakala bagi item dengan min terendah ialah C7 (Min = 4.59, SP = 0.60) iaitu “Saya mengajak rakan-rakan untuk melakukan kerja amal.” Walaupun masih pada tahap tinggi, item ini mencadangkan bahawa penglibatan secara aktif dalam mengajak orang lain melakukan kebaikan mungkin masih boleh ditingkatkan. Hal ini mungkin disebabkan oleh kekangan masa, kekurangan pendedahan kepada aktiviti kesukarelawanan, atau pengaruh rakan sebaya yang kurang aktif dalam kerja sosial.

Secara keseluruhannya, dapatan kajian menunjukkan bahawa pelajar Politeknik Ibrahim Sultan mengamalkan nilai moral pada tahap yang tinggi hasil daripada pendedahan melalui Kursus Penghayatan Etika dan Peradaban. Walaupun skor bagi item C7 adalah yang terendah, ia masih berada dalam kategori tinggi, menunjukkan bahawa pelajar masih menzahirkan nilai positif namun memerlukan lebih galakan dalam memimpin rakan ke arah aktiviti kebajikan. Keseluruhan dapatan ini membuktikan bahawa kursus ini berjaya membentuk pelajar yang bukan sahaja memahami, malah mengamalkan nilai-nilai moral dalam kehidupan harian selaras dengan matlamat pembentukan masyarakat harmoni dalam konteks budaya dan agama yang pelbagai di Malaysia.

5. KESIMPULAN

Hasil kajian menunjukkan bahawa pelajar Politeknik Ibrahim Sultan mempunyai tahap kefahaman dan pengamalan nilai moral yang tinggi setelah mengikuti Kursus Penghayatan Etika dan Peradaban (PEP). Dapatan ini membuktikan bahawa kursus ini memainkan peranan yang penting dalam membentuk kesedaran etika dan sahsiah positif dalam kalangan pelajar. Aspek kefahaman pelajar terhadap nilai moral seperti hormat-menghormati, ikhlas, toleransi, dan tanggungjawab berada pada tahap tertinggi. Ini selari dengan matlamat kursus Penghayatan Etika dan Peradaban (PEP) yang dirangka untuk membina kesedaran pelajar terhadap peranan mereka sebagai agen perpaduan dan keharmonian sosial. Nilai hormat sesama kaum dianggap sebagai asas utama kepada kestabilan negara, dan pemahaman pelajar terhadap nilai ini menunjukkan bahawa pengajaran kursus tersebut telah berjaya menyampaikan mesej moral yang relevan dengan realiti masyarakat majmuk di Malaysia.

Dalam aspek pengamalan, pelajar turut menunjukkan kecenderungan yang kuat untuk mempraktikkan nilai moral dalam kehidupan seharian, seperti menjaga hubungan baik, mengelakkan perbuatan buruk, dan berkawan dengan individu yang memberi pengaruh positif. Namun, pengamalan yang melibatkan inisiatif memimpin atau mengajak orang lain ke arah kebaikan, seperti kerja amal, mencatat skor yang sedikit rendah walaupun masih berada pada tahap tinggi. Secara keseluruhannya, kajian ini membuktikan bahawa Kursus Penghayatan Etika dan Peradaban berkesan sebagai medium pendidikan nilai moral, dan berpotensi besar dalam menyumbang kepada pembentukan warganegara yang beretika,

bertanggungjawab, dan seimbang dari segi rohani dan sosial. Walau bagaimanapun, terdapat keperluan untuk memperkukuh penglibatan pelajar secara praktikal dan kolaboratif, agar nilai yang difahami bukan sahaja diamalkan secara individu, tetapi juga disebarkan dalam komuniti.

Kajian seperti ini juga boleh membantu merancang langkah-langkah penambahbaikan yang bukan hanya fokus kepada isi kandungan kursus, tetapi juga mengambil kira pengaruh persekitaran pelajar, seperti rakan sebaya, media sosial, dan suasana di kampus yang turut mempengaruhi pembentukan sahsiah dan tingkah laku pelajar secara menyeluruh. Kajian ini juga membantu pensyarah menyesuaikan pendekatan pengajaran agar lebih aktif, reflektif, dan kontekstual sekaligus memastikan nilai moral yang diajar bukan sahaja difahami, tetapi diamalkan secara konsisten dalam kehidupan pelajar. Kajian seterusnya disarankan untuk memberi tumpuan kepada faktor luaran yang berpotensi mempengaruhi pengamalan nilai moral dalam kalangan pelajar. Antara faktor yang dikenal pasti termasuklah pengaruh rakan sebaya, pendedahan kepada media sosial, latar belakang keluarga, serta persekitaran komuniti kampus. Faktor-faktor ini memainkan peranan penting dalam membentuk tingkah laku pelajar dan boleh menjadi pengaruh sama ada positif atau negatif terhadap amalan nilai moral yang telah difahami melalui proses pembelajaran formal. Dengan meneliti aspek ini, penyelidik dapat mengenal pasti jurang antara tahap kefahaman dan tahap pengamalan nilai moral, sekali gus memberi gambaran yang lebih menyeluruh tentang keberkesanan kursus yang ditawarkan.

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Big Data in Digital Entrepreneurship: Exploring Adoption Issues and Strategic Challenges among SMEs in Malaysia

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ABSTRACT

Global economic transitions and the acceleration of digital technology adoption have profoundly impacted business landscapes especially for Small and Medium-sized Enterprises (SMEs). These developments have catalysed the emergence of digital entrepreneurship - a phenomenon where businesses are created, managed and scaled using digital technologies. Among these technologies, big data has emerged as a powerful enabler of innovation, operational efficiency and strategic decision-making. However, the effective adoption of big data remains a significant challenge for many SMEs, particularly in emerging economies such as Malaysia. While government agencies have introduced multiple programs to support digitalization including financial grants, training and digital market access, many SMEs still face structural, technical and strategic barriers in embracing big data. Current literature often prioritizes general digital transformation or information systems in large firms neglecting the nuanced challenges faced by SMEs in digital entrepreneurship. This study seeks to bridge the gap by focusing on the issues and challenges surrounding big data adoption within digital business platforms among Malaysian SMEs. Specifically, the study explores how resource availability, digital capabilities and strategic alignment influence the adoption of big data. It also considers the post-pandemic context where the need for digital resilience and competitive advantage has intensified. By adopting a holistic lens, the research not only identifies adoption bottlenecks but also provides practical insights for entrepreneurs, ecosystem builders and policymakers. The findings are expected to contribute to the growing body of knowledge in digital entrepreneurship and big data readiness particularly within the SME sector. Ultimately this research aims to inform strategic policymaking and support Malaysian SMEs in leveraging data-driven digital business models for long-term sustainability and growth.

Keywords: Digital entrepreneurship, big data, SMEs, digital transformation

1. INTRODUCTION

The international economic changes and the rapid development of information technology have changed the pattern and policies of the national economy. This is why the digital economy is crucial at this time. The digital economy has become a major development trend in countries such as the United States and China, which contribute 40% of world GDP and take the lead in a lot of digital technology (UNCTAD, 2019). These modifications include the virtualization of the new manufacture, services, logistics, finance and marketing, so that the market grows and its price reduced (Murthy et al., 2021). The internet era has transformed how businesses operate with the fast proliferation of digital information and the emergence of a number of technologies such as big data, AI, cloud computing and digital platforms. Today, these technologies are essential to business practices and daily routines. As a result, digital entrepreneurship has become a tool for re-inventing how businesses do business and deliver value. It has created new business models across various industries, with activities such as bookkeeping, data handling, procurement and communication going online. This shift ushers in what we refer to as the digital economy. With digital technologies, new technologies are part of the business models and overall strategy. Therefore, digital entrepreneurship is the innovation process that leads to the reinvention of the existing companies through the new value creation as well as innovation development initiator (Sataalkina & Steiner, 2020). This has led to the creation of a new business model which cuts across all

economies ranging from the virtualization of administrative, financial and storage services to digitalization of industrial and commercial operations like procurement, distribution, manufacturing and communication. This technological revolution led to the emergence of the digital economy (Asliturk et al., 2016). The remainder of the paper is organized as follows: the objective of the study which is to identify issues and challenges for Malaysian SMEs that affect the implementation of big data in digital entrepreneurship platforms.

2. LITERATURE REVIEW

2.1. Big Data Adoption

In the digital transformation age, big data has become an essential tool for the business to understand the trends of the market and customer's behaviour. Through demographic, psychographic, geographic and user interaction insights, companies are finally able to predict what customers want and adjust their strategies accordingly. Through big data, the almost real-time collection and integration of large, frequently unstructured data sets from various sources is now possible (Brunink, 2016). This evolution represents a significant change in how businesses are run and from backward-looking to forward forecasting business models. Leveraging big data enables corporate leaders to make their decision making more data-driven at every level of their organization, including in areas of strategic importance such as financial results, customer and brand perception (Grandhi et al., 2021).

The increasing dependence on data has caused organizations to develop strategies for handling internal and external sources in order to compete within a data-driven business landscape. Big data is large and unwieldy, such that conventional data management tools may not necessarily be employed to analyse it (Matilda, 2016). This entails that organizations require sophisticated systems to collect, store, search and analyze a great amount of dynamic data (Fonseca & Boutaba, 2015). According to Oracle. com (2021), big data comprises diversity, velocity and volume. These features open up new possibilities for creativity, particularly when the traditional approaches to data processing are not sufficient. In the era of digital platforms, big data is more important than ever for building agile and responsive business strategies that can adjust to changing consumer and market expectations.

One key concept to understand big data is the six V's — a chart that categorizes the dimensions of its shape and utility. The first of V's - *volume*, records the enormous amounts of data that are being generated every day, touching on everything from tweets to Internet of Things (IoT) sensor readings (Sestino et al., 2020). *Velocity* is concerned with the speed at which data is generated and moved and where applicable, how soon it must be acted upon, such as in many smart-device applications that either occur in real-time or a close facsimile thereof (Dubey et al., 2019). From variety's point of view, data can have two shapes, tidy fields, following the tables in a SQL database and messy streams like video, audio and free-text logs. *Value* is created when patterns are detected by teams to guide strategic behavior (Opresnik & Taisch, 2015; Fosso Wamba et al., 2015). *Veracity* concerns the accuracy (even truthfulness) of data which is dependent on platforms such as Shopee and Facebook which need reliable performance measures (Gandomi & Haider, 2015). The last V is *variability*, it refers to the inherent malleability of data – how the identical data can morph in meaning, depending on where and how it is applied – such as changing meal delivery patterns or the rolling peaks of Google search trends we observe (Ebner et al., 2014).

In addition to those established six V's, understanding the precise genealogy of big data is fundamental to unlocking the power of it. Matilda (2016) categorizes the origins of big data into three main buckets - Data Flow, which consists of continuous streams from sensors, processors, mobile activity logs etc., including those in transportation, mobile communication, healthcare and the role of sensors in the Industrial Internet; Social Networks, which hosts mammoths like Facebook and Instagram and more recently, YouTube, WhatsApp, blogs, where human interactions churn out mountains of user-centric data; and the Public Domain, which is home to for-free troves like Wikipedia, government data websites, the World Bank, the Microsoft Azure DataMarket, etc. Together, these currents provide companies with the sinew to streamline marketing strategies, craft new products and expand on customer service. The diverse and voluminous nature of these streams empowers organizations to comprehensively map

customer preferences, identify market trends and assess external drivers at a level that has never been possible before.

As businesses push deeper into the digital world, big data has evolved from being an asset stored and analyzed by a small number of data scientists to one that is used by many – occasioning a leap from the business world to the mainstream. Artificial intelligence advances, machine learning and predictive analytics are now enabling decision-makers to decode complex data sets almost as they happen (Leonardi, 2020; Schiliro, 2020). Falling prices for data storage and processing also have made such tools available even to smaller companies. Therefore, decision-making is not only quicker but knowledge-based and efficient. Yet, organisations should take-into-account the impact of organisational rules and structures, which can sometimes undermine the objectivity of the data interpretation (Grandhi et al., 2021). Big data analytics will continue to underpin innovation, agility and long-term competitive advantage in the ever-more-digital world.

2.2. Digital Entrepreneurship

Entrepreneurship is still among the strategic influences on business developments and undergoes continuous changes influenced by business environment evolution, process adaptation, roles and enterprise frameworks. Despite the extensive of the construct in research, it seems that researchers have not reached consensus on what psychopathic means (the kind of thing that one would have expected for a term that has been used to this extent (Kraus et al., 2012). Related constructs constantly recurring are innovation, value-creation, economic development and job and wealth creation (Morris et al., 2010). Similarly, entrepreneurship is defined as a dynamic activity that involves identifying and taking advantage of business opportunities from the marketplace (MEDEC, 2020).

The entrepreneurship in the form of technology (or digital) based ventures has, however, been scarcely covered by most scholars. As Daunfeldt and Halvarsson (2015) argue, the economic value of individuals owning businesses has attracted more interest in scholarly research than of the (potentially) high-growth digital ‘start-up’ businesses (Kraus et al., 2012). Additionally, Acs et al. (2016) assert that most startups have no initial customer base; thus, the knowledge on market dynamics before the inception of the firm has been emphasized. These observations suggest that digital entrepreneurship is an important phenomenon to understand the business context in the contemporary business world. Yet, there remain a gap in comprehending the role of digital technologies (and agents) within entrepreneurship and how digital transformation affects institutionalised as well as agent-based change (Sussan & Acs, 2017).

This background makes the study of digital entrepreneurship relevant and necessary. It offers a new perspective that integrates systemic thinking with interdisciplinarity and offers an empirical stance for theory in management studies (Satalkina & Steiner, 2020a). Although digitalization is well surveyed “in management and information systems research, it is not well-represented as applied to entrepreneurial action, especially in digital start-ups” (Sussan & Acs, 2017). This article addresses this vacuum by advocating the importance of digital entrepreneurship, an area which has started to be looked upon by academics since the early 2000s (Ben Saad & Choura, 2022) and remains a relevant field of further exploration and new research.

2.3. Digital Business Platform

During the past two decades, a new top class of technology-based organizations have materialized to transform sectors including finance, communications, advertising, operating systems and other internet related services such as real estate and transportation (Song, 2019). The impact of digitalization is no longer confined to increasing operational efficiency - it is at the heart of business planning and strategy. With the transformation of digital platforms from operational information systems to a strategic asset, the role of digital platforms in business management is becoming increasingly crucial (Yeow et al., 2018b). However, numerous studies have suggested that disconnect between business objectives and information and communication technology (ICT) activities during digital entrepreneurship could inhibit scalable digital transformation and long-term survival [Karimi & Walter, 2015; Vial, 2021; Yeow

et al., 2018a]. Moreover, strong digital platform capabilities are found to enhance organizational agility and enhance overall firm performance (Karimi & Walter, 2021; Matt et al., 2015; Lechner et al., 2002).

The ecosystem of entrepreneurship has been transformed by digital intermediaries by introducing new actors and intermediaries to the market. Steininger et al. (2022) observe that the digital economy has facilitated the management of participation through the development of new supply-demand models and intermediaries. These are today central players, especially in digital start-ups where a majority are organized around platform-based models. Furthermore, successful business world initial public offerings (IPOs) are increasingly dominated by companies offering digital platforms, thus demonstrating the importance of these sites for digital entrepreneurship. This unbundling of the firm unanchors Schumpeter's vision of innovation as "creative destruction" and positions digital platforms as destabilising forces of market equilibrium which instigate and enable the continued evolution and experimentation of business models (Fritsch, 2017).

Malaysia's digital development strategy is articulated in its national plans including Twelfth Malaysia Plan (RMKe-12) and Wawasan Kemakmuran Bersama 2030 (WKB 2030). It is aimed to accelerate inclusive and sustainable growth through harnessing the digital economy as the main engine (Economic Planning Unit, 2021). The Malaysian Digital Economy Blueprint 2021 was established to realise this benefiting society, businesses and Government simultaneously. Many ministries and agencies have already started integrating digital solutions into their operations, but more needs to be done to stay ahead of developments in technology, labour and the market. Malaysia has been embracing the digital journey since 1996 with the creation of the MSC to develop a high-tech ecosystem. Policy initiatives since aimed at accelerating digital preparedness and enable the country to realize its vision of a developed knowledge economy.

2.4. Small and Medium-sized Enterprises in Malaysia

SMEs are well known as the backbone of the Malaysia economy. According to the SME Insights 2019/20, in 2015, they accounted for 98.5% of the business establishments and nearly 75% of these were microenterprises (SME Corp. Malaysia, 2021). Small and medium enterprises were major contributors to the gross domestic product (GDP) at 38.3% and RM167.34 billion in exports in 2017, the largest shares were services (50.4%), manufacturing (47.2%) and agriculture (2.4%). In 2019, SMEs contributed 38.9% to GDP and employed 48.4% of the total working population in the country (National Entrepreneur and SME Development Council, 2020). Their inherent importance has made them highly vulnerable to economic disturbances, such as the COVID-19 pandemic, which have a straight bearing on the country's financial stability and business ecosystem.

Most SMEs were hit hard by the epidemic. Moreover, it also promoted the transformation of SMEs to digital. Online facilities like e-commerce have enhanced SMEs' ability to grow and to compete against bigger businesses (Jere & Ngidi, 2020). A survey by the International Trade Center reveals that 55% of 4,467 firms surveyed in 132 countries were severely affected by the crisis. In Malaysia, economic activity has crashed, falling by 17.1% in the Q2 2020 (National Entrepreneur and SME Development Council, 2020). To address this downturn, digital entrepreneurship is taking on even greater significance. IT technologies allowed enterprises to function even during the lockdowns, as highlighted by Modgil et al. (2022) - the relevance of digital means in crisis situations.

In tackling these challenges, the government has established support programmes which are customised to meet the requirements of SMEs, covering support in finances, skills development and enhanced access to markets. The significance of SMEs in the economic discourse of Malaysia is embedded and realized since so many years, particularly in underdeveloped regions (Omar et al., 2019; Srinivasan & Venkatraman, 2018; Ng et al., 2020; Chatterjee et al., 2021). The era of digital technologies presents opportunities for SMEs to expand and continue to compete through digital entrepreneurship (Jere & Ngidi, 2020). Yet, with these studies, the digitalization processes appear to be seen more from a managerial or marketing perspective and not so much from that of digital entrepreneurship.

Consequently, more research is needed to explore the manner in which pandemics and geopolitical changes are drivers of development of new digital business models (Chatterjee et al., 2020).

3. METHODOLOGY

This review paper follows the literature review approach to describe on how Malaysian SMEs integrate big data on digital entrepreneurship. Reputable sources such as Scopus, Web of Science, Google Scholar were used to screen articles published between 2015 and 2023. The search included the following keywords: “big data”, “digital entrepreneurship”, and “SMEs in Malaysia”. Only those studies with meaningful insights, specifically valuable empirical information were integrated. Thematic analysis identified themes and patterns that recurred. This way of approach helps to understand present issues, ambiguities and new opportunities under consideration for researchers, policy makers and players in SMEs.

4. FINDINGS AND DISCUSSION

Today’s entrepreneurs live in a hurriedly changing digital world where technology is a cornerstone of idea generation, operation and market access. With the aid of social media and artificial intelligence, founders can monitor impact, optimize outreach and innovate on offerings. Digital technologies are common technological underpinnings of production, marketing and distribution activities that are embedded in different systems (Samara & Terzian, 2021). However, the incorporation of big data in these platforms is not without issues, especially when entrepreneurs aim to exploit them for competitive advantage. Strategic and executional misalignment in digital technologies may impose risks, disrupt or clutter business affairs and raise uncertainties in transitions (Gupta et al., 2021). In order to harness the power of big data, the companies have to rethink their organizations and business strategies.

The challenge for going with big data is the central orientation of most digital networks. Facebook and Apple iOS, for example are closely controlled and the owner determines who participates and what rules of usage are imposed (Hein et al., 2020; Satariano et al., 2019). This rigidity, which was most recently communicated in Google’s move to reduce collaboration with hardware partners in 2019 highlights the volatility and command digital entrepreneurs must grapple with. Thus, entrepreneurs will have to be adaptive and forward thinking as they encounter technological disruptions especially in areas such as data governance and analytics. By utilizing the power of social network analytics, it is possible to learn how to shape business models and to provide enterprises with the ability to substantiate decisions with a solid data-driven rationale. Initiating data-driven digital ventures also depends on selecting and deploying appropriate data with intention. Start-ups are often challenged in terms of validating platform models, especially if resources to experiment are scarce (Gocke & Meier, 2021; Ghezzi, 2019). Although lean is now near universal, the articulation of minimal viable product still seems too frequently elusive. Yet these businesses can apply ICT to expand product lines and trial overseas markets, and the digital affordances definitely accentuate these routes. However, without the money or the technical expertise, the big data vision is often out of reach.

The digital platforms bring an added wrinkle. They mix modular hardware, software and standardised protocols that encourage third party innovation and coordination (De Reuver et al., 2018; McIntyre & Srinivasan, 2017; Cenamor et al., 2019). To rein in this complexity while extracting new business value, companies have to incorporate big data and analytics into their internal processes and ways of thinking. Promoting a culture of managed experimentation, tearing down silos and designing incentives around data-based outcomes can help ignite and keep the flame alive for innovation in data (Ciampi et al., 2021). Capital expenditures are still necessary, especially for digital marketing where big data enhances advertising accuracy and increases customer engagement because it allows for faster, cheaper and more personalized messages (Wang et al., 2020; Shirazi & Mohammadi, 2019).

In addition, companies have to deal with the ongoing challenge of how to integrate and rationalize their digital acquisitions. Real big data embedding depends on effective information system engagement and well-coordinated action at all decision levels (Zatsarinnyy & Shabanov, 2019; Vidgen et al., 2017). In the

end, becoming a data driven organization is not just about implementing new tools, but about the need to redefine core processes, support complementary skills and develop human capital strategies around data (Kristoffersen et al., 2021). Digitalization is actually a source of challenge for many firms that have experienced difficulties during more than 10 years in adapting core operations and organizational culture (D'Ippolito et al., 2019). By understanding them and working with them, companies can exploit the value in big data for their business, and that means extending focus beyond its technical aspects to encompass strategic, cultural and operational change.

5. CONCLUSION

There is a reconceptualisation of digital entrepreneurship being shaped by the socially constructed relationship between the entrepreneur, the entrepreneurial process and the digital ecosystem. At the heart of this transition are entrepreneurs and the attitudes, skills and adaptive thinking - or the lack thereof - that will determine the extent to which opportunities, especially those connected with big data, will be translated into defining and successful offerings. Despite the potential of digital technologies, most SMEs find it hard to bring their ambitious dreams and realistic actions in harmony. Often the divide is when high-level strategy ambitions around data fail to be rooted in the operational requirements to make them real. Not surprisingly, this lack of alignment leads to digital initiatives that do not convert into measurable performance improvements (Gupta et al., 2021). That is why digital leadership and increased data literacy for SMEs is so critical, in enabling those big data assets to be turned into tangible value throughout entrepreneurial businesses.

The entrepreneurial environment of today has been dramatically altered by digital tools and data-informed decisions. While these are developments that can help to make everything quicker and more efficient, SMEs often feel the pressure. They are hampered by limited resources and technical expertise and are in a perpetual game of catch up thanks to uncertainty around the business model. Loads of young companies pursue lean procedures but continue to struggle in identifying potentially successful products and expanding beyond the pilot phase (Ghezzi, 2019; Gocke & Meier, 2021). The sense of thread is strengthened by the very centralized digital platforms led by Google and Apple, which contribute to a high entry threshold, proving for disorienting conditions for small companies to have a relevant business in these ecosystems (Hein et al., 2020). Big data makes it all the harder. Interoperability, data integrity and legacy and new systems intercompatibility throw up challenges that need focused investment and strategic choreography. Without that strong blueprint in place, and with the sheer volume and complexity of data now available, SMEs can soon become overwhelmed by it, meaning growth is stifled rather than sped up.

The path to sustainable digital entrepreneurship sounds very promising indeed, as when it develops within an integrated ecosystem that's aligned to ultimately create long-lasting value. For smaller businesses, though, the transition to big data and digital platforms is about more than changing tools, it's about reimagining the business itself. In general, many organizations struggle with fragmented data sources, limited budgets for analytics and lack of people who can convert raw data to strategic actions (Kristoffersen et al., 2021; Vidgen et al., 2017). Sustainable entrepreneurship requires harmonizing economic, social and planetary values. Big data may be an important compass for the journey if navigated right. In order for SMEs to thrive, all stakeholders including governments, educators, funders, large firms, etc need to provide interconnected infrastructure complimentary skillsets and digital designs which allow SMEs to innovate, compete and contribute to a meaningful extent to the digital green economy.

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Healthy Workplace and Employee Well-being: Reviewing Tools for Assessing Healthy Work Environments for Shift Workers

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ABSTRACT

Healthy work settings is critical for employees, especially for workers in high stress, physicalised contexts. Although numerous instruments were developed to assess quality working environment, most of them were applied to healthcare or corporate settings, and none of them was designed for the special circumstance of shift work in border services. The purpose of this review is to identify existing instruments to measure work quality, to determine what gaps currently exist in relation to these measures for shift workers and offer some guidance on how to develop a new, context-specific measure. Through multiple literature searches, we identified papers reporting the development and psychometric validation of quantitative instruments related to healthy workplace. We focussed on identifying tools relevant to organisational support, job satisfaction, physical safety and emotional well-being. The review identified six solid tools such as PES-NWI, and the Professional Quality of Life Scale (ProQOL), each of which are well-supported psychometrically. However, these tools do not assess high-risk, isolated environments such as border services, nor do they reflect the key dimensions of physical safety, isolation, and mental health support in high-stress settings. This review paves the way to a new, validated instrument that can consider both the physical and psychological health implications of working in border services, considering the demands of their specific operational and environmental conditions. A purpose-built tool will contribute to the health and wellbeing of shift workers in this vital sector.

Keywords: Healthy workplace, instrument, shift workers, workplace well-being, work environment assessment

1. INTRODUCTION

Promoting a healthy work environment is essential to the wellbeing, satisfaction and performance of employees in any type of occupation. The efficient operation of a healthy work environment not only improves the physical well-being of employees, but also enhances job performance, loyalty and organisational success (Chang, 2024). Over the past years, research results provide strong evidence that the quality of work environment plays a significant role in the physical, psychological and emotional health of employees. Leadership support, work-life balance, team communication and safety at the workplace are some of the important components of a healthy work environment, and its proper treatment can effectively prevent negative consequences such as job dissatisfaction, absenteeism and turnover (Nassani et al., 2024).

A variety of tools and instruments have been created to measure the quality of work environments, especially those in fast-paced sectors such as healthcare and corporate offices. For example, the Practice Environment Scale of the Nursing Work Index (PES-NWI) and the Workplace Integrated Safety and Health (WISH) Assessment are widely used across the health sector to evaluate organisational climate, supportive systems for employees, and the overall occupational health of the workplace (Gómez et al., 2021; Janíková et al., 2021; Kiptulon et al., 2024). Such tools are routinely used to measure and improve work environments for employees in workplaces that depend on good teamwork and leadership characteristics. However, no matter how good these tools for evaluating work environments may be, they are often ill-equipped to assess the challenges of shift workers in highly specialised roles, such as those in border services.

For shift workers, especially those in border services such as customs and immigration, specific stressors may be present due to the nature of the work environment. In Malaysia, the Agensi Kawalan dan Perlindungan Sempadan Malaysia (AKPS) was recently established to coordinate border security enforcement, currently operating at 22 major entry points, including northern land borders such as Bukit Kayu Hitam, as well as key airports and seaports. By 2026, AKPS aims to expand its workforce to 16,000 officers to manage all 114 entry points nationwide, yet the present shortfall in personnel at critical locations intensifies the demands placed on existing shift workers (Bala Krishnan, 2025). These employees can experience a high level of stress in security-focused, high-stakes, remote and isolated work environments, often under 'never-ending' shifts (Bao et al., 2024; Virna et al., 2021). These circumstances can make for a highly stressful work environment, which can often lead to fatigue and burnout.

Unfortunately, there are few, if any, specific instruments that assess the quality of the work environment for this population. Many of the existing occupational health and safety assessment tools are well-designed and robust but do not address the unique needs of shift workers, particularly those in more remote or high-security settings. As more and more attention is given to the need for job-specific assessments of the quality of work environments, we argue that there is a need to re-conceptualise current tools to better assess the issues of shift work as it takes place in border services settings. This review aims to examine current instruments used to study the quality of work environments, highlight their strengths and limitations, and examine their applicability to our context in terms of border shift workers. By identifying the gaps, we are taking the first step to create a new, context-specific tool that can be applied to the physical, psychological and structural problems of shift work in border services.

This review systematically examines existing instruments, highlights their limitations in the context of shift work at border services, and provides a rationale for developing a new context-specific tool that addresses the unique physical, psychological, and operational challenges faced by this workforce.

2. METHODOLOGY

2.1. Search Strategy

Through a search of the literature, studies evaluating instruments designed to measure the quality of the work environment or their validation studies were identified. An extensive search of relevant scientific databases, including Scopus, Web of Science and Google Scholar, was made possible using a list of relevant keywords and key phrases. The following search terms were used, in combination with Boolean operators (AND, OR) to ensure a comprehensive search: work environment assessment, healthy workplace, workplace well-being, organisational health, occupational safety, job satisfaction, workplace stress. As the result, the search covered studies from the earliest available relevant publication 1985 up to 2024, ensuring the inclusion of both foundational instruments and recent developments in the field.

2.2. Eligibility Criteria

In addition, inclusion and exclusion criteria were set to ensure that the studies selected for review were relevant and rigorous. The eligibility criteria applied in selecting studies are summarised in Table 1.

Table 1: Inclusion and Exclusion Criteria

Inclusion criteria	Exclusion criteria
1. Research that developed or validated quantitative measures of the quality of healthy work environments.	1. Studies without quantitative data or psychometric validation of the instrument.
2. Research reporting psychometric information (e.g., Cronbach's alpha, content or construct validity).	2. Studies focused solely on qualitative assessments or case studies without instrument development.
3. Peer-reviewed articles published in English.	3. Review articles, conference proceedings, editorials, and letters.
	4. Studies restricted to highly specific environments (e.g., military, extreme environments) with limited generalisability.

3. RESULTS

The search initially retrieved 118 records across all databases. After removing 24 duplicates, 94 unique records remained for screening. Based on titles and abstracts, 72 records were excluded for not meeting the eligibility criteria, leaving 22 articles for full-text review. Following the application of the inclusion and exclusion criteria, six studies describing distinct instruments met the final criteria and were included in this review. The Table 2 provides a summary of the six instruments reviewed for the assessment of healthy work environment with details of the authorship of the tool, country of origin, year of development of the tool, key dimensions assessed, target population, psychometric properties, and limitations.

The Practice Environment Scale of the Nursing Work Index (PES-NWI), developed by Lake (2002) in the USA, is one of the most widely used tools for assessment of nurse participation, leadership, and staffing adequacy in healthcare environments. It shows a very high internal consistency (Cronbach's alpha > 0.80) and validity in numerous studies conducted in diverse healthcare settings. However, since the tool is specific to healthcare, it is less suitable for other industries. Meanwhile, The Workplace Integrated Safety and Health (WISH) Assessment developed by Sorensen et al. (2018) in the USA evaluates leadership commitment, worker safety, and cross-boundary collaboration in industrial and academic settings. This measure has been well-cognitively tested and iteratively validated but requires further testing in non-general industry settings to test generalisability.

The Work Environment Assessment Instrument (WE-10), created by van der Doef and Maes (1999) in the Netherlands, is designed to measure QL, OC and QWL in general work environments and corporate settings. This instrument, with Cronbach's alpha between 0.953 and 0.956, is considered strong and reliable. However, the generic focus on general work environments makes it less appropriate for more specific or higher stress settings. The Professional Quality of Life Scale (ProQOL), developed by Stamm (2005a) in the USA, addresses compassion satisfaction, burnout and secondary traumatic stress, and is used primarily with human service and health care professionals. With good internal reliability (Cronbach's alpha > 0.80), ProQOL is suitable across a wide range of professional populations but remains narrowly focused on individual emotional wellbeing and lacks broader organisational dimensions.

The Job Satisfaction Survey (JSS) by Spector (1994) in the USA measures job satisfaction associated with pay, promotion, supervision, communication and demographic characteristics in various industries, including administrative work. This instrument shows reliable results with Cronbach's alpha scores above 0.70, yet it is a general job satisfaction instrument without a deeper exploration of the work context. Lastly, the People in the Office Scale (POS), used to assess ergonomics, communication and infrastructure in offices, was devised by Pavlova et al. (2023). It showed very good reliability (> 0.77) and validity in office settings. Although validated in office settings, POS has limited applicability in more physically or psychologically demanding environments. Taken together, the instruments reviewed in this essay seem to have strengths within their respective contexts, but few have the specificity to capture elements important for certain work settings (ie, those that are physically or psychologically

demanding). These gaps point to the value of developing new tools to evaluate broader aspects of the workplace environment.

Table 2: Summary of Reviewed Instruments for Assessing Healthy Work Environment

Study	Country	Instrument	Key Dimensions Assessed	Population	Psychometric Properties	Limitations
(Lake, 2002)	USA	PES-NWI (Practice Environment Scale of the Nursing Work Index)	Nurse participation, leadership, staffing adequacy, nurse-physician relationships, quality of care foundations	Nurses in healthcare settings	High internal consistency ($\alpha > 0.80$), validated in multiple healthcare contexts	Primarily focused on healthcare settings, less relevant for other sectors
(Sorensen et al., 2017)	USA	WISH (Workplace Integrated Safety and Health Assessment)	Leadership commitment, worker safety, supportive practices, compliance with regulations, collaboration	Organizational settings across industries	Good cognitive testing, six core constructs validated through an iterative process	Requires further validation across diverse industry settings
(Van der Doef & Maes, 1999)	Netherlands	WE-10 (Work Environment Assessment Instrument)	Quality of life (QL), organizational climate (OC), quality of work life (QWL)	General workforce, corporate settings	Strong reliability ($\alpha = 0.953-0.956$), validated through exploratory factor analysis	General work environments only, lacks specific focus on unique or high-stress environments
(Stamm, 2005b)	USA	ProQOL (Professional Quality of Life Scale)	Compassion satisfaction, burnout, secondary traumatic stress	Healthcare and human services workers	High internal consistency ($\alpha > 0.80$) across various professional populations	Limited focus on broader organizational dimensions; focused on emotional well-being
(Spector, 1985)	USA	JSS (Job Satisfaction Survey)	Job satisfaction, pay, promotion, supervision, co-workers, communication	Various industries, administrative roles	Reliable instrument with Cronbach's alpha > 0.70 for different sectors	General job satisfaction tool; lacks in-depth work environment analysis
(Pavlova et al., 2023)	Finland	POS (People in the Office Scale)	Ergonomics, freedom of action, internal communication, external infrastructure	Office workers	Strong reliability, validated across multiple dimensions	Designed for office environments, lacks validation for physically demanding or high-stress settings

In addition to the tabulated summary, visual presentations were created to provide a clearer comparative overview of the reviewed instruments. Figure 1 illustrates the reliability of each instrument based on Cronbach's alpha, highlighting that most instruments meet or exceed the commonly accepted threshold of 0.70 for internal consistency.

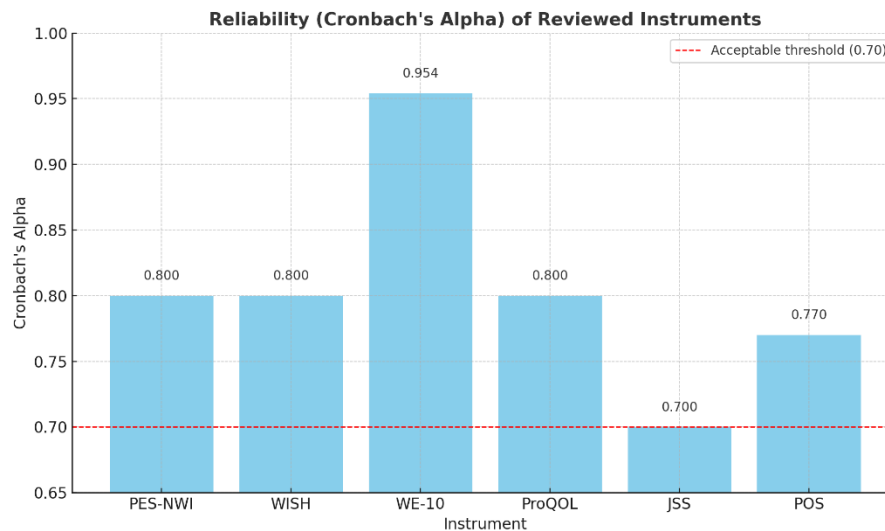


Figure 1: Reliability of Reviewed Instruments for Assessing Healthy Work Environments (Cronbach's Alpha)

Figure 2 presents a radar chart mapping the coverage of five key dimension leadership and organisational support, physical safety, emotional well-being, job satisfaction, and ergonomics/infrastructure across the instruments. This visual underscore that while instruments such as PES-NWI and WISH strongly address leadership and organisational support, they lack emphasis on physical safety and ergonomics, whereas POS excels in ergonomics but neglects leadership and emotional well-being. These patterns highlight the absence of a comprehensive tool that adequately covers all dimensions relevant to shift workers in border services.

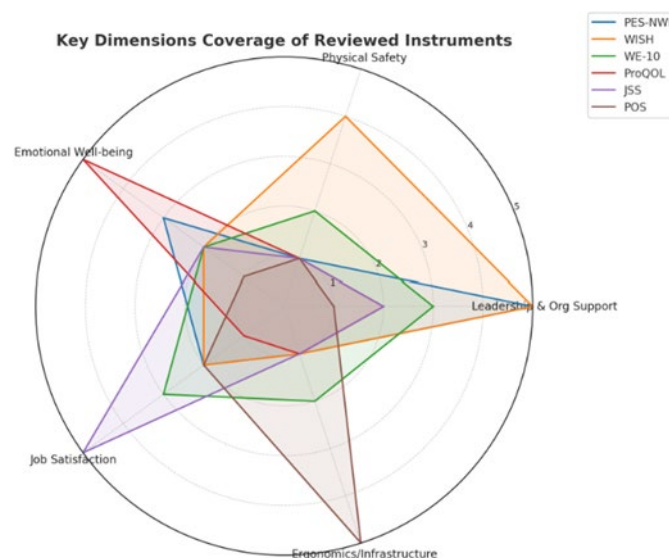


Figure 2: Coverage of Key Dimensions in Reviewed Healthy Work Environment Instruments

4. DISCUSSION

4.1. Key Dimensions Assessed by Existing Instruments

The instruments that were reviewed such as the PES-NWI, WISH, ProQOL are unanimous in focusing on organizational support, leadership and emotional wellbeing as the main indicators of a healthy work environment. For example, the PES-NWI, which was developed for use in healthcare settings to evaluate nurses' working conditions, focuses on leadership and staffing adequacy and asks questions related to the extent to which the nursing structure and facility leadership empower and support nurses (Kiptulon et al., 2024). Likewise, ProQOL, which was developed for use in the healthcare sector, specifically with therapists or social workers, measures compassion satisfaction and burnout (Dwyer et al., 2021). These

dimensions are undoubtedly essential to a healthy work environment, a place where people can feel supported and appreciated by their supervisors and co-workers, and where they can grow and develop professionally and personally. However, for border services, which have unique characteristics, a more holistic assessment is needed, especially in relation to occupational isolation, physical security risks, and the psychological effects of sustained vigilance in high-stress environments (Kecklund & Axelsson, 2016).

Compared with these existing instruments, this new instrument for border shift workers needs to include an extra set of dimensions related to physical safety, environmental stress and operational demands related to the remote and hazardous nature of border work. Epidemiological studies have consistently shown that poor work environment quality, particularly in high-demand shift work, is associated with increased cardiovascular risk, metabolic disorders, and mental health problems such as depression and anxiety (Kecklund & Axelsson, 2016; Vetter et al., 2016). However, these elements are often underrepresented in most current instruments. Thus, although the two core dimensions of leadership and emotional support are critical, they need to be expanded to reflect the unique work challenges faced by border shift workers.

4.2. Gaps Identification in Applicability Across Different Work Settings

The other aim was to identify opportunities where existing instruments are not applicable to the border settings, especially among shift workers. The review of instruments revealed that most of these instruments, such as the WE-10 (Van der Doef & Maes, 1999) and POS (Pavlova et al., 2023) were developed for general corporate or office work settings, which fail to capture the specific stressors of border work. For example, shift workers in border settings have to work long shifts in remote locations, continuously monitor security operations, and face unpredictable threats, none of which are included in the current instruments. As is often the case in high-pressure work environments, mental and physical health in border services are deeply interconnected. The absence of instruments explicitly developed for assessing these kinds of specialised conditions represents a further lacuna. Previous research shows that generic instruments based on work-stress tests that do not take into account the particular psychological strain and physical demands associated with high-risk occupations cannot impact of working in border services (Emal et al., 2023; Menghini & Balducci, 2021). A new tool would need to incorporate questions that can measure the kinds of stresses that come with security, isolation and the need for constantly monitoring one's surroundings.

4.3. Psychometric Properties of Reviewed Instruments

The third aim was to summarise the psychometric properties of existing instruments, namely their reliability and validity. The majority of reviewed instruments proved to have excellent reliability, most scoring 0.80 or above for Cronbach's alpha, a measure of the internal consistency of items in the scale. This is a sign of high reliability, which means that the instruments are appropriate for studying these work environments in those settings. But a high reliability in any one setting does not mean that the same instrument can be applied in another. Instruments such as PES-NWI (Lake, 2002) and ProQOL (Stamm, 2005) were designed for office environments, and, while they may be appropriate for some physically demanding or isolated settings (eg, border services), they have not been validated for these contexts.

A key challenge in developing a new instrument for border shift workers will therefore be to bring together content validity and contextual relevance. This accords with the findings from literature that show that the reliability of a given instrument alone doesn't ensure that using authentic features of the conditions of work, if that instrument was not developed work in mind. Thus, even with strong psychometric starting points, development of a new tool requires vigorous testing and validation in border service settings to ensure that it is measuring the dimensions of wellbeing and work quality that are specific to this context (Emal et al., 2023; Menghini & Balducci, 2021).

5. CONCLUSION

The review emphasized the importance of developing a new measurement tool to capture border services shift work environment quality. Even existing tools for measuring such things as leadership and organizational support often fail to capture the special physical, psychological and operational demands on border shift workers. A new, validated measure that captures these elements should help to build a more robust understanding of the broad aspects of workplace wellbeing.

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The Relationship Between Motivation and Commitment Towards Organization Among Maybank's Employees

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ABSTRACT

The aim of this study is to determine the relationship between motivation and commitment towards organization among Maybank's employees. For about 181 non-executive respondents were selected as a sample for this study. Simple random sampling method were used to select sample of this study. Two research instruments were used in this study. Herzberg Questionnaire and the Allen and Meyer Questionnaire were used to measure motivation and commitment. Researchers used Pearson correlation analysis to determine the relationship between motivation and commitment towards organization among Maybank's employees. The findings found that there is a positive and significant relationship between motivation and commitment towards organization among Maybank's employees. It can be concluded that motivation can influence commitment towards organization. Therefore, it's very essential to increase employee's motivation in order to enhance their commitment towards organization. Human Resource departments should play vital role in ensuring employees stay motivated so that it can enhance their commitment towards organization. It is suggested that Human Resource provide incentives like bonus or rewards or redesigning job and provide job challenges to increase employee's motivation. As they become motivated, they can help organization to gain organizational success by giving full efforts and commitment towards organization.

Keywords : Motivation, commitment, organization

1. INTRODUCTION

Motivation can be defined as a person's internal view to be concerned with and approach positive encouragements and avoid negative encouragements (Deckers, 2010; Steve et al., 2008; Mitchell, 2003). Encouragement is the appraised reward or event available in the environment. It is an important criterion for any organization to recognize and to configure the work environment to inspire self-motivated behaviours and demoralize those unproductive employees, because by manipulating workplace can affect performance and behaviours. (Steve et. al, 2008; Mitchell, 2003). It is very important for organization to increase their employee's motivation since it can help organization to achieve its goals. Therefore, in order to maintain, attract, increase workers' efforts, satisfaction and commitment, organizations need to place all efforts to ensure that incentives such as intrinsic motivators, extrinsic motivators and performance management approaches are implemented. (Salleh et al, 2016). These incentives can retain motivation among employees thus enhance their commitment towards organization.

Instead of motivation, commitment also very essential to increase productivity and efficiency. Commitment can be defined as a situation when an employee is aligned with an organization's objectives thus, they have the desires to uphold affiliation with the organization. (Robison, 2010; Salleh et. al, 2016). Rumengan et. al; 2022 and Allen et al.; 1990 stated that employees who are committed towards organization helps to achieved organization's success and helps to reduce the rate of turnover in

organization. Previous study had done research about the impact between motivation and organizational commitment, job motivation and organizational commitment among health professional, the influence of work motivation and organizational commitment in the workplace. Previous literature reviews found that motivation can influence organizational commitment to health professionals, restaurant employees and academicians (Rumengan et. al. 2022; Salleh et. al. 2016; George and Sabapathy, 2011). Same with this study, this study also aims to determine the relationship between motivation and commitment towards organization but the respondents are among banking employees. Previous study focusses on sample such as academician, restaurant employees, health professionals, but still no research focus on respondents from banking industry. This is considered as research gap that researchers trying to explores. Below is the research objective of this study:

- i. Determine the relationship between motivation and commitment towards organization among Maybank's employees

2. RESEARCH METHODOLOGY

This study used Pearson correlation analysis to determine the relationship between motivation and commitment towards organization. For about 181 employees from Maybank were selected as a sample of this study. Simple random sampling method were used to select samples. Simple random sampling method is a method where each individual in a population has an equal chance of being selected for a sample. It's a fundamental probability sampling technique used to create a representative subset of a larger group. This method is straightforward and avoids bias by ensuring that every member of the population has an equal opportunity to be chosen (Singh, 2013; Blair, 2014). Based on demographic data of respondents, 100 of the employees are women while 81 are males. Based on the demographic factors (race) 75 % of the employees are Malay, only 10 % are Indian and 15 % are Chinese. All of the respondents were non-executive employees and had diploma certificate. The research instrument for organizational commitment was adapted from Allen and Meyer (1999), while the research instrument for motivation was from Chia (2008) using Herzberg questionnaire. From the reliability analysis, it was found that the Cronbach's Alpha value for both questionnaires is 0.75 for organizational commitment, and 0.79 for motivation. Based on the reliability analysis, it can be assumed that both instruments are reliable and valid. The hypothesis of this study as below:

H1: There is a positive and significant relationship between motivation and commitment towards organization among Maybank's employees.

3. RESULT

Table 1 below shows the results of the Pearson correlation analysis. According to table 1, correlation value, r is 0.717, $n = 181$ $p = .000$. It was found that there is a significant and positive relationship between motivation and commitment towards organization among Maybank's employees. This result thus supported the hypothesis of this study.

Table 1. Correlation Analysis: Relationship Between Motivation and Commitment Towards Organization

Category	Commitment	Motivation
Motivation Pearson correlation	0.717**	1
Sig. (2 tailed)	.000	
N	181	
Commitment Pearson correlation	1	0.717**
Sig. (2 tailed)		.000
N		181

**correlation is significant at 0.01 level (2 tailed)

4. DISCUSSION AND CONCLUSION

Based on the finding, there is significant and positive relationship between motivation and commitment towards organization among Maybank's employees. These findings thus support previous research done

by Rumengan et. al (2022); George and Sabapathy (2011); Salleh et. al (2016), which found a positive and significant relationship between motivation and commitment towards organization among academicians, healthcare professionals and restaurant employees. Therefore, it can be concluded that motivation can influence organizational commitment among employees. It's very essential to keep employees stay motivated so it can enhance their commitment towards organization. Based on this finding, Human Resource department play a vital role in ensuring employees in the organization stay motivated in order to enhance their commitment towards organization. For research implication, it is suggested that human resource department provides incentive such as bonus or rewards to keep employees motivated. Human resource department also can redesign job or provide job challenges in order to increase the employee motivation thus can enhance their commitment towards organization. For future research, researchers suggest research should be focus more on moderator or mediator variables that can influence the relationship between motivation and commitment towards organization. This can help future researcher determine the impact of mediator or moderator variable on relationship between motivation and commitment towards organization. In addition, future researcher should focus choosing respondent among employees in other industry instead of banking employees.

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Strategic Thinking in Creative SMEs: Validating a Multidimensional Strategic Orientation Model

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ABSTRACT

Strategic orientation is a critical determinant of how micro and small enterprises (MSEs) navigate volatile and resource-constrained business environments. In the context of Indonesia's creative economy, understanding strategic orientation as a multidimensional construct—comprising Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—is essential for informing both theory and practice. This study aims to validate the measurement model of Strategic Orientation among creative SMEs in Padang through a pilot empirical investigation. Using a quantitative approach, data were collected from 34 creative SMEs as sample size using a structured questionnaire. Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed to analyse the data, utilizing both first- and second-order reflective constructs. The instrument's psychometric properties—including convergent validity, internal consistency, and discriminant validity—were assessed. The results confirm that all three dimensions of strategic orientation are statistically valid and reliable. CO emerged as the most dominant dimension, reflecting SMEs' strong responsiveness to customer needs and market alignment. IO showed acceptable reliability but slightly lower mean scores, indicating potential challenges in innovation execution due to limited resources. NO demonstrated solid internal consistency, suggesting that SMEs leverage inter-firm collaboration and relational capital to overcome structural constraints. Furthermore, the second-order construct of Strategic Orientation showed strong structural integrity, supporting its theoretical formulation. This validated model not only strengthens the empirical basis for future causal studies linking strategic orientation to performance outcomes but also offers practical value as a diagnostic tool for entrepreneurship training, SME development programs, and policy interventions. The pilot findings set the foundation for a full-scale investigation involving a larger sample and broader geographic scope, aimed at exploring the strategic pathways that drive competitive advantage and resilience among creative SMEs in emerging economies.

Keywords: Strategic orientation, customer orientation, innovation orientation, network orientation, creative SMEs

1. INTRODUCTION

Small and medium-sized enterprises (SMEs) are a critical engine of economic growth and innovation, especially in developing countries. In the context of Indonesia, particularly in creative sectors such as culinary and digital-based microbusinesses, the ability of SMEs to survive and thrive in a dynamic environment is largely dependent on their strategic orientation. Strategic Orientation (SO), which encompasses Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO), serves as a compass that guides firms in aligning their internal capabilities with external opportunities (Yang et al., 2022; Dutot & Bergeron, 2016).

Customer Orientation reflects a firm's commitment to understanding and fulfilling customer needs. It is a central pillar in market-driven strategies and has been linked to improved product innovation and long-term competitiveness (Hurley & Hult, 1998; Bekata & Kero, 2024). Innovation Orientation, on the other hand, signifies the extent to which a firm is open to and actively pursues new ideas, products, and

processes to differentiate itself from competitors (Norris & Ciesielska, 2019; Afifah & Gustiawan, 2015). Meanwhile, Network Orientation emphasizes the strategic use of relationships with external stakeholders—customers, suppliers, institutions, and peer firms—to leverage knowledge, resources, and market access (Zhang & Zhang, 2022; Anantadjaya et al., 2023). Numerous studies have affirmed the positive effect of strategic orientation dimensions on SME performance across contexts. For instance, Iriyanto et al. (2021) and Afifah et al. (2022a) highlight how CO and IO strengthen competitive positioning in local creative industries. Similarly, research by Afifah et al. (2023) on coffee shops in Sumatera Barat underscores the role of digital and network capabilities in fostering resilience and advantage amid post-pandemic recovery.

However, despite its importance, empirical evidence validating the construct of Strategic Orientation—particularly in the form of a second-order model integrating CO, IO, and NO—remains limited in the Indonesian SME context. This article aims to address this gap by presenting results from a pilot study conducted on creative SMEs in Padang City. The focus is to test the construct validity and internal consistency of SO dimensions using data from early-stage measurement, as part of a broader project to develop a comprehensive model of competitive advantage for creative micro-enterprises. This study aims to validate the construct of Strategic Orientation (SO)—comprising Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—as a second-order multidimensional model for creative SMEs in Indonesia, using a pilot study approach. Through this study, we aim to contribute to the refinement of Strategic Orientation constructs and their applicability in local contexts, providing a foundation for further research and policymaking that supports the sustainability and scalability of SMEs.

2. LITERATURE REVIEW

2.1. Strategic Orientation

Strategic orientation refers to the guiding principles that influence a firm's strategic direction and behaviour, particularly in how it responds to environmental dynamics, market demands, and innovation opportunities (Jeong et al., 2006; Yang et al., 2022). In the context of small and medium-sized enterprises (SMEs), strategic orientation is not merely a reflection of strategic planning, but an embedded mindset that shapes decision-making and resource allocation (Afifah et al., 2022a; Dutot & Bergeron, 2016).

Strategic Orientation (SO) can be conceptually anchored in the Resource-Based View (RBV) and Dynamic Capabilities Theory, both of which emphasize the role of intangible resources and capabilities in achieving sustainable competitive advantage. According to Barney (1991), unique and valuable resources that are rare, inimitable, and non-substitutable (VRIN) form the foundation for superior firm performance. Within this framework, the dimensions of SO—Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—can be interpreted as critical intangible strategic resources. CO provides market intelligence and the ability to anticipate customer needs, IO enhances the capacity for continuous renewal and product differentiation, while NO facilitates the access to external knowledge, partnerships, and complementary assets.

Building upon RBV, the Dynamic Capabilities Perspective (Teece, 2007) argues that firms must not only possess valuable resources but also develop the capability to integrate, build, and reconfigure these resources in response to rapid environmental changes. SO aligns with this view by representing a strategic posture that enables SMEs to sense opportunities (via CO), seize them through innovation (via IO), and transform their operations by leveraging networks (via NO). In the context of resource-constrained creative SMEs, these orientations function as dynamic capabilities that allow firms to adapt, innovate, and thrive in competitive markets despite limited tangible resources.

The multidimensional construct of strategic orientation—comprising Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—offers a comprehensive lens through which SMEs can enhance their adaptive capacity and long-term competitiveness (Bekata & Kero, 2024; Zhang & Zhang, 2022).

2.2. Customer Orientation (CO)

Customer orientation emphasizes the importance of understanding, meeting, and anticipating the needs of target customers. It encompasses behaviours related to gathering market intelligence, responding to customer feedback, and building long-term relationships (Hurley & Hult, 1998; Lukas & Ferrel, 2000; Bekata & Kero, 2024). For SMEs, CO is instrumental in building product-market fit and ensuring the relevancy of offerings amid changing consumer preferences (Afifah & Gustiawan, 2012; Afifah et al., 2022b). Empirical studies have shown that firms with strong customer orientation demonstrate greater innovation responsiveness and superior business performance (Dhaleez & Abdelfattah, 2022).

2.3. Innovation Orientation (IO)

Innovation orientation reflects a firm's propensity to engage in and support new ideas, experimentation, and creative processes that lead to novel products or services (Norris & Ciesielska, 2019; Iriyanto et al., 2021). It involves not only technological innovation but also process, marketing, and organizational innovation (Farooq et al., 2021; Ayinaddis, 2023). In the context of Indonesian creative SMEs, IO has been shown to mediate the relationship between entrepreneurial behaviour and competitive advantage (Afifah & Gustiawan, 2015; Afifah et al., 2023). Innovation-oriented SMEs tend to outperform their peers in dynamic environments due to their capacity for adaptation and differentiation.

2.4. Network Orientation (NO)

Network orientation refers to a firm's strategic approach in managing relationships with external partners, such as suppliers, customers, competitors, and institutions (Zhang & Zhang, 2022; Permatasari & Praswati, 2024). It reflects the firm's ability to leverage social and professional networks to acquire resources, share knowledge, and access markets (Anantadjaya et al., 2023). In SMEs, particularly those operating in resource-constrained environments, NO plays a critical role in facilitating innovation diffusion and sustaining market presence (Afifah et al., 2021; Indriani et al., 2022).

2.5. Conceptual Framework

Based on the reviewed literature, this study conceptualizes Strategic Orientation as a second-order construct composed of three interrelated first-order dimensions: Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO). This configuration allows for a more nuanced understanding of how strategic orientations interact to influence SME competitiveness. Below is the proposed conceptual framework model:

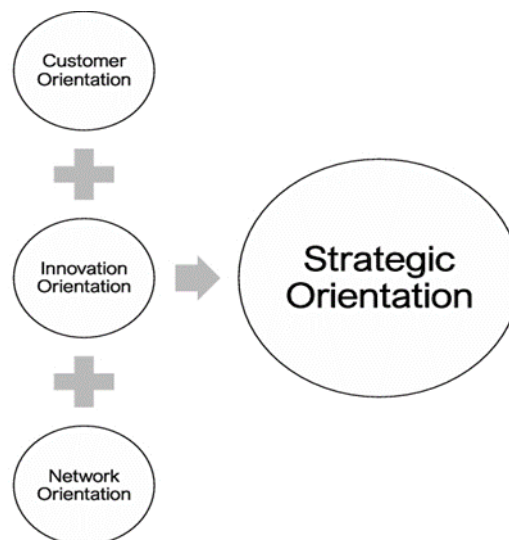


Fig 1: Strategic Orientation Research Framework

3. RESEARCH METHODOLOGY

3.1. Research Design

This study adopts a quantitative research design, utilizing a pilot study approach to examine the role of strategic orientation—comprised of customer orientation, innovation orientation, and network orientation—in enhancing competitive advantage among creative SMEs in Padang, Indonesia. The use of a pilot study is essential for testing the validity and reliability of measurement instruments before proceeding to a full-scale survey (Abdurrahman et al., 2011; Bougie & Sekaran, 2019).

3.2. Respondent Profile

Respondents in this pilot study were drawn from selected creative SMEs operating in Padang, West Sumatra, particularly those engaged in food & beverage, fashion, and craft industries. These SMEs are registered with local business networks and possess the following characteristics: operated for at least two years, employ fewer than 20 full-time. Most respondents are founders or owner-managers actively involved in the strategic and operational decisions of their enterprises. The pilot study involved a total of 32 creative SMEs in Padang as valid respondents. While modest in size, the sample meets the minimum requirement for pilot testing in PLS-SEM, which prioritizes indicator reliability and preliminary model fit before full-scale hypothesis testing (Ghozali, 2016; Hair et al., 2017 in Ghozali & Latan, 2012).

The pilot study involved 32 creative SME owners operating across various sub-sectors such as culinary, fashion, craft, and personal care in Padang, West Sumatra. The respondents were predominantly female (96.9%), with only one male respondent recorded. This gender composition reflects the significant role of women entrepreneurs in the local creative economy, particularly in home-based and small-scale ventures. In terms of age distribution, most participants were within the 30–50 age range, with the youngest respondent aged 24 and the oldest aged 69. This suggests a mix of both emerging and seasoned entrepreneurs, offering diverse perspectives on strategic orientation and business behaviour.

Regarding educational background, most respondents had completed secondary education (SMA or SMK), accounting for over 60% of the sample. Notably, seven participants (21.9%) held bachelor's degrees, while others reported education levels ranging from elementary school (SD) to vocational diplomas (D3 and PGA). This variation is consistent with the educational diversity typically observed among micro and small business operators in Indonesia. From a business perspective, most SMEs were relatively young: over 50% of the businesses were established after 2018, with a few longstanding enterprises dating back to the early 2000s. The number of employees varied from zero to two full-time workers, illustrating the micro-scale nature of the enterprises. Similarly, most businesses reported sales of one transaction per day or less, confirming their small operational scope.

In terms of entrepreneurial role, nearly all respondents identified themselves as either founders or owner-managers, actively engaged in both strategic decision-making and daily operations. This confirms the appropriateness of these individuals as key informants for evaluating constructs such as customer orientation, innovation behaviour, and network embeddedness. Finally, most businesses employed a single-business model structure, typically characterized by direct-to-consumer distribution through offline or online channels. A few respondents (less than 10%) reported more diversified or hybrid models, involving multiple product lines or distribution platforms.

3.3. Data Collection Instruments

This study employed a structured questionnaire to measure the construct of Strategic Orientation, which consists of three core dimensions: Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO). The questionnaire was administered to owners or managers of creative SMEs, who serve as the key decision-makers and are thus well-positioned to provide reliable assessments of their firms' strategic behaviours. All items were adapted from established and validated scales developed by Jeong et al. (2006), Hurley and Hult (1998), Omar et al. (2022), Anantadjaya et al. (2023), and Correia et

al. (2020). Each item was rated using a 5-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). To ensure content validity and contextual relevance, the instrument underwent a careful translation and adaptation process, followed by a pilot test with selected SME practitioners. The pilot test aimed to evaluate item clarity, internal consistency (with Cronbach's Alpha > 0.70), and construct validity prior to full-scale analysis.

Examples of items for each dimension include: *"Our company actively understands the needs and desires of customers"* (CO), *"We are open to adopting new technologies in our business processes"* (IO), and *"Our company actively collaborates with various external parties"* (NO). Each dimension was represented by four reflective indicators that capture the behavioural expressions of strategic orientation relevant to the context of Indonesian creative micro and small enterprises.

4. FINDINGS AND DISCUSSION

4.1. Descriptive Statistics

The descriptive analysis of strategic orientation constructs—Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—was conducted to provide an initial overview of the respondents' strategic behaviour. As presented in Table 1, the mean values for all indicators ranged from 3.81 to 4.44, indicating that the SMEs in this pilot study generally perceived themselves as strategically oriented. The highest average was recorded on CO4 (understanding customer needs) with a mean of 4.44, suggesting strong customer attentiveness, while IO2 (technological novelty) reported a relatively lower mean of 3.81, indicating potential gaps in technological innovation efforts.

Table 1: Descriptive Statistics for Customer Orientation

Variable	Indicator	Code	Mean	Median	Mode	Std. Deviation	Variance
Customer Orientation	Our product ideas are derived from market needs	CO1	4.09	4.00	4	0.884	0.782
	Our products provide added value to customers	CO2	4.43	4.00	4	0.545	0.289
	We develop products that match customer needs	CO3	4.48	4.00	4	0.505	0.255
	We actively seek market information to understand customer needs	CO4	4.42	4.00	5	0.622	0.387

The average scores for all indicators under Customer Orientation are relatively high (all means above 4), suggesting that respondents generally agreed or strongly agreed with the statements. The highest mean score was recorded for CO3 (4.48), indicating that most SMEs reported aligning their products with customer needs. The consistent median value of 4 across all indicators shows that the central tendency of responses lies in the "agree" category, and there is no significant deviation pulling the values downward. The mode values, mostly at 4 (and 5 for CO4), also reflect that "agree" and "strongly agree" were the most frequent choices. The low standard deviations and variances across all indicators indicate strong consistency among responses, meaning that the perception of Customer Orientation was largely shared among participants.

Table 2: Descriptive Statistics for Innovation Orientation

Variable	Indicator	Code	Mean	Median	Mode	Std. Deviation	Variance
Innovation Orientation	We actively seek innovative ideas for product and service improvement	IO1	4.61	5.00	5	0.493	0.243
	We continuously refine and develop our portfolio of products and services	IO2	4.50	4.50	4	0.506	0.256
	We are able to quickly implement innovations across our organization	IO3	3.98	4.00	4	0.590	0.348

All employees are encouraged to participate in developing new product and service ideas	IO4	4.00	4.00	5	0.940	0.884
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The descriptive results show that Innovation Orientation indicators also received high mean scores (mostly above 4), indicating agreement or strong agreement with innovation-related statements. The highest mean was found in IO1 (4.61), highlighting that SME owners are actively seeking innovative ideas for product and service renewal. Median values mostly at 4 support the idea that respondents leaned toward agreement, with little skewness in response distribution. Mode values being either 4 or 5 further reinforce this pattern. Although IO3 and IO4 have slightly lower mean scores and higher standard deviations, overall response consistency remains acceptable. These patterns suggest a general recognition of innovation's value, even though actual implementation may vary among firms.

Table 3: Descriptive Statistics for Network Orientation

Variable	Indicator	Code	Mean	Median	Mode	Std. Deviation	Variance
Network Orientation	Our partnerships are mutually beneficial	NO1	4.27	4.00	4	0.624	0.389
	Our relationships with partners are strong	NO2	4.07	4.00	4	0.759	0.577
	There is information exchange among entrepreneurs and with business partners	NO3	4.02	4.00	4	0.762	0.581
	There is an exchange of goods/materials between entrepreneurs and business partners	NO4	3.30	3.00	5	0.878	0.771
	We utilize tangible resources (e.g., human resources, finances) from external parties	NO5	3.82	4.00	4	0.870	0.757

Network Orientation indicators also reflect relatively high mean scores, though two items (NO4 and NO5) fall slightly below the threshold of 4. The highest mean was observed in NO1 (4.27), suggesting strong and beneficial partnerships among SMEs and their collaborators. Median values were predominantly at 4, indicating a central tendency of agreement. Notably, NO4 had a median of 3, suggesting a more neutral stance on the exchange of goods/materials. Interestingly, the mode for NO4 was 5, which—despite the lower mean and median—indicates that a specific subset of respondents strongly agreed with the statement, while others did not, creating variability. This is supported by the higher standard deviations and variances in NO4 and NO5, suggesting more diverse views among respondents concerning tangible exchanges and resource sharing. Meanwhile, NO1 through NO3 showed greater consistency in responses, reinforcing the notion that informational and relational aspects of networking are more commonly practiced than material collaboration.

4.2. Measurement Model Evaluation

To assess the psychometric properties of the constructs, the measurement model was evaluated using the reflective indicator model in PLS-SEM. This includes analyses of convergent validity, internal consistency reliability, and discriminant validity.

Table 2: Convergent validity and Internal Consistency Reliability

Construct	Item code	Outer loadings	AVE	Cronbach's alpha	CR (rho_a)	CR (rho_c)
First Order Construct						
CO	CO2	0.802	0.641	0.72	0.726	0.843
	CO3	0.764				
	CO4	0.834				
IO	IO1	0.851	0.626	0.685	0.726	0.83
	IO2	0.898				
	IO3	0.591				

NO	NO1	0.955	0.87	0.854	0.928	0.93
	NO2	0.909				
Second Order Construct						
SO	CO	0.859	0.658	0.733	0.766	0.851
	IO	0.895				
	NO	0.661				

The measurement model demonstrates acceptable levels of convergent validity and internal consistency reliability for both first-order and second-order constructs. Convergent validity is indicated when the outer loadings of each indicator exceed 0.70 and the Average Variance Extracted (AVE) is greater than 0.50. For the Customer Orientation (CO) construct, all three indicators—CO2, CO3, and CO4—exhibit strong loadings ranging from 0.764 to 0.834, with an AVE of 0.641. This confirms that the items are well-correlated and sufficiently capture the underlying construct. Similarly, Innovation Orientation (IO) demonstrates acceptable convergent validity, with IO1 and IO2 having strong loadings above 0.85. Although IO3 has a slightly lower loading (0.591), it is retained due to its theoretical relevance and the overall AVE of 0.626, which remains above the recommended threshold. The Network Orientation (NO) construct shows particularly strong convergent validity, as both items NO1 and NO2 exhibit very high loadings (0.955 and 0.909, respectively) and the AVE reaches an excellent value of 0.870.

For the second-order construct of Strategic Orientation (SO), the three first-order dimensions (CO, IO, and NO) load significantly onto the higher-order factor, with loadings ranging from 0.661 to 0.895. The AVE of the second-order construct is 0.658, indicating that more than half of the variance in the indicators is explained by the latent construct, thereby confirming convergent validity at the higher-order level. In terms of internal consistency or reliability, all constructs meet the recommended thresholds. Cronbach's Alpha values range from 0.685 (IO) to 0.854 (NO), and Composite Reliability (CR) values—both rho_A and rho_C—consistently exceed 0.80. While the alpha value for IO is slightly below 0.70, it is still considered acceptable in exploratory research contexts, especially when the composite reliability is strong (CR = 0.83). The second-order construct SO also shows good internal consistency, with Cronbach's Alpha at 0.733 and CR at 0.851.

In summary, the measurement model provides robust evidence of convergent validity and internal consistency. All constructs are reliably measured, and the use of a second-order factor structure for Strategic Orientation is statistically justified and appropriate for further analysis within the structural model.

Table 3 Discriminant Validity: Heterotrait-Monotrait Ratio (HTMT)

	CO	IO	NO	SO
First Order Construct				
CO				
IO	0.975			
NO	0.388	0.536		
SO	1.106	1.179	0.79	
Second Order Construct				
LV Scores -SO				1.281

Discriminant validity was assessed using the Heterotrait–Monotrait Ratio of Correlations (HTMT), which is a more robust method than the Fornell-Larcker criterion in detecting issues of construct distinctiveness. A commonly accepted threshold is that HTMT values should be below 0.85 or 0.90 for conceptually distinct constructs (Henseler et al., 2015).

For the first-order constructs, the HTMT value between Customer Orientation (CO) and Innovation Orientation (IO) is 0.975, slightly exceeding the conservative threshold of 0.90. This suggests a high level of correlation between these two constructs, potentially due to overlapping conceptual domains or shared variance in small enterprise behaviour. However, considering this is a pilot study, such a result

may reflect context-specific patterns rather than a structural flaw. In contrast, the HTMT values between CO and NO (0.388) and between IO and NO (0.536) fall well below the threshold, indicating adequate discriminant validity between these constructs. These results suggest that Network Orientation is perceived as a relatively distinct strategic domain by the respondents.

The HTMT values for the second-order construct (Strategic Orientation – SO) further support the structure of the model. The correlations between SO and its dimensions—CO (1.106), IO (1.179), and NO (0.790)—reflect the formative relationship between the second-order and first-order constructs. The values above 1 for CO and IO are statistically possible in HTMT due to sampling variation, especially in smaller samples or when second-order modelling is applied. However, the relatively high HTMT values may also imply that further scale refinement or theoretical clarification is needed in future studies to reduce redundancy between CO and IO items. Lastly, the HTMT value of 1.281 for the latent variable scores of SO exceeds the ideal threshold and suggests multicollinearity or conceptual overlap in the second-order model, which must be monitored closely during the main study.

In conclusion, while discriminant validity is acceptable for most constructs, the overlap between Customer and Innovation Orientations requires cautious interpretation. These insights reinforce the importance of refining item wording and enhancing theoretical distinctiveness in future stages of model development.

First-Order Factor Analysis: Structural Model Evaluation

The figure illustrates the path diagram of the first-order factor structure of the Strategic Orientation (SO) construct, which consists of three dimensions: Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO). Each of these dimensions is modelled as a latent variable measured by multiple reflective indicators.

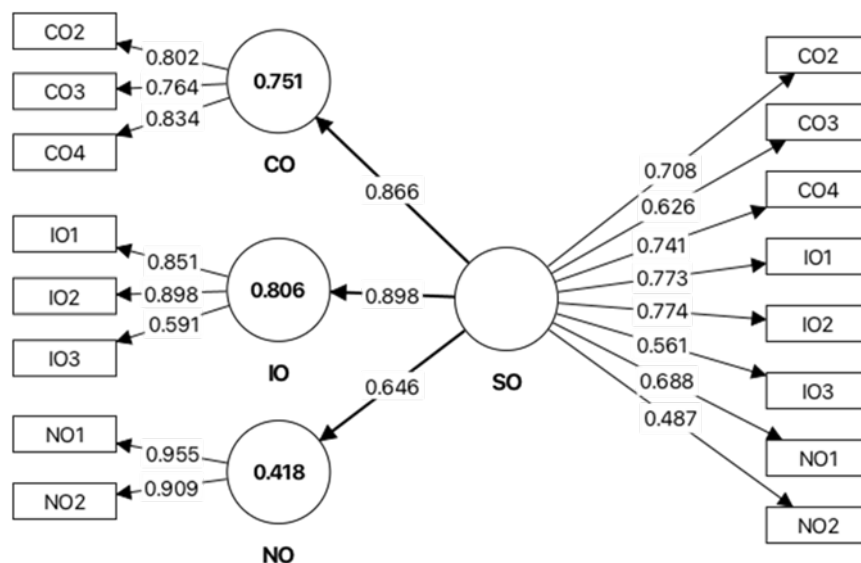


Fig 2: Initial PLS-Path Model First Order

The first-order factor analysis of the strategic orientation construct demonstrates strong measurement quality for its three underlying dimensions: Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO). Each dimension is modelled as a reflective latent variable with multiple indicators, and the analysis confirms that the indicators effectively represent their respective constructs.

For Customer Orientation, three indicators—CO2, CO3, and CO4—show outer loadings of 0.802, 0.764, and 0.834, respectively, all of which exceed the commonly accepted threshold of 0.70. This confirms satisfactory indicator reliability. The construct's coefficient of determination (R^2) is 0.751, indicating that 75.1% of the variance in CO is explained by its observed indicators. Additionally, cross-loadings affirm discriminant validity, as CO indicators load highest on their intended factor compared to other constructs.

Innovation Orientation also displays robust measurement quality. Indicators IO1 and IO2 have high loadings of 0.851 and 0.898, while IO3 presents a slightly lower loading at 0.591. Although IO3 falls below the ideal threshold, it may still be retained for theoretical relevance, particularly in exploratory studies where some degree of flexibility is allowed (Hair et al., 2019). Although IO3 has a relatively low loading (0.591), it was retained for this pilot study due to its theoretical significance and the need to preserve the construct's domain coverage. Following Hair et al. (2019), such indicators may be kept in preliminary studies for further refinement. The construct's R^2 value is 0.806, which is notably high and suggests that IO is strongly reflected by its indicators. The cross-loadings reinforce adequate convergent and discriminant validity.

For Network Orientation, the two indicators—NO1 and NO2—exhibit exceptionally high loadings of 0.955 and 0.909, confirming excellent reliability. However, the R^2 value for NO is 0.418, which, although acceptable, is lower than the other two constructs. This implies that, despite the strength of its indicators, NO as a latent variable contributes relatively less to the overall structural model in this context. The variation may reflect a broader range of experiences among SMEs regarding inter-firm collaboration and resource sharing.

In summary, all three first-order constructs demonstrate reliable and valid measurement properties. The loadings, R^2 values, and cross-loading patterns support the reflective nature of the model and justify the use of CO, IO, and NO as valid components of the higher-order strategic orientation construct. These results offer a solid foundation for advancing to second-order analysis and structural path modelling in the broader framework of competitive advantage research.

Second-Order Construct of Strategic Orientation

The initial PLS-Path model in the second-order construct evaluation illustrates the hierarchical structure of Strategic Orientation (SO), modelled reflectively by three first-order latent variables: Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO). Each of these dimensions is represented by latent variable (LV) scores derived from previously validated first-order factor models.

In this model, the outer weights (or loadings) connecting the first-order constructs to the second-order construct demonstrate substantial contributions. Specifically, Customer Orientation (CO) has a loading of 0.859, Innovation Orientation (IO) contributes the highest with 0.895, and Network Orientation (NO) shows a lower but still acceptable loading of 0.661. These results indicate that all three dimensions are positively and significantly related to the higher-order construct, supporting the conceptualization of SO as a multidimensional construct composed of customer focus, innovation capability, and network collaboration.

The R^2 value for the second-order construct is 1.000, which is expected given the formative-reflective type modelling where the second-order latent variable is entirely formed by the three underlying dimensions. The model thereby confirms the structural integrity of the reflective-reflective specification (type I hierarchical component model), where each lower-order construct is itself reflective and contributes as a dimension to the higher-order strategic orientation.

The outer loadings of the individual indicators—shown to the right—remain consistent with those in the first-order model, reaffirming indicator reliability and model stability after second-order integration. These include strong loadings for CO2 to CO4, IO1 to IO3, and NO1 to NO2, most of which remain above the 0.70 benchmark, with some exception (e.g., IO3 and NO2), which are acceptable in exploratory research.

In summary, the second-order model provides a robust structure for the strategic orientation construct. It captures the multidimensional nature of strategic posture in small businesses, validating the inclusion of CO, IO, and NO as reflective components. These findings justify further testing of structural relationships between strategic orientation and potential outcome variables, such as competitive advantage or firm performance, in the main study.

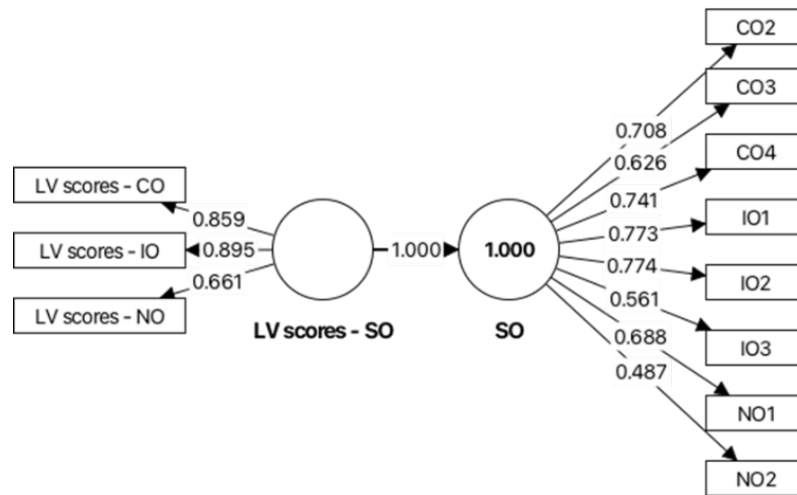


Fig 3: Initial PLS-Path Model Second Order

5. DISCUSSION

The findings from this pilot study yield valuable insights into the psychometric structure and empirical relevance of *Strategic Orientation (SO)* as a second-order construct in the context of Indonesian creative SMEs. The results affirm the multidimensionality of SO, comprising Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO), all of which demonstrate satisfactory levels of convergent validity, internal consistency, and discriminant validity. These results strengthen the argument for employing a higher-order conceptualization of strategic behaviour in SMEs, consistent with prior works by Jeong et al. (2006), Yang et al. (2022), and Correia et al. (2020).

Customer Orientation (CO) emerged as the most dominant and robust dimension in the measurement model. The indicators CO2 ("Our products provide added value to customers") and CO4 ("We actively seek market information to understand customer needs") scored high in both outer loadings (0.802 and 0.834, respectively) and descriptive means (4.43 and 4.42), reflecting a strong strategic tendency among SMEs to align offerings with evolving customer demands. This is consistent with the argument by Afifah et al. (2022b) and Lukas & Ferrell (2000) that CO plays a crucial role in enhancing competitive advantage by fostering customer loyalty and value co-creation, especially in dynamic market environments.

Innovation Orientation (IO) also demonstrated substantial psychometric validity, with loadings above 0.85 for IO1 and IO2, and acceptable reliability (CR = 0.83). However, the relatively lower loading for IO3 (0.591) and lower mean scores for innovation-related items suggest a disconnect between innovation awareness and execution capacity. This reflects previous findings by Farooq et al. (2021) and Norris & Ciesielska (2019) who identified resource constraints—such as limited technological infrastructure and managerial capability—as key barriers for innovation in SMEs. The descriptive result that IO3 ("We are able to quickly implement innovations") had the lowest mean score among IO items (3.98) confirms the notion of an "innovation implementation lag," a challenge also documented by Afifah et al. (2023) in post-pandemic SME recovery contexts.

Network Orientation (NO), while less dominant than CO and IO in terms of structural loading (0.661), still contributes significantly to the SO construct. The highest loading for NO1 ("Our partnerships are mutually beneficial") at 0.955 and its high mean (4.27) underscore the value of relational strategies in small business ecosystems. However, the greater variability observed in NO4 and NO5—evident from higher standard deviations and lower means—highlights that tangible forms of collaboration (e.g., material exchanges or shared financial resources) are not as universally embraced or practiced as informational or relational linkages. Although NO demonstrates high item reliability (e.g., NO1 = 0.955 and NO2 = 0.909), its lower loading to the second-order SO construct (0.661) may reflect the heterogeneity of networking practices among SMEs. This suggests that while respondents agree on the benefits of strong partnerships, network strategies are less systematically integrated compared to customer and innovation orientations, especially among micro-scale creative SMEs with limited external

collaboration. This heterogeneity supports the argument by Zhang & Zhang (2022) and Anantadjaya et al. (2023) that while social capital remains a critical enabler of business agility, its manifestation can vary across firms depending on cultural, contextual, and institutional factors.

From a theoretical perspective, the validation of SO as a second-order reflective-reflective construct supports a more nuanced understanding of SME strategy. Rather than treating strategic behaviour as a singular domain, this multidimensional approach reveals how SMEs may deploy various configurations of customer engagement, innovation processes, and network building in response to environmental pressures (Teece, 2007; Yang et al., 2022). The R^2 value of 1.000 in the second-order model confirms that the higher-order SO construct is fully explained by the underlying dimensions, affirming the conceptual integrity of this structure. Yet, the study also uncovers critical challenges. Notably, the HTMT values between CO and IO exceed the conservative threshold of 0.90, indicating conceptual overlap or item redundancy between these two dimensions. The high correlations between CO and IO (HTMT = 0.975) indicate conceptual complementarity, where customer responsiveness and innovation efforts are closely intertwined. While this synergy is advantageous for competitive advantage, it also highlights the potential overlap in measurement that will be addressed in the full-scale study through refinement of the survey items. This requires further theoretical clarification and scale refinement to ensure construct distinctiveness in future studies. Additionally, the limited sample size and pilot nature of this study restrict the generalizability of the findings across the broader creative SME sector in Indonesia.

Practically, the validated SO construct offers a diagnostic tool for assessing strategic capabilities in SMEs. It can serve as a foundation for testing causal relationships with performance outcomes in the main study, such as competitive advantage, innovation performance, or firm resilience. Policymakers and business support institutions may also leverage these findings to design capacity-building programs that simultaneously nurture customer responsiveness, innovation agility, and network embeddedness. In conclusion, this pilot study substantiates the multidimensional structure and empirical validity of Strategic Orientation among creative SMEs in Padang. It reveals both the strengths and developmental gaps in strategic posture and provides a methodological basis for more comprehensive modelling in the subsequent main research phase.

6. CONCLUSION

This pilot study aimed to validate the construct of Strategic Orientation (SO)—comprising Customer Orientation (CO), Innovation Orientation (IO), and Network Orientation (NO)—among creative SMEs in Padang, Indonesia. Employing a reflective second-order modelling approach within the PLS-SEM framework, the study confirms that all three dimensions demonstrate strong internal consistency, convergent validity, and discriminant validity. These psychometric properties indicate that the measurement instrument is both statistically robust and contextually suited for assessing strategic behaviour in small business settings.

From a theoretical standpoint, the findings support the conceptualization of SO as a multidimensional construct that captures the diverse strategic responses of SMEs operating in dynamic and resource-constrained environments. The reflective structure—validated across three interrelated orientations—reinforces the integrative view of SME strategy that blends customer focus, innovation capacity, and network embeddedness (Jeong et al., 2006; Yang et al., 2022; Zhang & Zhang, 2022). The empirical support for this model in an Indonesian context contributes to the growing literature on strategic management in emerging economies. Practically, the validated SO instrument offers a reliable diagnostic framework for evaluating strategic posture among micro and small enterprises. It holds promise for informing entrepreneurship training, SME advisory services, and policy interventions—especially in identifying capability gaps in innovation and inter-firm collaboration. By doing so, business development efforts can shift from compliance-oriented assistance to strategic capacity-building tailored to local entrepreneurial realities.

To translate these findings into actionable strategies, several practical interventions can be considered to strengthen the strategic orientation of creative SMEs. For instance, innovation grants and product

development subsidies from local governments or private incubators can help SMEs overcome financial constraints in pursuing innovation-oriented strategies. Similarly, network incubation programs, business clusters, and collaborative mentoring platforms can be established to enhance relational capital, knowledge exchange, and market access—directly supporting network orientation.

Furthermore, the role of digital transformation is increasingly critical in reinforcing all three dimensions of SO. Digital tools and platforms enable SMEs to conduct more precise customer data analytics (enhancing CO), adopt digital R&D and online prototyping (supporting IO), and leverage virtual networking and e-marketplace collaborations (strengthening NO). These interventions not only complement the validated SO construct but also align with current policy priorities for SME competitiveness in the digital era. Looking ahead, this study sets the foundation for a full-scale empirical investigation involving a larger and more heterogeneous sample of creative SMEs. The subsequent research phase will test the causal relationships between Strategic Orientation and Competitive Advantage, incorporating potential mediators such as digital leadership, strategic agility, and market performance. The overarching goal is to establish an evidence-based model that can inform SME transformation strategies and contribute to more inclusive and sustainable economic development at the regional level.

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Assessing Tourist Satisfaction at Malacca's UNESCO World Heritage Sites

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ABSTRACT

Tourist satisfaction is vital for sustaining heritage tourism at UNESCO-recognized sites such as Malacca, Malaysia. This study investigates the influence of five experiential dimensions—emotional, recreational, cultural, entertainment, and perceived service efficiency on visitor satisfaction. A quantitative survey of 318 tourists was conducted using structured questionnaires, with data analyzed via descriptive statistics, multiple regression, and correlation tests in SPSS. Results show high mean scores across all dimensions, with cultural experience rated highest. Regression analysis indicates that emotional, cultural, recreational, and efficiency dimensions significantly predict satisfaction, collectively explaining 70.1% of its variance, while entertainment, though positively perceived, is not significant. Findings suggest that authentic, culturally immersive, emotionally engaging, and efficiently managed experiences are key drivers of satisfaction. These insights highlight the importance of enhancing heritage storytelling, cultural programming, and operational efficiency to strengthen destination image, encourage repeat visits, and promote sustainable heritage tourism in Malacca.

Keywords: Tourist satisfaction, heritage tourism, cultural heritage, travel experience

1. INTRODUCTION

Analyzing tourism-related economic indicators is essential to comprehending Malaysia's overall economic performance. According to Arumugam and Abd Majid (2023), nations with larger tourist arrivals generally experience an increase in revenue, which is crucial for the advancement of the country. For Malaysia, where UNESCO-recognized sites such as Melaka and George Town, along with other cultural heritage assets, are essential in attracting foreign tourists, this observation remains especially pertinent. The expansion of tourism offers several advantages, including increasing revenue, sustaining local jobs, and boosting demand for domestic products and services, all of which enhance overall economic activity.

Shatnawi et al. (2023) investigated the impact of electronic word-of-mouth, destination image, and visitor satisfaction on the intention to return to the Petra UNESCO World Heritage Site in Jordan. Their study found that visitor satisfaction was positively influenced by destination image; however, intention to return was not directly affected. Rather, the main element influencing return visits was visitor satisfaction. Applying these results to the Malaysian context, it can be argued that more visitors—particularly to well-maintained and enjoyable heritage sites—may lead to greater satisfaction levels, which may in turn motivate repeat visits. This underscores the importance of providing high-quality experiences at historic sites to support sustained tourism growth and economic advancement. By the end of September 2024, Melaka had received about 10 million visitors, exceeding its initial target of 8.7 million. This achievement demonstrated the effectiveness of the Visit Melaka Year 2024 (TMM2024) campaign. Approximately 80% of these tourists were domestic, according to Chief Minister Dato' Seri Ab Rauf Yusoh, reflecting a strong demand for travel within the country. He also emphasized that, in anticipation of Melaka hosting World Tourism Day (WTD) in 2025, the state administration was making a concerted effort to attract more foreign visitors. This global event, supported by UNESCO's recognition

of Melaka's rich historical and cultural heritage, is expected to further enhance international visibility and promote sustainable tourism growth (Bernama News, 2024).

Although historical tourism at the Malacca UNESCO World Heritage Sites is gaining increasing popularity, limited research has examined how specific dimensions of travel experience—namely emotional, recreational, cultural, and entertainment experiences, along with perceived service efficiency—influence overall visitor satisfaction. Existing studies often focus solely on direct satisfaction outcomes, overlooking the complex interrelationships between these experiential factors and destination image. Given the city's growing tourist population, it is essential to understand how these elements can be managed to enhance visitor satisfaction without compromising the authenticity of Malacca's cultural heritage. This study aims to address this gap by investigating the individual and collective effects of emotional, recreational, cultural, entertainment, and efficiency-related experiences on visitor satisfaction in Malacca.

1.1. Research Objective

- i. To quantify the levels of emotional, recreational, cultural, and entertainment experiences, as well as perceived service efficiency, among visitors to Malacca's world heritage sites within the study period.
- ii. To examine the impact of emotional, recreational, cultural and entertainment experiences, along with service efficiency, on overall satisfaction among heritage tourists.
- iii. To determine which experiential dimensions serve as the most influential predictors of satisfaction among visitors to Malacca's world heritage sites.

1.2. Research Question

- i. What are the levels of emotional, recreational, cultural, and entertainment experiences, as well as perceived service efficiency, among visitors to Malacca's world heritage sites?
- ii. To what extent do emotional, recreational, cultural, and entertainment experiences, together with perceived service efficiency, influence overall visitor satisfaction?
- iii. Which experiential dimensions are the most significant predictors of visitor satisfaction at Malacca's world heritage sites?

1.3. Conceptual Framework

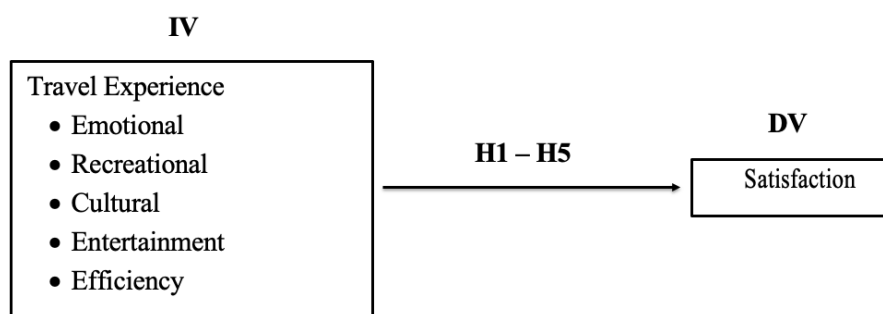


Fig. 1: Conceptual framework of the study

2. LITERATURE REVIEW

2.1. Tourist Satisfaction in Heritage Tourism

Its historical landmarks, cultural diversity, and recognition as a UNESCO World Heritage Site make it highly attractive to tourists. However, increasing visitor numbers have raised concerns about preserving authenticity amid modern tourism pressures. Thus, understanding how emotional, recreational and cultural experiences interact with destination image is essential for sustainable tourism planning and long-term tourist satisfaction in Malacca (Hanafiah et al., 2020). Acharya et al. (2022) state that two of the most crucial metrics for assessing the effectiveness and sustainability of tourist destinations are destination satisfaction and intention to return. The general emotional reaction of visitors during or

after their trip is referred to as destination satisfaction, and it can be influenced by a number of factors, including infrastructure, services, culture, and the environment. This is corroborated by research by Lee et al. (2020) and Pai et al. (2020), which found that visitor satisfaction with specific destination aspects greatly influences total visitor satisfaction, which is strongly associated with loyalty and positive behavioral outcomes such as word-of-mouth advertising. A key element of destination loyalty is revisit intention, which is the possibility that a visitor will return to a particular location. Overall satisfaction is a powerful indicator of intention to return, according to Humagain and Singleton (2021), underscoring the need to efficiently manage visitor experiences. All of these results support Acharya et al.'s (2022) conclusion that improving visitor satisfaction and intention to return is crucial for the long-term viability of historic destinations.

2.2. Travel Experience in Satisfaction

De Vos et al. (2021) argue that the overall level of travel satisfaction is significantly influenced by the travel experience. Their research indicates that the method of transportation chosen directly impacts satisfaction both during and after the trip, in addition to reflecting personal views and objectives. A pleasant travel experience can reinforce enjoyment and influence future travel behavior, according to the Travel Mode Choice Cycle (TMCC), which was developed in the study and links important psychological constructs: attitude, desire, intention, behavior, and satisfaction. This implies that improving the quality of travel experiences can lead to higher levels of satisfaction, which is crucial for destination perception and visitor loyalty. In the present study, travel experience is conceptualized through five interrelated dimensions—emotional, recreational, cultural, entertainment, and efficiency—each of which will be examined for its influence on visitor satisfaction in Malacca's heritage tourism.

2.3. Emotional Experience

Emotional satisfaction is derived from feelings of awe, nostalgia, and pride when engaging with historical sites and cultural storytelling (Hosny, 2022). Volo (2020) calls for a deeper understanding of emotions in tourism and introduces the concept of emotion-oriented tourism design, in which experiences are intentionally crafted to elicit emotional responses, thereby increasing tourist satisfaction and strengthening a destination's appeal. Volo's work also positions tourism as a valuable field for advancing broader emotion theory. He asserts that tourists' emotions play a crucial role in shaping their cognitive evaluations and behavioral responses, even though they are frequently fleeting and rooted in individuals' biological makeup, personal experiences, and mental associations.

2.4. Recreational Experience

According to N. I. Cetin et al. (2021), recreational experience plays a significant role in shaping travel behavior, particularly in urban natural settings like the Ömerli Catchment in Istanbul. Using the random utility travel-cost method, the study revealed that visitors' recreational habits, satisfaction, and experiences with nature were key factors influencing their decision to visit. The findings highlight that recreational experiences not only enhance visitor satisfaction but also generate considerable value, as shown by the consumer surplus exceeding average travel costs. This underscores the importance of integrating recreational experiences into tourism planning, especially in urban areas where green spaces are limited.

2.5. Cultural Experience

Creating memorable travel experiences requires an understanding of the history, customs, and culture of the destination. Through cuisine, art, and rituals, tourists in Malacca immerse themselves in a distinctive cultural fusion that heightens their appreciation and sense of fulfillment. Tourist perceptions are greatly influenced by cultural heritage, both tangible (such as A Famosa and St. Paul's Hill) and intangible (such as customs and food). In historic tourism, genuine cultural encounters are important sources of satisfaction. "Cultural experiences play a vital role in shaping tourists' impressions and satisfaction," according to Richards et al. (2020). Additionally, these encounters arouse feelings of

wonder and admiration, which enhance visitors' understanding of the locals and their values (Su et al., 2020).

2.6. Entertainment

According to Hosany and X. Chen et al. (2020), entertainment plays a crucial role in shaping both the cognitive and emotional dimensions of a tourist's experience. Cultural performances, festivals, and local events not only enhance a destination's uniqueness but also leave lasting impressions on visitors. Events such as music festivals, theatre productions, and traditional celebrations can evoke positive emotions like joy, excitement, and relaxation. These emotional responses are key in creating meaningful travel memories and increasing overall tourist satisfaction. Therefore, entertainment is not merely an add-on but a vital component of the destination experience, contributing significantly to how visitors perceive and enjoy the place.

2.7. Efficiency

According to Zhang et al. (2021), efficiency is a key element in shaping the transportation component of a destination's image. In their study of Beijing, they found that while tourism authorities projected an image of modernity and advanced infrastructure, international tourists perceived the city's transportation as fast, efficient, and convenient. This alignment between projected and perceived images underscores the importance of efficiency in forming a positive destination image. Their findings suggest that emphasizing efficient transportation systems can enhance tourists' overall perception and satisfaction with a destination.

3. RESEARCH METHODOLOGY

This study adopts a quantitative research methodology to investigate the factors influencing tourist satisfaction at Malacca UNESCO World Heritage Sites. The primary objective is to explore how emotional, cultural, and recreational experiences together with destination image affect overall satisfaction, with the goal of informing sustainable heritage tourism strategies.

3.1. Research Design

This study adopts a quantitative research design to examine the relationship between tourist experiences and satisfaction at the Malacca UNESCO World Heritage Site. Data was collected through an online survey using Google Forms, distributed via WhatsApp, Facebook, and Instagram to individuals who had previously visited the site. The questionnaire consisted of seven sections: demographics, emotional experience, recreational experience, cultural experience, entertainment, efficiency, and overall satisfaction. Except for the demographic section, all responses were measured using a five-point Likert scale. Primary data was obtained directly from respondents through structured questionnaires, while secondary data was gathered from academic sources and government reports to support the analysis. The survey items were designed to ensure clarity and relevance. Data analysis was conducted using SPSS, applying descriptive and inferential statistics to summarize findings and test hypotheses.

3.2. Research Framework

The research framework provides a structured approach to examine the relationships between tourist experiences and satisfaction. It defines the key variables and guides the data collection and analysis process. Primary data was obtained through structured questionnaires distributed to tourists visiting Malacca, allowing direct insight into their experiences and perceptions.

3.3. Data Collection Method

Using non-probability sampling, a self-administered on-site survey was carried out among both local and foreign visitors to the Malacca UNESCO World Heritage Site at the busiest time of year (March–May).

Following data screening, 318 valid replies were kept from the 322 questionnaires that were delivered. In order to ensure accuracy, the survey was developed in English and double-translated into Malay. SPSS was used for data analysis, which included reliability testing, demographic profiling, and inferential statistical methods to look at correlations between important variables.

3.4. Instrument Development and Validation

The research instrument used in this study was a structured questionnaire designed to collect reliable and relevant data aligned with the research objectives. To ensure validity and reliability, the instrument underwent expert review and a pilot test, as suggested by Ufitimfura and Amolo (2025). This process helped refine ambiguous items and ensure internal consistency. The questionnaire was designed to be clear, unbiased, and easy to use, with straightforward instructions to guide respondents. Its content was directly aligned with the study's aims to accurately measure tourist experiences and satisfaction in Malacca.

3.5. Sampling

This study targets all tourists who have visited the Malacca UNESCO World Heritage Site. A sample size of 384 respondents was determined using Krejcie and Morgan's (1970) table, ensuring a 95% confidence level with a 5% margin of error. This slightly larger sample allows for greater reliability by accounting for potential non-responses. A random sampling method was used to give all tourists an equal chance of selection, minimizing bias and enhancing the representativeness of the data for generalization to the wider tourist population.

4. RESULT

Table 1: Descriptive Analysis of Demographic Profile

Demographic	Variables	Frequency (n)	Percent (%)
Age	Below 18	19	5.9
	18 - 24	191	59.3
	25-34	71	22
	35-44	17	5.3
	Above 45	24	7.5
Gender	Male	97	30.1
	Female	225	69.9
Country Region	Malaysian	319	99.1
	Singapore	2	0.6
	Indonesia	1	0.3
Frequency of Visit	First Time	105	32.6
	2 - 5 Time	136	42.2
	More 5 time	81	25.2

A total of 318 respondents participated in this study. Although this number is slightly below the 384 recommended by Krejcie and Morgan (1970) for a representative sample, it still meets Hair et al.'s (2011) guideline, which suggests that the sample size should be 5–10 times the number of variables. With 22 variables, the required range is 110–220, making 318 a sufficient size for analysis. The majority of respondents were aged 18–24 (59.3%), followed by those aged 25–34 (22%). Smaller proportions were aged below 18 (5.9%), 35–44 (5.3%), and above 45 (7.5%), indicating a predominantly young respondent base. In terms of gender, 69.9% were female, while 30.1% were male. Most participants were Malaysian (99.1%), with very few from Singapore (0.6%) and Indonesia (0.3%). Regarding frequency of visits, 42.2% had visited 2–5 times, 32.6% were first-time visitors, and 25.2% had visited more than 5 times, indicating a balanced mix of new and returning respondents.

Table 2: Reliability Statistic

Cronbach's Alpha	N of Items
.952	24

To ensure internal consistency and reliability of the survey instrument, a reliability analysis was conducted on all 24 questionnaire items, using 318 valid responses with no exclusions. The analysis produced a Cronbach's Alpha of 0.952, indicating excellent reliability ($\alpha > 0.9$). This high value demonstrates strong inter-item correlation and confirms that the items consistently measure the intended constructs. The result suggests that the instrument is statistically sound and suitable for examining variables such as travel experience, destination image, and tourist satisfaction. The high internal consistency also indicates that respondents interpreted the items clearly and consistently, reinforcing the credibility and reliability of the study. Therefore, the questionnaire is deemed appropriate for further analyses, including correlation and regression.

Table 3: Descriptive Statistic

	N	Minimum	Maximum	Mean	Std. Deviation
Emotional	318	2.75	5.00	4.3066	.56789
Recreational	318	2.50	5.00	4.3011	.59236
Cultural	318	2.75	5.00	4.4638	.54079
Entertainment	318	2.00	5.00	4.1258	.64827
Efficiency	318	2.25	5.00	4.2948	.58416
Satisfaction	318	2.50	5.00	4.4237	.55235
Valid N (listwise)	318				

Table 3 presents the descriptive statistics for six key constructs based on 318 valid responses. Overall, the mean scores for all items are above 4.0 on a 5-point Likert scale, indicating generally positive perceptions among respondents. The highest mean score was recorded for the cultural dimension ($M = 4.4638$, $SD = .54079$), suggesting that cultural experiences were particularly well received. This was followed closely by satisfaction ($M = 4.4237$, $SD = .55235$), reflecting a high level of overall contentment with the travel experience. Emotional ($M = 4.3066$), recreational ($M = 4.3011$), and efficiency ($M = 4.2948$) dimensions also showed consistently favorable responses. Entertainment, while still positively rated, had the lowest mean score ($M = 4.1258$, $SD = .64827$), indicating slightly more varied opinions. The standard deviation values, ranging from .54079 to .64827, suggest moderate variability, with most respondents showing relatively consistent ratings across the constructs. These results indicate that the survey instrument effectively captured positive and coherent responses related to travel experience, destination image, and tourist satisfaction.

Table 4: Test of Normality

Table 11: Test of Normality						
Kolmogorov -Smirnov			Shapiro - Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.
Satisfaction	0.84	318	<.001	.956	318	<.001

A normality test was conducted for the satisfaction variable using the Kolmogorov-Smirnov and Shapiro-Wilk tests on a sample of 318 respondents. Both tests returned significant results ($p < .001$), indicating that the data is not normally distributed. As the assumption of normality is violated, non-parametric statistical methods may be more appropriate for further analysis.

Table 5: Descriptive Statistic

	N	Minimum	Maximum	Mean	Std. Deviation
Satisfaction	318	2.92	5.00	4.3193	.49282
Valid N (listwise)	318				

The results show a mean satisfaction score of 4.3193 with a standard deviation of 0.49282, based on 318 respondents. Since the mean is relatively high on a scale of 1 to 5, it indicates that most tourists were highly satisfied with their visit. The low standard deviation suggests consistent responses among participants. Overall, this reflects a strong level of satisfaction, highlighting its importance as a key factor influencing tourism to the site.

Table 6: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.837 ^a	.701	.696	.30466

a. Predictors: (Constant), Efficiency, Cultural, Entertainment, Emotional, Recreational

Table 7: Anova^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	67.754	5	13.551	145.994	<.001 ^b
	Residual	28.959	312	.093		
	Total	96.713	317			

a. Dependant Variable: Satisfaction

b. Predictors: (Constant), Efficiency, Cultural, Entertainment, Emotional, Recreational

Table 8: Coefficients

Model		Unstandardized β	Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	.315	.156		2.019	.044
	Emotional	.258	.047	.265	5.450	0.001
	Recreational	.095	.047	.102	2.009	.045
	Cultural	.251	.046	.246	5.394	.001
	Entertainment	.081	.044	.095	1.870	.062
	Efficiency	.265	.044	.280	5.970	.001

a. Dependant Variable: Satisfaction

To address Objective 2, a multiple regression analysis was conducted to assess how emotional, recreational, cultural, entertainment experiences, and efficiency influence tourist satisfaction. The overall model was statistically significant ($F = 145.994$, $p < 0.001$) and explained 70.1% of the variance in satisfaction ($R^2 = 0.701$), indicating strong predictive power. Significant predictors included emotional experience ($B = 0.258$, $t = 5.450$, $p < 0.001$), recreational experience ($B = 0.095$, $t = 2.009$, $p = 0.045$), cultural experience ($B = 0.251$, $t = 5.394$, $p < 0.001$), and efficiency ($B = 0.265$, $t = 5.970$, $p < 0.001$). However, entertainment was not a significant predictor ($p = 0.062$). These results suggest that satisfaction is strongly influenced by emotional, recreational, and cultural experiences, as well as efficiency.

5. CONCLUSION

The interpretation of the results indicates that tourist satisfaction at Malacca's UNESCO World Heritage Sites is strongly driven by their emotional, cultural, recreational, entertainment and efficiency-based experiences. The multiple regression analysis shows that these five factors (emotional, cultural, recreational, and efficiency) have significant positive effects on satisfaction, with the strongest contribution coming from efficiency ($\beta = 0.265$) and emotional experience ($\beta = 0.258$). Recreational experience also has a meaningful but smaller impact ($\beta = 0.095$), while entertainment was not statistically significant, suggesting that while entertainment may be valued, it does not heavily influence overall satisfaction in this context. This finding emphasizes that tourists are more satisfied when they engage in authentic and meaningful experiences—those that evoke emotional connection, cultural immersion, and leisure activities that are efficiently managed. The significant correlation between travel experience and destination image ($r = .791$, $p < .001$) further indicates that visitors who enjoy positive, well-rounded travel experiences tend to have a more favorable perception of Malacca's destination image. This relationship suggests that enhancing the quality of experiences can directly elevate tourists' perceptions, thereby encouraging repeat visits and positive word-of-mouth.

These findings offer several practical implications. Destination managers and policymakers should focus not only on improving experiential elements such as heritage storytelling, cultural immersion, and leisure activities but also on enhancing tourists' overall perception of the destination's efficiency and entertainment value. Improving signage, cleanliness, crowd control, transportation, and cultural programming can elevate both experience and satisfaction levels. In summary, these results highlight that improving the authentic, emotional, and cultural aspects of the visitor experience, along with

ensuring the destination's operations are smooth and efficient, are key strategies for increasing tourist satisfaction. This, in turn, fosters a positive destination image and supports sustainable heritage tourism by balancing visitor needs with the preservation of cultural authenticity. When integrated into the broader conclusions, it underscores the need for destination management to prioritize these experiential factors to foster long-term tourism growth and heritage conservation in Malacca.

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Digitalization of Financial Reporting for “Rendang Lokan MSMEs” Based on Accurate Accounting Information System: An Integrative Strategy Toward Sustainable Finance in Pesisir Selatan Regency

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ABSTRACT

Micro, Small, and Medium Enterprises (MSMEs) play a vital role in regional economic development, especially in coastal areas rich in natural resources such as Pesisir Selatan Regency in West Sumatra, Indonesia. Lokan which is a freshwater clam is also one of the commodities that are leading in the region and undergoes processing where rendang lokan is a local food produced with high chances of market potential within the country as well as internationally. This innovation can increase the competitiveness of MSME products while contributing to increasing regional income. Nonetheless, quite a few of the local MSMEs also continuously struggle with financial recordkeeping and reporting despite their potentials. By far adopted by most businesses are the manual and unstandardized methods which render them prone to errors and exposure to financing, transparency and chances of sustainable development. To counter such a scenario, this work developed and designed a digital financial reporting system based on the requirements of the MSMEs, with the help of Accurate version 5.0. This study utilized the action research approach, descriptive qualitative approach and the system development approach. The researcher developed a case study regarding one of rendang lokan MSME at the Pesisir Selatan, data on which are gathered using interviews, observations, document analysis, and system requirement assessments. This was implemented by providing organization on financial data, opening balances, calculating the cost of goods manufactured (COGM) through Excel, and creating financial reports by using Accurate. Findings showed that digitalization enhanced transaction recording, precision in costs as well as automatic creation of important reports on financial statements like profit and loss accounts, balance sheets, and cash flow reports. It was a transition that increased operational efficiency, transparent financial information, and funding applications. Moreover, the digital financial systems encourage the sustainable business models in accordance with Environmental, Social, and Governance (ESG) principles and with the implementation of the Sustainable Development Goals (SDGs). The research paper will provide practical and theoretical insights in relation to the enhancement of competitiveness of MSMEs along coastal areas.

Keywords: MSMEs, digital accounting, Accurate, ESG, SDGs

1. INTRODUCTION

The micro, Small, and Medium Enterprises (MSMEs) are important to the growth of the economy, especially in coastal areas full of natural resources that cannot be found elsewhere on the earth such as Pesisir Selatan Regency located in West Sumatra Province. As per 2023, the economic growth rate of the area was 4.19 percent, which was increased by 17 basis points in comparison with the past growth of 4.02 percent. The figure was higher than the average growth target rate of 4.17 percent established in the 2021 -2026 Regional Medium-Term Development Plan (RPJMD) (Sumbar, 2024). Lokan, a freshwater shell which is found along the coasts and the estuaries is also one of the major local commodities of the region. This commodity gives significant livelihood to the local people when processed as rendang lokan, not only that, when processed as rendang lokan, it also has a strong potential to be a unique value-added product that has the potential to enter not only the national market but also international markets (Ministry of Cooperatives and MSMEs, 2020).

In recent years, the local government of Pesisir Selatan has demonstrated strong commitment to developing seafood-processing MSMEs through various empowerment programs. These include local food processing training, legal business facilitation (NIB, PIRT, Halal), participation in MSME product exhibitions, and equipment assistance. These strategies aim to increase the added value of local products and broaden market access, thereby enabling coastal MSMEs to move beyond raw material sales toward producing competitive processed goods (Pesisir Selatan Regency Government, n.d.). However, a major challenge faced by MSMEs in this sector is the weakness of financial recording and reporting systems. Many enterprises still rely on unstandardized manual bookkeeping, making it difficult to measure profitability, cost efficiency, or prepare financial statements for financing, partnerships, or accountability purposes (Nugraheni, 2021). This weakness ultimately limits their potential for sustainable business scaling.

As awareness of responsible and sustainable business practices increases, financial reporting is no longer merely an administrative tool it is a means of achieving transparency and accountability aligned with Environmental, Social, and Governance (ESG) principles and contributes to the Sustainable Development Goals (SDGs). Properly structured financial reports can help MSMEs improve efficiency in raw material use, manage production waste, create local employment opportunities, and promote gender inclusion—all of which are directly linked to SDG indicators such as: SDG 8 (Decent Work and Economic Growth), SDG 12 (Responsible Consumption and Production), and SDG 9 (Industry, Innovation, and Infrastructure) (United Nations, 2015; UNDP, 2020). Within this context, this research aims to design and implement a financial reporting system using the Accurate accounting application, tailored to the users' needs and characteristics. According to PSAK 201, the purpose of financial statements is to provide information about an entity's financial position, performance, and cash flows that is useful to a wide range of users in making economic decisions. Financial reports also reflect management's accountability for the use of entrusted resources. Accurate was selected due to its popularity, comprehensive features suited to MSMEs, and ability to facilitate gradual, measurable digital transformation in accounting (Accurate, 2022).

Using an applied research approach, this study not only offers a technological solution but also supports the transformation of MSME business practices toward greater professionalism, transparency, and sustainability. It is expected that MSMEs in coastal regions can improve their competitiveness through strengthened financial accountability, broader access to financing, and a greater contribution to inclusive and sustainable regional economic development (Junaidi & Sari, 2020; World Bank, 2019).

While there has been considerable research on MSME development and accounting information system adoption, there remain notable gaps particularly in the context of coastal-based MSMEs utilizing local marine resources such as *lokan*. Most prior studies have focused on urban MSMEs or those operating in trade and service sectors (Nugraheni, 2021; Junaidi & Sari, 2020). Few studies have specifically investigated MSMEs in coastal regions, especially those engaged in seafood processing. These MSMEs have unique characteristics in terms of resource access, production culture, and limited exposure to technology and financial literacy. Furthermore, most studies on accounting digitalization in MSMEs have centered on theoretical frameworks or user perception assessments. There is a lack of applied research that directly designs and implements digital accounting systems in real operational settings of traditional micro-enterprises, leaving their practical impact largely unmeasured.

Therefore, implementing accountable digital financial reporting has strong potential to enhance MSMEs' contributions toward ESG and SDG targets. Many MSMEs struggle to access or operate digital accounting systems due to high costs, complexity, or incompatibility with their scale of business. Thus, this study, which applies Accurate, a system known for its practicality and MSME-oriented features, provides a much-needed model of implementation that is applicable, affordable, and replicable. By addressing these research gaps, this study aims to make both theoretical contributions by enriching the literature on MSME accounting digitalization in local and sustainability contexts, and practical contributions by offering a real-world implementation model using Accurate as a digital accounting solution for MSMEs based on local resources. It also aligns with governmental policy goals on local economic empowerment, digital transformation, and regional-level SDG achievement.

2. LITERATURE REVIEW

Micro, Small, and Medium Enterprises (MSMEs) are the backbone of the economy in many developing countries, including Indonesia. In coastal regions like Pesisir Selatan Regency, these businesses play an essential role in turning marine resources into high-value products that support local livelihoods (BPS, 2021). One such problem which MSMEs usually encounter, however, is the absence of a stable system of financial recording and reporting (Nugraheni, 2021). Lack of consistency in accounting process makes it impossible to make good business decisions, secure funding and gain trust in the form of transparency by many MSMEs. Thankfully, the digital tech has facilitated the handling of finances by MSMEs. Consider such tool as Accurate that provides userfriendly functionality and assists a business to monitor transactions, automatically generates financial reports, and analyzes business performance more efficiently (Accurate, 2022). Research demonstrated that the use of digital accounting systems translates to more precision, efficiency in time, and reliable financial information (Nugraheni, 2021; Junaidi & Sari, 2020). It is more than just the numbers though. Sound financial management is also in favor of higher-order objectives that are environmentally and socially oriented. Under the Environmental, Social and Governance (ESG) guidelines, transparent financial accounts assist companies weigh the level of their corporate responsibility in their utilization of resources, employment practices and into business operation decisions (UNDP, 2020). The practices directly conform to the Sustainable Development Goals (SDGs), particularly SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation, and Infrastructure), as well as SDG 12 (Responsible Consumption and Production) (United Nations, 2015).

Nugraheni (2021) found that the implementation of digital accounting systems can improve recording accuracy, accounting process efficiency, and the ability of MSME owners to prepare bankable financial reports. However, this study focused on service and trade sectors in urban areas, not yet addressing processing sectors in coastal regions. Similarly, the study by Junaidi and Sari (2020) regarding the implementation of the Accurate application among MSMEs showed that it is user-friendly, flexible, and affordable for small business operators. However, they emphasized that training and mentoring are essential for sustainable system adoption. Several recent studies have also started to link MSME digitalization with sustainability. For instance, Purwanti & Wibowo (2022) explored how the use of accounting information systems can enhance MSMEs' awareness of raw material efficiency, waste management, and inclusive business practices. This opens opportunities to connect financial digitalization with contributions to the SDGs and ESG principles. Nevertheless, most of these studies remain descriptive or quantitative using survey approaches and have not adopted an applied research approach that directly implements systems in community-based or local production MSMEs.

Based on these previous studies, there is a clear gap in research specifically addressing the implementation of digital accounting systems for rendang lokan processing MSMEs in Pesisir Selatan Regency. Despite the region's strong local economic potential, it has received minimal technological intervention in financial management. This gap underscores the novelty and value added of this study. Grounded in this background and the identified research gap, this study aims to examine and validate whether implementing an Accurate-based accounting information system can enhance the quality of financial reporting and support sustainable financial practices in MSMEs rooted in local commodities. The hypothesis is developed based on the relationship between accounting technology adoption, financial literacy capacity, transparency, and contribution to sustainability dimensions (ESG and SDGs). The research questions are as follows:

- i. How is the Accurate Version 5.0 application implemented in the Rendang Lokan enterprise?
- ii. How is the financial report prepared in the Rendang Lokan enterprise using Accurate Version 5.0?

3. METHODS

This research is categorized as applied research using a descriptive-qualitative approach combined with system development, utilizing the Accurate accounting application. The study also employs a case study method, focusing on a micro, small, and medium enterprise (MSME) engaged in rendang lokan

production in Pesisir Selatan Regency. The data collection techniques include interviews, observations, and document reviews. The data analysis method applies a qualitative approach aimed at exploring indepth insights regarding the needs and expectations of the rendang lokan enterprise toward the financial reporting application designed by the research team.

The initial stage of system development involved gathering general company information as well as operational and production policies. General data includes product selling prices, employee salary lists, supplier records, and the company's opening balance sheet. Production-related data encompasses production tools and equipment, raw material inventory, indirect materials inventory and finished goods inventory. The researcher also conducted a reassessment of the company's fixed assets, including the depreciation method applied. Subsequently, the cost of goods manufactured (COGM) was calculated using Microsoft Excel for each product type. This calculation included raw and indirect material usage, indirect labor costs, and factory overhead expenses. The final stage involved the preparation of financial statements using the Accurate application, which enabled the enterprise to generate standardized and automated financial reports.

4. RESULTS

The object of this research is Rendang Lokan Enterprise, a manufacturing company specializing in the production of rendang, with its flagship product being rendang lokan, a culinary specialty of Pesisir Selatan Regency. The company has expanded its market reach to several areas including Padang, Payakumbuh, Bukit Tinggi, and Jakarta. Despite having a relatively substantial turnover, the company has not yet implemented adequate financial reporting policies. Currently, the business still relies on manual bookkeeping that only records cash inflows and outflows.

Moreover, the company has not applied depreciation to its fixed assets, has not calculated the cost of goods sold (COGS), and its accounting practices remain very basic. The use of Accurate Accounting Software Version 5.0 in this study is intended to assist the company in improving its financial recording processes, calculating COGS, and ultimately producing more structured and comprehensive financial statements. To address these challenges, the researcher will input one month of actual transaction data into the Accurate system. This implementation aims to demonstrate how digital accounting can enhance the accuracy and quality of financial reporting for small manufacturing enterprises. The following are some screenshots and outputs generated during the financial reporting process using the Accurate application:

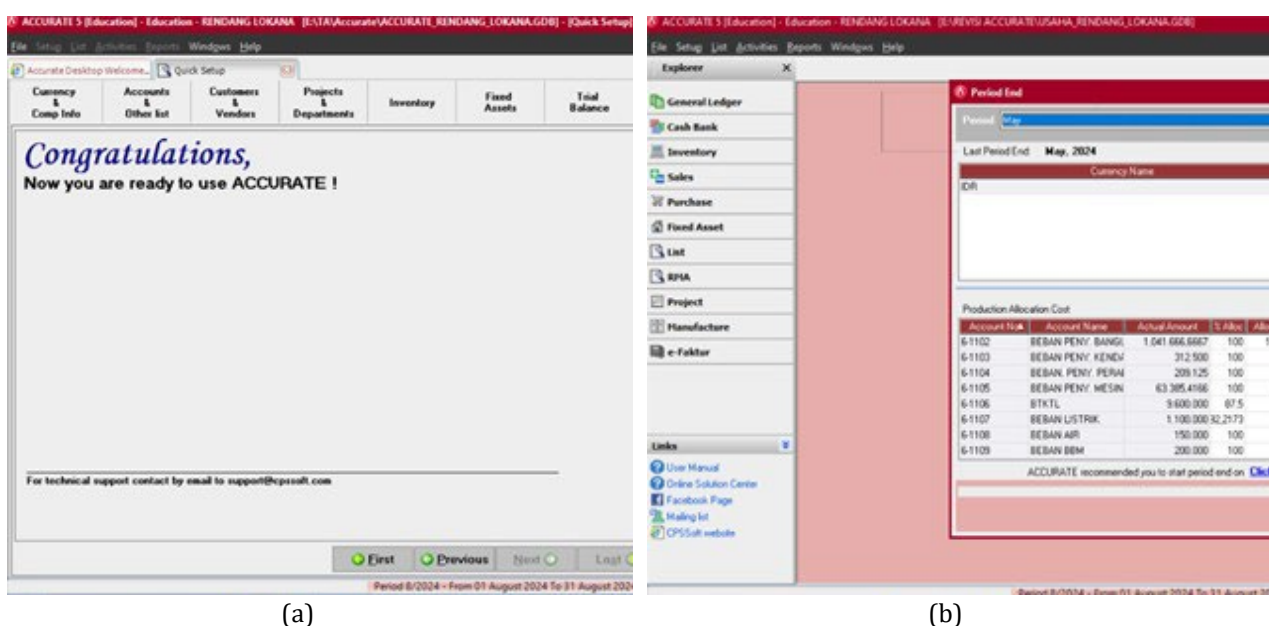


Fig. 1: (a) Display of Initial Data Input in the Application, (b) Display of End-of-Accounting-Period Activities

The main result of using this application is the automatic generation of the company's financial reports. With Accurate, users can easily access and review their financial data anytime they need. For example, in the case of the Rendang Lokan enterprise, once all transaction data is entered, the system can produce a full set of financial statements, such as general journal entries, profit and loss reports, statements of changes in equity, balance sheets, and cash flow reports. These reports provide a clear and complete picture of the business's financial health, making it easier for owners or managers to understand how the business is performing. This not only supports more informed decision-making but also improves financial transparency and promotes accountability in managing the business.

Account No.	Account Name	Debit (Base)	Credit (Base)	Description	1-31 May 2024
01 May 2024 Purchase Payment PP 01				OPERATING REVENUE	
210102	Account Payable IDR	180.000,00	0,00	PENJUALAN	112.990.000,00
1-1101	KAS DI TANGAN	0,00	180.000,00	Sales Term Discount IDR	-4.614.300,00
		180.000,00	180.000,00	Total OPERATING REVENUE	108.375.700,00
01 May 2024 Purchase Payment PP 02				Cost of Goods Sold	
210102	Account Payable IDR	320.000,00	0,00	COGS	59.308.082,55
1-1101	KAS DI TANGAN	0,00	320.000,00	VARIANCE	0,00
		320.000,00	320.000,00	Total Cost of Goods Sold	59.308.082,55
01 May 2024 Purchase Payment PP 03				GROSS PROFIT	49.067.617,45
210102	Account Payable IDR	7.091.000,00	0,00	Operating Expenses	
1-1102	KAS DI BANK	0,00	7.091.000,00	BEBAN PENY. BANGUNAN TOKO	520.833,33
		7.091.000,00	7.091.000,00	BEBAN LISTRIK TOKO	55.010,00
01 May 2024 Purchase Invoice PI 01				BEBAN SAMPAH	50.000,00
1-1401	PERSEDIAAN BAHAN BAKU	180.000,00	0,00	BEBAN FOTOCOPY	66.000,00
210102	Account Payable IDR	0,00	180.000,00	BEBAN GAJI KASIR	1.200.000,00
		180.000,00	180.000,00	BEBAN PENY. PERALATAN TOKO	127.542,08
01 May 2024 Purchase Invoice PI 02				BEBAN PEMASARAN	4.000.000,00
1-1401	PERSEDIAAN BAHAN BAKU	320.000,00	0,00	BEBAN PERLENGKAPAN TOKO	34.000,00
210102	Account Payable IDR	0,00	320.000,00	Total Operating Expenses	6.053.385,42
		320.000,00	320.000,00	INCOME FROM OPERATION	43.014.232,03
01 May 2024 Purchase Invoice PI 03				Other Income and Expenses	
1-1401	PERSEDIAAN BAHAN BAKU	5.560.000,00	0,00	Other Income	
1-1402	PERSEDIAAN BAHAN PENOLONG	1.531.000,00	0,00	Total Other Income	0,00
210102	Account Payable IDR	0,00	7.091.000,00	Other Expenses	
		7.091.000,00	7.091.000,00	Total Other Expenses	0,00
01 May 2024 Sales Invoice SI 01				Total Other Income and Expenses	0,00
110302	Account Receivable IDR	640.000,00	0,00	NET PROFIT/LOSS (Before Tax)	43.014.232,03
4-1101	PENJUALAN	0,00	640.000,00	NET PROFIT/LOSS (After Tax)	43.014.232,03
5-1101	COGS	345.041,80	0,00		
1-1403	PERSEDIAAN BAHAN JADI	0,00	345.041,80		
		985.041,80	985.041,80		

(a)

(b)

Fig. 2: (a) Display of All Journal Output, (b) Display of Profit and Loss Output

After installing the Accurate Version 5.0 in the Rendang Lokan business, it is now much easier to record the transactions in real time which has reduced and simplified the process of processing financial data. This finding also confirms the result of Pratama et al. (2023) who indicated that cloud-based accounting system can substantively improve the efficiency and quality of financial statements among MSMEs. Technology in accounting solutions also enhances financial transparency and accountability which are among the elements that enhance trust in the financial institutions. As it has been emphasized by Salsabila and Sriwindari (2025), transitioning to the digital systems will help small business to access financing more easily, as it will enhance transparency of their financial information. With Accurate, MSMEs in the rendang lokan industry can now generate standard (consistent) financial statements in the forms of income statements, balance sheets, cash flow statements, and asset depreciation reports and be able to comply with the guidelines of PSAK EMKM. This correlates with Osesoga et al. (2024), whose research findings revealed that digital accounting systems do not only assist businesses to meet the financial reporting requirement but also promote their sustainability in the long term. Also, the findings of the research that analyzed the use of financial reports created with the help of Accurate suggest that they help ease day-to-day operations in the context of any functioning business and help the management make more informed decisions (Garcia et al., 2022) which echoes the conclusion drawn by Fachruzzaman et al. (2021). Overall, digital accounting, in this case, enables MSMEs to have more powerful means to increase their business in responsible and sustainable ways.

It may therefore be surmised that using Accurate Version 5.0 has resulted in higher level of efficiency, accuracy and transparency in financial reporting. The system also enhances compliance with accounting standards and accelerates access to financing for MSMEs. However, the success of digital transformation remains highly dependent on the technological literacy of business owners and the quality of technical support provided. Therefore, to ensure the long-term success of digital transformation, structured training programs in digital literacy and basic accounting are necessary, especially for MSMEs in coastal regions with limited technological access. Moreover, improving the quality of technical assistance can be achieved through collaborative efforts between local governments, vocational education institutions,

and technology providers to ensure that the implementation of digital accounting systems is aligned with the actual needs and capabilities of MSME actors.

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The Influence of Green Human Resource Management on The Green Behaviour of Outsourcing Employees: Insight from Indonesia

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ABSTRACT

Environmental sustainability has become a central concern across industries, prompting organizations to adopt eco-friendly practices, including in Human Resource Management (HRM). Green Human Resource Management (GHRM) integrates environmental awareness into HRM functions. While existing research predominantly addresses permanent employees in developed countries, limited empirical evidence exists on how GHRM affects outsourced workers in developing contexts. This study explores the influence of GHRM practices—specifically green recruitment strategies (GRS), green institutional initiatives (GII), and green performance management and appraisal (GPM)—on employee green behaviour (EGB) among outsourced staff in Indonesian Company. Outsourced employees, often on the operational frontline, are critical to conveying institutional environmental values but remain underrepresented in sustainability literature. Findings indicate that environmentally oriented HR practices can foster green behaviour, even among non-permanent staff, through inclusive policies, targeted training, and strategic incentives. This research contributes theoretical insights and practical implications for promoting inclusive and sustainable HRM policies across diverse workforce segments in developing nations.

Keywords Green human resource management, outsource employee, employee green behaviour

1. INTRODUCTION

Environmental concerns have emerged as a critical worldwide problem in recent decades. Researchers are progressively concentrating on ecological strategies to avert environmental deterioration and conserve ecosystems (Benevene & Buonomo, 2020; Kim et al., 2017; Shafaei et al., 2020; Singh et al., 2020). Elkington's (1997) foundational research on the triple bottom line (people, profit, and planet) has catalyzed a significant increase in studies regarding sustainable production, consumption, and the responsibilities of individuals and organizations towards the environment (Chen et al., 2019; Pereira & Martins, 2021; Zhou et al., 2018). A significant result of modern research is the notion of 'becoming green' across all disciplines. The term 'green' has emerged as a prominent concept, prompting researchers to examine green consumption (Haws et al., 2014; Tezer & Bodur, 2020), green innovation (Song et al., 2020), green behaviour (Chaudhary, 2020; Davis et al., 2020; Pham et al., 2019), green investment (Doval & Negulescu, 2014; Heinkel et al., 2001; Sharma et al., 2020), green organizational behaviour (Anwar et al., 2020; Pham et al., 2019), and green-related creativity (Awan et al., 2019; Maitlo et al., 2022). In reaction to this predicament, several sectors, including enterprises and organizations, have begun the integration of sustainability concepts into their operations. A rapidly evolving technique is the incorporation of environmental considerations into human resource management systems, referred to as Green Human Resource Management (GHRM).

Researchers have highlighted the significance of environmental consciousness and the function of human resource management as a mechanism for achieving a 'green company' that positively influences people, society, and the environment. Consequently, emphasizing the facets of poverty (environmental, economic, and social), novel research on GHRM has surfaced (Fawehinmi et al., 2020; Ren et al., 2018;

Renwick et al., 2013; Wehrmeyer, 2017). According to Jabbour, GHRM is a concept that integrates human resource management practices with organizational policies and objectives aimed at environmental sustainability (Jabbour, 2013, pp. 147-148). Veerasamy et al. (2024) assert that GHRM is a strategic methodology in human resource management that incorporates concepts of environmental sustainability into its operational operations. GHRM involves actions like the recruitment of environmentally conscious personnel, eco-friendly training, performance assessments based on contributions to environmental conservation, and incentives for employees demonstrating pro-environmental behaviour (Parida et al., 2021). GHRM is a human resource management strategy that advocates for the use of sustainable resources, the establishment of an eco-friendly workplace, and the cultivation of an environmentally conscious culture among workers, yielding advantages for both society and the environment (Ahmad, 2015; Mampra, 2013; Shahriari et al., 2019).

Prior research has shown that the implementation of Green Human Resource Management (GHRM) may enhance environmentally friendly behaviour among workers. The majority of GHRM studies emphasize on the prospective advantages of HRM methods and provide guidance for future study (Ahmad, 2015; Benevene & Buonomo, 2020). Research has progressively advanced and furnished empirical data on the impact of GHRM on employee green behaviour (Iftikhar et al., 2021; Shafaei et al., 2020). Employee green behaviour (EGB) denotes activities by employees that promote environmental sustainability, either by engaging in eco-friendly practices or by refraining from ecologically detrimental behaviours. EGB encompasses a variety of measurable and evaluable actions related to the environmental impact of employee activities in the workplace (Zacher et al., 2023). These green behaviours include actions such as saving energy, disposing of waste properly, reusing paper, and educating coworkers about the importance of protecting the environment. Certain scholars contend that GHRM guarantees environmental objectives by emphasizing a triadic approach: dematerialization, decarbonization, and demobilization (Chen et al., 2018; Hossen et al., 2018).

Research on GHRM in educational institutions outlines green HRM practices such as recruitment, performance management, green compensation, and green training and development among employees (Bhagyalakshmi & Priyanka, 2019). A study by Veerasamy et al. (2023) divided GHRM into three main dimensions that directly influence outcomes: green recruitment strategies (GRS), green institutional initiatives (GII), and green performance management and appraisal (GPM). The study findings indicate that green recruitment strategies, green institutional initiatives, and green performance management and appraisal have a significant positive influence on employee green behaviour in educational institutions. GRS refers to the approach used by organizations to attract and select candidates who are aware of and committed to environmental issues. This strategy is part of Green Human Resource Management (GHRM) practices, which aim to acquire human resources that support environmental sustainability (Wang et al., 2024). GII refers to steps taken by institutions, both governmental and non-governmental, to encourage sustainable and environmentally friendly practices in society and the industrial sector. These initiatives aim to reduce negative environmental impacts and promote sustainability through policies, regulations, and programs that support green behaviour (Liang et al., 2023). Meanwhile, GPM refers to the systems and processes used by organizations to measure, evaluate, and improve employees' environmental performance and their contribution to organizational sustainability. This includes setting sustainability-focused goals, measuring green performance, and providing relevant feedback to encourage environmentally friendly behaviour in the workplace (Aniqoh et al., 2022).

Some scholars contend that the existing literature on GHRM mostly emphasizes the Western context, with little studies addressing environmental management in developing nations (Renwick et al., 2013). Shahriari et al. (2019) indicated a persistent deficiency of extensive investigations and research on GHRM in underdeveloped nations. As a result, there is little understanding of the impact of GHRM practices on human and organizational outcomes (Ren et al., 2018; Benevene & Buonomo, 2020). The majority of research on GHRM practices in underdeveloped countries is mostly conceptual rather than empirical. Varma and Balachandran (2021) provide a conceptual framework for GHRM activities inside Indian higher education institutions. Pothuraju and Battu (2018) conducted non-empirical research examining rising trends in human resource practices within developing countries.

Empirical research in the context of developing countries have focused on the study of green behaviour in the manufacturing sector (Davis et al., 2018), and the hospitality industry (Iftikhar et al., 2021; Shafaei et al., 2020). Bhagyalakshmi & Priyanka (2019) focus in educational institutions delineate GHRM practices among employees, including recruitment, performance management, green compensation, and green training and development. However, not many studies have focused on outsourced employees, especially in developing countries like Indonesia. This study aims to complement this learning by examining GHRM practices carried out by outsourced employees to demonstrate environmental concern by employees. Organizations are accountable for fostering a green culture, ensuring that employees are aware of the importance of waste management, maintaining sanitation, and utilizing environmentally favourable resources (Bhandari, 2019; Mukharjee et al., 2020).

Outsourced employees are generally in positions directly involved in daily operational activities. They are often the initial representation of the organization's image to the external environment (Fallis, 2013). Therefore, it is important to ensure that outsourced employees also adopt environmentally friendly work behaviours. However, their non-permanent status, coupled with minimal involvement in organizational processes, raises questions about whether GHRM practices are effectively applied to them.

GHRM practices such as employee training on environmental awareness, rewarding pro-environmental behaviour, and employee participation in environmental conservation programs have the potential to significantly impact work behaviour (Veerasamy et al., 2024). By providing opportunities for employees to participate in green programs, organizations not only create a more environmentally friendly work environment but also foster a more inclusive and socially responsible work culture (Adolph, 2016). Research by Veerasamy et al. (2023) also underscores the importance of employee participation and engagement, as well as environmentally oriented training and development, in strengthening the relationship between GHRM policies and green behaviour. This implication is particularly relevant for outsourced workers in Indonesia, who often do not receive as much training and participation as permanent employees. However, given the flexible working conditions of outsourced employees and the relative differences between permanent employees, in-depth research is needed to determine whether a GHRM approach applied to them can yield similar results. Can green training, values-based recruitment, and reward systems improve environmental awareness among outsourced employees as they do among permanent employees? Considering the importance of this topic and the limited literature on GHRM among outsourced employees in Indonesia, this research is highly relevant. It is hoped that this research will provide theoretical and practical contributions to the development of environmentally conscious and inclusive human resource policies for all types of workers.

2. THEORETICAL FRAMEWORK AND HYPOTHESES DEVELOPMENT

Green Human Resource Management (GHRM)

GHRM is a corporate strategy for sustainable human resource management that integrates environmental considerations to maintain environmental sustainability in organizational management (Welewska et al., 2023). GHRM is a novel strategy for HR performance and operations inside a business, whereby the environmental context underpins all activities. GHRM refers to the engagement in all activities related to the creation, implementation, and maintenance of sustainable systems designed to cultivate environmentally conscious personnel inside the firm (Welewska et al., 2023). GHRM is a human resource management approach that integrates environmental considerations into HR operations to create a sustainable firm (Lamptey, 2021). The application of GHRM seeks to enhance employee performance efficiency, resulting in a more sustainable and ecologically friendly setting. Several steps must be taken to facilitate GHRM implementation, including green training, green recruitment, and so on. All of these activities are based on environmentally friendly human resource management (Nawangsari & Wardhani, 2022).

According to Veerasamy et al. (2020), GHRM practices are based on the Ability, Motivation, and Opportunities (AMO) theory (Appelbaum et al., 2000; Blumberg & Pringle, 1982; Campbell et al., 1970; Renwick et al., 2013; Vroom, 1964). These three dimensions explain GHRM practices through green recruitment strategies (GRS), green institutional initiatives (GII), and green performance management and appraisal (GPM). Each dimension plays a significant role in encouraging work behaviours that focus on environmental sustainability. GRS is a recruitment method focused on attracting individuals with environmental knowledge and concern (Ajadi et al., 2022). GII encompasses actions taken by an organization to encourage sustainable and environmentally friendly practices. GPM is a performance management system that links employee assessments to environmental goals set by the organization (Aniqoh et al., 2022).

Human resource management seeks to guarantee the sustained advancement of an organization, which must adjust to changing environmental dynamics. GHRM is a crucial element of human resource management inside the organization to respond to dynamic environmental changes (Ali et al., 2020). The installation of GHRM is crucial. GHRM encompasses practices that correspond with the three pillars of environmental, social, and economic sustainability (Mansyur et al., 2023) and provide enduring advantages for the company (Alwi et al., 2024). GHRM is a component of an extensive corporate social responsibility initiative (Utami & Emilia, 2024). In this context, HR managers are anticipated to cultivate knowledge among workers about the enhancement of the organization's environmental performance via human behaviour. GHRM is an approach to human resource management that focuses on environmental sustainability. Researchers such as Renwick et al. (2013), Jabbour (2015), and Veerasamy et al. (2023) emphasize that GHRM practices aim not only to improve resource efficiency but also to build an environmentally friendly organizational culture.

Employee Green Behaviour (EGB)

Understanding EGB, Katz et al. (2022) defines it as a measurable behavioural action undertaken by employees related to environmental responsibility and contributing to environmental sustainability. Meanwhile, according to Li et al. (2023), EGB is defined as a series of policies or practices that encourage environmentally friendly behaviour among employees to create an organization that is environmentally sensitive, resource-efficient, and socially responsible (Tang et al., 2023). George & Jayakumar (2019) outline five main indicators used to measure Employee Green Behaviour: 1) Separate waste management, 2) Sharing environmental knowledge, 3) Commitment to environmental protection, 4) Understanding the importance of the environment, 5) Concern for resource sustainability.

The Influence of Green Recruitment Strategies on Employee Green Behaviour

According to the AMO model, in the context of GHRM during the recruiting phase, organizations must focus on potential candidates' understanding of environmental knowledge. The primary aim of the HRM department is to recruit and cultivate high-performing environmentally conscious personnel. Identifying people with the motivation and capacity to exhibit pro-environmental behaviour is essential for promoting ecologically sustainable actions. Green recruiting refers to the process of identifying personnel whose expertise, competencies, methodologies, and conduct are congruent with an organization's environmental management system (Ahmad, 2015). Current studies indicate that an ecologically aware younger generation is crucial for both ecological performance and organizational reputation (Renwick et al., 2013; Philpott & Davies, 2007), a conclusion corroborated by later researchers (Jabbour et al., 2010). Holtom et al. (2008) discovered that employee ambient warmth had an inverse correlation with turnover intentions and a direct correlation with fulfillment.

Green job descriptions are included in employment contracts at some organizations, and environmentally conscious firms recruit high-caliber employees (Stringer, 2009). Current studies indicate that firms favor recruiting and employing people that exhibit environmental awareness and prefer employment in sustainable positions (Brekke & Nyborg, 2008; Guerci et al., 2016). Moreover, environmental norms may positively influence workers' eco-friendly views (Grolleau et al., 2012). Therefore, based on the available empirical evidence, we propose the following hypothesis:

H1: Green recruitment strategy has positive and significant influence on the green behaviour of outsourced employees in Indonesia.

The Influence of Green Institutional Initiatives (GII) on Employee Green Behaviour

Organizations adopt corporate social responsibility by implementing green programs that encourage ecologically sustainable practices among workers (Boselie et al., 2001). The motivational aspect of AMO pertains to institutional efforts that encourage sustainable and environmentally friendly behaviour. These activities include the establishment of paperless workplaces where feasible, the promotion of energy saving and solar-powered systems, and the encouragement of car sharing to mitigate carbon emissions from gasoline-powered vehicles (Ahmad, 2015). Contemporary firms manifest culture via green activities that reduce adverse effects and promote beneficial outcomes (Roscoe et al., 2019; Sroufe et al., 2010). Organizations now promote the use of stairs over elevators, advocate for reduced paper usage, and ensure adherence to relevant environmental rules (Ren et al., 2018). Empirical research indicates that green efforts provide favorable results by fostering environmentally friendly behaviours and attitudes (Norton et al., 2015; Pham et al., 2019). Organizational green efforts are predicted to favorably impact EGB. Based on the above explanation, we offer the following hypothesis:

H2: Green institutional initiatives have a positive and significant influence on the green behaviour of outsourced employees in Indonesia.

The Influence of Green Performance Management and Appraisal (GPM) on Employee Green Behaviour

AMO theory posits that performance management is essential for inspiring workers to adopt environmentally sustainable behaviours. Employees engaging in organizational opportunities to exhibit environmentally sustainable behaviour, according to the "opportunity" aspect of AMO, will have this recognized in their performance evaluations. Prior studies indicate that performance evaluations enhance civic behaviour and commitment (Gahlawat & Kundu, 2020). Positive effects have been seen in both green management performance and employee behaviour evaluations concerning green HRM methods (Guerci et al., 2016; Haddock-Millar et al., 2016; Zaid et al., 2018). Research done in Italian service and industrial firms revealed a beneficial effect of performance management on employees' ecologically sustainable job results (Longoni et al., 2018). Previous investigations have emphasized the significance and beneficial outcomes of performance management and assessments (Epstein & Roy, 1997). Effective performance evaluations provide workers chances to participate in environmental stewardship and management (Jackson et al., 2011). Based on existing empirical evidence and theory, we propose the following hypothesis:

H3: Green performance appraisal management have positive and significant effect on the green behaviour of outsourced employees in Indonesia.

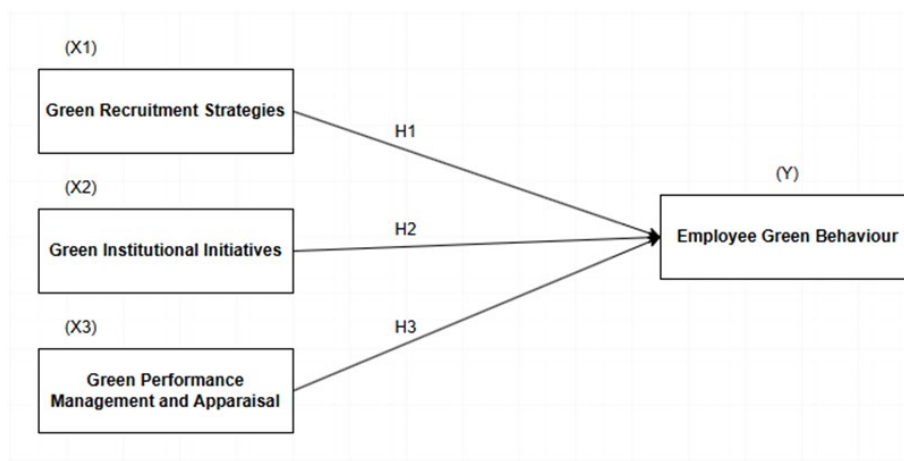


Figure 1: Theoretical framework

3. METHODS

3.1. Sample and data collection

The data used is original data acquired directly from respondents via surveys. Data were gathered by a self-administered questionnaire, delivered both online and offline to enhance accessibility. The sampling used a non-probability approach using purposive sampling. The data sources included outsourced personnel from commercial and state-owned enterprises in Indonesia. A total of 100 replies were successfully gathered from outsourced workers.

Total 100 Respondents involved in this study. There were 30 male and 70 female respondents. The majority is dominated by MD (Merchandiser) with 23%, followed by BA (Beauty Advisor) 15%, SMD (Supervisor Merchandiser) 12%, DC (Distribution Center) 8%, Private 8%, and SPG (Sales Promotion Girl) 8%. Other categories that also contribute include SALES 8%, TL (Team Leader) 4%, APE (Area Promotion Executive) 2%, MTM (Modern Trade Merchandiser) 2%, and Promoter 2%. Meanwhile, ARCO (Area Coordinator), DGO (Display General Officer), Educator, PIC (Person In Charge), Retail FMCG (Fast-Moving Consumer Goods), SPV (Supervisor), TFA (Trade Field Assistant), and TSM (Territory Sales Manager) each have 1%, indicating the diversity of respondents' job fields with a strong focus on roles in marketing, sales, and distribution. The majority were dominated by respondents with experience <1 year, covering 67% of the total. This was followed by respondents with 2 to 4 years of experience, which reached 30%. Meanwhile, respondents with 5 to 10 years of experience accounted for only 3%, and no respondents had more than 10 years of experience. This data indicates that the majority of respondents are employees with relatively short work experience in their current positions.

3.2. Measurement

GRS is measured by adopting scales from Zibarras & Coan (2015); Tang et al. (2018); Guerci et al. (2016) consist of 5 item scales. GII is measured by adopting item scales from Jabbour et al. (2010); Tang et al. (2018) consist of 5 item scales. GPM is measured by adopting item scales from Tang et al. (2018); Gholami et al. (2016) consist of 5 item scales.

3.3. Data Analysis

Data were evaluated with SEM through the SmartPLS 4 software. Validity was assessed by convergent validity and discriminant validity. Convergent validity may be assessed using factor loading and Average Variance Extracted (AVE). The discriminant validity is assessed by determining if the square root of the Average Variance Extracted (AVE) of a construct exceeds the correlation between that construct and other constructs. The assessment of dependability was conducted using Composite dependability (CR). Table 1 shows satisfactory validity and reliability.

Table 1: Correlation, AVE, square root of AVE, and composite reliability

Variabel	GRS	GII	GPM	EGB	AVE	SQRT AVE	CR
GRS	1.000	0.434	0.475	0.669	0.676	0.822	0.893
GII	0.434	1.000	0.346	0.664	0.672	0.820	0.911
GPM	0.475	0.346	1.000	0.628	0.728	0.853	0.931
EGB	0.669	0.664	0.628	1.000	0.616	0.785	0.865

Hypothesis testing was conducted using the bootstrapping based on the resulting t-statistic value. The evaluation criteria used in this test are as follows: T-statistic value <1.96 indicates that the relationship between constructs is statistically significant at the 5% significance level ($\alpha = 0.05$).

4. RESULTS

Based on the results of the first hypothesis test, the GRS (X1) variable on EGB (Y) has an original sample value of 0.338 and a t-statistic value of 4.230 > t-table 1.985, which indicates that the effect is positive. The p-value of 0.000 < 0.05 also indicates that the effect is significant. Thus, it can be concluded that the

GRS (X1) variable has a positive and significant effect on the EGB (Y) of outsourcing employees in Indonesia.

Based on the results of the second hypothesis test, the GII (X2) variable on EGB (Y) has an original sample value of 0.404, indicating a positive influence. The t-statistic value of $6.425 > t\text{-table } 1.985$, and the p-value of $0.000 < 0.05$, indicate that the relationship is statistically significant. Thus, it can be concluded that GII (X2) has a positive and significant influence on EGB (Y) of outsourcing employees in Indonesia.

Based on the results of the second hypothesis test, the GPM (X3) variable on EGB (Y) has an original sample value of 0.328, which indicates a positive influence. The t-statistic value of $4.595 > t\text{-table } 1.985$, and the p-value of $0.000 < 0.05$, indicate that the relationship is statistically significant. Thus, it can be concluded that GPM (X3) has a positive and significant effect on EGB (Y) of outsourcing employees in Indonesia. Therefore, hypothesis H3 is accepted.

Table 2: Hypothesis test results

Relationship	Original sample (O)	T statistics	P values	Decision
GRS -> EGB	0.338	4.230	0.000	Supported
GII -> EGB	0.404	6.425	0.000	Supported
GPM -> EGB	0.328	4.595	0.000	Supported

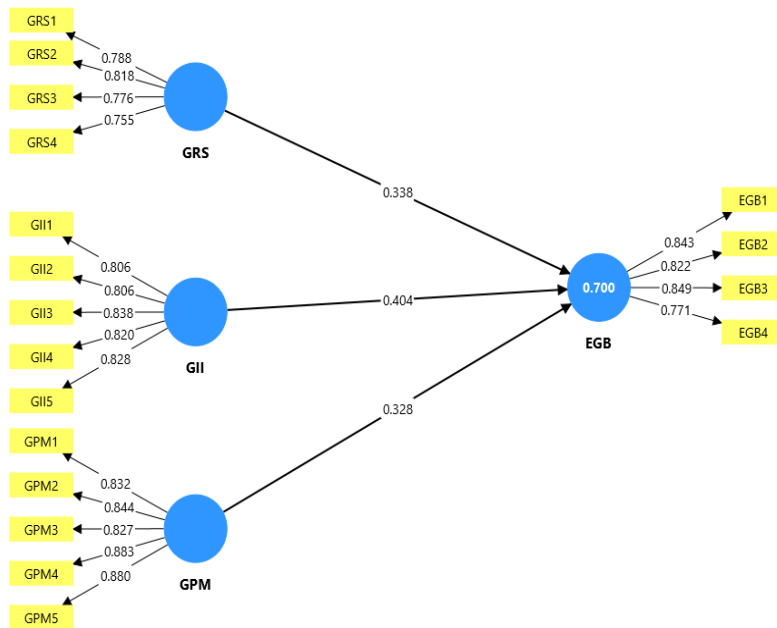


Figure 2: Final model

5. DISCUSSION

Based on the results of the first hypothesis test, the GRS (X1) variable on EGB (Y) has an original sample value of 0.338 and a t-statistic of $4.230 > t\text{-table of } 1.985$, indicating a positive effect. A p-value of $0.000 < 0.05$ also indicates a significant effect. Thus, it can be concluded that the GRS (X1) variable has a positive and significant effect on EGB (Y) of outsourced employees in Padang. These results align with previous research by Brekke & Nyborg (2008) and Guerci et al. (2016), which states that companies tend to recruit individuals with high environmental awareness because they have the potential to demonstrate better pro-environmental behaviour. Furthermore, Jabbour et al. (2010) added that a selection process that reflects sustainability values can strengthen an organizational culture that supports green behaviour. Thus, it can be concluded that the green recruitment strategy implemented by the organization functions as a significant internal factor in encouraging the formation of Employee Green Behaviour.

Based on the results of the second hypothesis test, the GII (X2) variable on EGB (Y) has an original sample value of 0.404, indicating a positive effect. The t-statistic value of 6.425 is greater than the t-table value of 1.985, and the p-value is $0.000 < 0.05$, indicating a statistically significant relationship. Therefore, it can be concluded that GII (X2) has a positive and significant effect on EGB (Y) of outsourced employees in Padang. This finding supports the AMO (Ability, Motivation, and Opportunity) theory, which states that opportunities and motivation provided by an organization can enhance employee green behaviour. Research by Roscoe et al. (2019), Pham et al. (2019), and Ren et al. (2018) also found that institutional initiatives, such as paper reduction, alternative energy use, and energy-saving campaigns, have been shown to encourage pro-environmental behaviour in the workplace. It can be concluded that the success of an organization in instilling environmental values and practices through institutional initiatives has a significant impact on shaping environmentally oriented employee behaviour.

Based on the results of the second hypothesis test, the GPM (X3) variable on EGB (Y) has an original sample value of 0.328, indicating a positive influence. The t-statistic value of $4.595 > t\text{-table } 1.985$, and the p-value of $0.000 < 0.05$, indicate that the relationship is statistically significant. Thus, it can be concluded that GPM (X3) has a positive and significant effect on EGB (Y) of outsourced employees in Padang City. Therefore, hypothesis H3 is accepted. These results are supported by AMO theory, which states that providing opportunities through environmentally based performance evaluations can encourage employees to demonstrate pro-environmental behaviour. Research by Guerci et al. (2016), Zaid et al. (2018), and Longoni et al. (2018) also shows that employees are more motivated to engage in sustainability actions if their performance evaluations consider their contribution to the environment. Thus, a performance management system that integrates sustainability goals has been proven to encourage employees to be more environmentally responsible in their work activities.

5.1. Limitation and future research

There are several limitations to this study. First, the respondents were limited to outsourced employees in Padang City, so the results cannot be broadly generalized to outsourced employees in other regions or different industrial sectors. Social conditions, work culture, and the implementation of Green Human Resource Management (Green HRM) policies can vary across regions. Second, the independent variables in this study only cover three main dimensions of Green HRM: Green Recruitment Strategy, Green Institutional Initiatives, and Green Performance Management and Assessment. However, employee green behaviour can also be influenced by other factors, such as green training and development, employee engagement, or environmentally oriented leadership.

Third, the data collection method used was a closed-ended online questionnaire, which limited further exploration of the in-depth reasons behind each respondent's answers. Subjective aspects, such as personal motivation or individual values regarding the environment, could not be fully explored. Fourth, the research approach employed was a descriptive quantitative approach, which emphasizes numerical measurement and generalization of data. This approach is unable to provide an in-depth explanation of the context, individual perceptions, or social dynamics that may influence employee green behaviour. Fourth, the sample in this study was selected using a purposive sampling technique, meaning only individuals who met certain criteria were included in the study. This could potentially introduce bias in the representation of the overall outsourcing employee population.

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Integrating Islamic Principles in Waqf Forest Governance: A Maqashid Shariah Perspective

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ABSTRACT

The concept of waqf forests has evolved beyond traditional forms mosques, cemeteries, and madrasahs to include more productive uses such as forest development. A waqf forest refers to a forest established on endowed (waqf) land and managed for the benefit of the broader community. In Indonesia, a notable example is the Bogor Waqf Forest, which has implemented various programs that significantly benefit the surrounding society. The success of these programs requires sound and effective governance. This study aims to investigate how the Bogor Waqf Forest Foundation applies Islamic principles in its governance practices and how these practices contribute to achieving the objectives of maqashid shariah. Using an exploratory case study approach, data were collected through interviews and observation. The findings indicate that the foundation has adopted strong governance practices grounded in Islamic values. These include legal compliance (tauhid, amanah), an established organizational structure (mas'uliyah), financial documentation (amanah, mas'uliyah), segregation of waqf and non-waqf funds (amanah), staff training (mas'uliyah), financial reporting (mas'uliyah), information dissemination ('adalah), program planning and target setting (shura), regular meetings (shura, hisbah), use of digital tools (mas'uliyah, hisbah), implementation of multi-sectoral programs (amanah, 'adalah, taqwa), establishment of basic SOPs (taqwa), external collaboration (shura), internal supervision (hisbah), and active community outreach (tauhid, taqwa). The foundation's vision also reflects the principle of tauhid. Overall, the implementation of these Islamic principles contributes to achieving the five objectives of maqashid shariah: protection of religion (Hifz ad-Din), life (Hifz an-Nafs), intellect (Hifz al-'Aql), lineage (Hifz an-Nasl), and wealth (Hifz al-Mal). These findings suggest that the governance model of the Bogor Waqf Forest Foundation effectively integrates Islamic values and supports the comprehensive realization of shariah objectives

Keywords: Waqf forest governance, Islamic principles, maqashid shariah

1. INTRODUCTION

Based on Law No. 41 of 2004, waqf is a legal act by a waqif to separate and/or transfer part of their property to be used permanently or for a specified period of time in accordance with their intentions, for the purpose of worship and/or public welfare in accordance with sharia principles. In Indonesia, waqf land is generally used for the construction of mosques, cemeteries, and madrasahs (Islamic schools). According to data from the Ministry of Religious Affairs' Waqf Information System (Siwak Kemenag), approximately 71.41% of waqf land is used for mosques and prayer rooms (*mushollas*), 14.87% for Islamic boarding schools and educational institutions, 4.35% for cemeteries, and the remaining 9.37% is allocated for other social purposes.

Currently, the utilisation of waqf is no longer limited to the traditional "3M" (mosques, madrasahs, and mausoleums), but has expanded to include green waqf, or waqf dedicated to environmental purposes. In Indonesia, this form of green waqf has emerged in the form of waqf forests. According to Ali and Jannah (2019), a waqf forest is a forest established on waqf land with the primary purpose of being preserved as a forest. These waqf forests provide not only environmental benefits but also social and

economic advantages for the surrounding communities. Amid the ongoing crises of climate change, environmental degradation, and the urgency of sustainable development, Muslims are called to play a vital role in preserving the balance of nature. Islamic teachings emphasize that nature must be managed properly and responsibly, as it is a trust (*amanah*) from Allah. In this context, waqf—particularly waqf forests—can serve as one of the viable solutions for achieving sustainable environmental stewardship (Ali & Jannah, 2024). Waqf forests in Indonesia gained national recognition in 2012. The initiative was pioneered by an individual from Aceh, who was inspired to act after witnessing the extensive deforestation in the region (Rohmaningtyas, 2022). Today, waqf forests have been established in four areas: the Aceh Waqf Forest, the Bogor Waqf Forest, the Mojokerto Waqf Forest, and the Sukabumi Waqf Forest (Billahi, 2025).

The Bogor Waqf Forest was established in 2018 and is managed by the Bogor Waqf Forest Foundation. It is located in Cibunian Village, Pamijahan District, Bogor Regency. The forest is managed productively through various economic, ecological, and social programmes. It adopts the concept of agroforestry, which enables the forest to generate both short-term and long-term benefits. These programmes help create employment opportunities for the surrounding community. Moreover, the waqf forest plays a crucial role in preventing natural disasters such as floods and landslides. In addition, it also serves as a platform for education and Islamic outreach (*da'wah*) (Ali & Jannah, 2019).

To realise these programmes, good governance aligned with sharia principles is essential in order to build and maintain public trust. According to Rozali Othman in Huda et al. (2020), the sustainable development of waqf requires several key factors: effective management and protection of waqf assets, competent and effective *nadzir* (waqf managers), appropriate financing mechanisms, ongoing investment, efficient marketing, as well as proper supervision and transparent reporting. Additionally, Firadilla (2024) notes that the accountability and transparency implemented by the Muhammadiyah Sumbar Cash Waqf Agency have had a positive impact—namely, increased public trust in waqf programmes, as reflected in the consistently rising number of waqf contributions each year.

Several studies have explored the governance framework for waqf management. One such study, conducted by Ihsan and Ayedh (2015), identifies three key principles of Islamic governance in waqf: *amanah* (trust), *'adalah* (justice), and *shura* (consultation), all of which are rooted in the overarching principle of *tawhid* (the oneness of God). Meanwhile, Kamaruddin and Hanefah (2021) propose a broader set of Islamic governance principles for waqf institutions, including *tawhid*, *'adalah*, *mas'uliyah* (accountability), *amanah*, *shura*, *taqwa* (God-consciousness), *hisbah* (promoting good and preventing wrongdoing), and *maqasid shariah* (the objectives of sharia). Similarly, Hassan et al. (2017) outline five principles in their waqf governance framework: *amanah*, *mas'uliyah*, *taqwa*, *hisbah*, and *shura*.

From this background, it is evident that waqf has evolved into green waqf, or environment-based waqf. One notable form of green waqf is the waqf forest. In Indonesia, several waqf forests have been established, including the Bogor Waqf Forest. The Bogor Waqf Forest is a form of productive waqf that implements various programmes benefiting the surrounding community. To successfully implement these programmes, sound governance is essential. Therefore, this research aims to examine how Islamic principles are applied in the governance of the Bogor Waqf Forest, and how this governance aligns with the realisation of the objectives of *maqasid shariah*.

2. LITERATURE REVIEW

2.1. Theoretical Foundations: Waqf, Governance, and Maqasid al-Shari'ah

Waqf, as regulated in Law No. 41 of 2004 and Government Regulation No. 42 of 2006, is defined as a legal act by a waqif (endower) to separate and/or transfer part of their property to be used permanently or for a specified period of time in accordance with their intention, for religious or public welfare purposes in line with sharia principles. Over time, waqf has evolved beyond traditional uses such as mosques, madrasas, and cemeteries, and has expanded into contemporary forms such as green waqf. Green waqf refers to the dedication of waqf assets to promote environmental sustainability, combining the spiritual and social goals of waqf with ecological responsibility. Through green waqf, communities

can work together to protect nature and maintain ecological balance, contributing to long-term sustainability (Greenpeace, 2023). One prominent form of green waqf is the waqf forest, which involves the use of waqf land for forest preservation.

According to Ali and Jannah (2019), a waqf forest is a forest established on waqf land with the primary aim of conserving the forest itself. In addition to providing environmental benefits, waqf forests also contribute to the social and economic well-being of the surrounding community. To ensure the success and sustainability of such programmes, effective governance is essential. Governance refers to the systems, processes, and principles used to direct, manage, and oversee an organisation or institution in a way that is effective, efficient, transparent, and accountable. In the context of waqf, good governance is vital to uphold ethical standards, safeguard trust, and maximise the benefits for stakeholders.

Islamic governance, in particular, emphasises ethical and spiritual values derived from the Qur'an and Hadith. These values are not only intended to ensure the continuity of waqf institutions but also to guide the management of waqf assets with spiritual consciousness, justice, and accountability to both God and society. Key principles include tawhid (oneness of God), amanah (trust), mas'uliyah (accountability), 'adalah (justice), shura (deliberation), taqwa (God-consciousness), and hisbah (supervision and enjoining good while preventing wrongdoing). These principles serve as a moral compass for waqf management and align closely with the objectives of Islamic law.

The concept of maqasid al-shari'ah - the higher objectives of sharia - provides an overarching framework for evaluating whether the governance and implementation of waqf programmes fulfil their intended purpose. Linguistically, maqasid refers to goals or intentions, while shari'ah denotes the divine law revealed by Allah as guidance for human well-being in this world and the hereafter. The core essence of maqasid al-shari'ah is to promote benefits and prevent harm (Shidiq, 2009). Imam al-Ghazali outlines five foundational objectives of sharia: hifz al-din (protection of religion), hifz al-nafs (protection of life), hifz al-'aql (protection of intellect), hifz al-nasl (protection of lineage), and hifz al-mal (protection of property). These five objectives offer a valuable lens through which to assess the impact of waqf forests and their governance in achieving both spiritual and worldly welfare.

2.2. Previous Studies

Afifah and Rochmiyatun (2021) conducted a study to examine the management of productive waqf and the application of Good Corporate Governance (GCG) principles at the Al-Furqon Integrated Islamic School Foundation. Using a descriptive qualitative method with steps including data reduction, data presentation, and conclusion drawing, the study found that the management of productive waqf at the foundation has been well implemented and meets the required indicators of GCG principles. In a related study, Rahmalina et al. (2023) aimed to analyse waqf as a means of promoting religious moderation in the pursuit of social welfare from the perspective of maqasid syariah. Employing a qualitative method with a descriptive-analytical approach based on literature review, the findings indicate that waqf, as a form of spiritual and social worship, reflects the values of religious moderation. Thus, waqf can serve as a key driver in promoting social welfare in line with the values of maqasid syariah.

Firadilla (2024) explored the practices of accountability and transparency in cash waqf management at the Muhammadiyah Cash Waqf Board of West Sumatra, focusing on the processes of implementation, collection, management, and reporting. This study adopted a qualitative descriptive approach and found that the institution has carried out its responsibilities effectively by upholding accountability and transparency in its waqf management.

Further, Ali and Kassim (2020) conducted a study aimed at developing a productive waqf forest scheme to support the achievement of the Sustainable Development Goals (SDGs). Using a literature review and interpretative analysis, their findings reveal that productive waqf forests offer both intangible and tangible benefits. These benefits contribute to various SDG targets, including poverty and hunger reduction, climate and environmental protection, health, biodiversity conservation, and water supply—most of which are directed toward the mauquf 'alaih (beneficiaries).

3. RESEARCH METHODOLOGY

This study employs an exploratory case study approach with a qualitative method to describe and analyse the relevant phenomena in depth. A case study approach is deemed suitable because it allows for a detailed and comprehensive understanding of the issues being investigated. The data collection techniques used in this study consist of interviews and document analysis.

For the interviews, online semi-structured interviews were conducted with members of the Bogor Waqf Forest Foundation, including the founder, accounting team, and field team. A semi-structured interview format was chosen to provide flexibility, with a list of guiding questions prepared in advance while still allowing space for follow-up questions during the interview process. The main purpose of the interviews is to gain an understanding of the governance practices applied by the Bogor Waqf Forest. In addition, secondary data relevant to the research was collected through documentation that included books “Waqf Forests: Theory and Practice” and scientific journal articles that support this study.

To analyse the data, thematic analysis was applied. According to Braun and Clarke (2006), thematic analysis is a method for identifying, analysing, and reporting patterns (themes) within the collected data. The process of thematic analysis involves the following steps: (a) familiarisation with the data, (b) generating initial codes, (c) searching for themes, (d) reviewing themes, (e) defining and naming themes, and (f) producing the report. The categorisation of research findings was based on grouping data by definition of each Islamic principle, as well as referring to findings and studies from relevant scientific journal articles as supporting evidence.

3.1. Overview of the Case

The journey of the Bogor Waqf Forest began in 2018, marked by the publication of an article titled “Waqf for Sustainable Forest Management” on the website sharianews.com. Following the publication, an alumnus of IPB (Bogor Agricultural University) contacted the initiators and expressed his intention to donate 1,500 m² of land located in Muara Village, Cibunian Village, Pamijahan District, Bogor Regency. This initial donation became known as Bogor Waqf Forest Zone 1. The land, previously a rice field, includes a water source and a shelter used for the activities of Sekolah Rimbawan Kecil, an educational initiative focused on environmental awareness for local children.

In 2019, the Bogor Waqf Forest community was formally established under the Yassiru Foundation and began its fundraising efforts. Waqf was collected in the form of monetary contributions, which were then used to expand the forest area. Through these funds, an additional 1,200 m² of land was acquired. Unlike the first zone, this land was already covered with fruit-bearing trees and included a sheep pen suitable for development. During the same year, outreach efforts began, including the publication of further articles to raise public awareness. In 2020, the Bogor Waqf Forest Community officially became the Bogor Waqf Forest Foundation, acquiring legal status through a Foundation Establishment Deed and a decree from the Ministry of Law and Human Rights.

The vision of the Bogor Waqf Forest is to establish a broad, productive, and sustainable waqf forest that brings ecological, economic, socio-humanitarian, and Islamic propagation (da’wah) benefits. To achieve this vision, the foundation has outlined several missions: (1) promoting the waqf forest to the Indonesian and global public through various platforms and social media, both online and offline; (2) raising waqf funds and other financial sources for land acquisition and forest management; (3) organising ecological, economic, social-humanitarian, and Islamic da’wah-oriented activities within the waqf forest; (4) conducting research and studies to support waqf forest development; and (5) providing transparent and accountable reports on finances and activities.

The programmes within the Bogor Waqf Forest encompass multiple aspects, including ecology, economy, education, social da’wah, humanitarian work, and research. These programmes are carried out through a range of collaborative activities involving various stakeholders.

4. FINDINGS AND DISCUSSION

4.1. Implementation of Islamic Principles in Bogor Waqf Forest Governance

a. *Tawhid (Oneness of God)*

Tawhid is the fundamental principle in Islam, asserting that all actions—including organisational governance—must ultimately be directed toward seeking the pleasure of Allah. Although not explicitly stated during the interviews, waqf activities carried out by the foundation embody the principle of tawhid, as waqf is a form of worship and a means of dedicating property to Allah for the purpose of worship and the benefit of society. The implementation of tawhid by the foundation is reflected in several practices.

First, the foundation formalised the waqf land through a waqf pledge deed and certification by the National Land Agency (BPN). By legally transferring ownership to Allah through waqf, the foundation affirms the intention of *lillahi ta'ala*—that the land is entrusted to serve the public good in the name of God. Second, the foundation actively engages in public outreach and socialisation. Through these efforts, it introduces the waqf forest to a broader audience and promotes the values of waqf and environmental sustainability as acts of worship and devotion to God's creation. This socialisation serves as a form of *da'wah* that disseminates Islamic teachings on the importance of waqf in enhancing social welfare.

Third, the principle of tawhid is also embedded in the foundation's vision: to establish a large, productive, and sustainable waqf forest that brings ecological, economic, social, and Islamic *da'wah* benefits. One of the foundation's core goals is to use the waqf forest as a medium for Islamic propagation and to contribute to the well-being of the *ummah*.

b. *Amanah (Trust)*

Amanah refers to the obligation of every individual and institution to uphold the trust entrusted to them by Allah, fellow human beings, and stakeholders. In the context of waqf management, this means that donated assets must be used strictly in accordance with the waqif's intentions. As emphasised by Hassan et al. (2017), *nazhir* (waqf managers) are not the absolute owners of waqf assets; rather, their duty is to fulfil the wishes of the waqif. The implementation of amanah by the Bogor Waqf Forest Foundation can be seen in several key practices:

- i. The foundation formalised the waqf land through the creation of a waqf pledge deed and registration with the National Land Agency (BPN), thereby ensuring legal recognition of the land's status and protection against potential invalid claims.
- ii. The foundation has established an organisational structure. Although some overlapping roles exist due to limited human resources, this structure reflects that individuals are assigned specific responsibilities and are accountable for their respective roles.
- iii. Financial records are maintained, documenting the use of funds as evidence of efforts to safeguard the financial trust placed by donors.
- iv. A clear separation is maintained between endowment and non-endowment funds to prevent the misallocation of waqf assets for unintended purposes.
- v. The foundation provides biannual reports on fund utilisation through its official website, demonstrating transparency and accountability to both waqif and the public, and thereby reinforcing the trust that has been given.
- vi. The foundation implements a variety of programmes as channels for distributing the benefits of waqf, ensuring that the benefits of the donated assets are received by those entitled and in need.

c. *Mas'uliyah (Accountability)*

Accountability refers to the conscious responsibility for one's actions, both before Allah and fellow human beings. The Qur'an, in Surah An-Nisa' verse 86, emphasises that every Muslim must act with care and be accountable for their deeds, as all actions will ultimately be judged by Allah in the hereafter. In the context of governance, accountability encompasses responsibility for performance, financial management, and decision-making. The Bogor Waqf Forest Foundation demonstrates its commitment to accountability through the following governance practices:

- i. Conducting basic financial record-keeping and providing training in financial reporting. These records are expected to be developed in greater detail and aligned with accounting standards, which underscores the need for continued capacity building. Financial reports function as a primary form of financial accountability.
- ii. Publishing financial reports on the foundation's official website, thereby enhancing transparency and enabling public access to relevant information.
- iii. Holding weekly meetings that serve as internal accountability mechanisms, allowing team members to report on progress, conduct evaluations, and plan future activities.
- iv. Utilising Notion, a digital workspace tool, to monitor progress and assign clear responsibilities to team members for their respective tasks.
- v. Implementing supervision systems to ensure that tasks are executed in alignment with the foundation's objectives.

d. Adalah (Justice)

'Adalah (justice) demands fairness in every aspect of organisational practice. The Bogor Waqf Forest Foundation reflects the implementation of this principle through the following actions:

- (a) Distributing benefits across various sectors—such as ecology, economy, education, social welfare, and da'wah—which indicates a fair and inclusive allocation of resources to the broader community.
- (b) Preparing financial reports and sharing information transparently with the public, without discrimination, ensuring that all stakeholders have equal access to relevant data.

Shura (Consultation)

Shura (consultation) emphasises the importance of participatory decision-making, where decisions are expected to be well-considered and supported collectively. The Bogor Waqf Forest Foundation implements this principle through the following practices:

- i. Conducting weekly meetings that serve as a forum for consultation related to planning, decision-making, and evaluation.
- ii. Developing programme plans and targets, which demonstrate that decisions are made through collective discussion and mutual agreement regarding the activities to be implemented.
- iii. Collaborating with various external parties, as part of a consultative approach to effectively realise the programmes carried out within the waqf forest.

Taqwa (Awareness of Allah)

Taqwa refers to awareness of and obedience to Allah. In the context of governance, taqwa serves as a moral compass that motivates individuals and institutions to act with honesty, responsibility, fairness, and professionalism. The Bogor Waqf Forest Foundation demonstrates the application of taqwa through the following practices:

- i. The foundation has generally implemented sound governance practices, including legal compliance, transparent reporting, regular meetings, the use of proper terminology, and the provision of benefits to the community.
- ii. Delivering benefits to the community reflects a sincere intention to do good, grounded in the spiritual awareness derived from taqwa.
- iii. Outreach and socialisation activities reflect a commitment to promoting public welfare, driven by a consciousness of serving Allah through social contribution.
- iv. The establishment of several Standard Operating Procedures (SOPs) ensures that activities are carried out in accordance with defined rules and standards, reinforcing discipline and integrity in practice.

Hisbah (Supervision and Enforcement of Goodness)

Hisbah in governance refers to the promotion of good practices and the prevention of wrongdoing, which requires ongoing supervision and evaluation to ensure compliance with established values and

objectives. The Bogor Waqf Forest Foundation applies the principle of hisbah through the following measures:

- i. Appointing a supervisor to oversee field activities, ensuring that implementation aligns with the foundation's mission and ethical standards.
- ii. Conducting weekly meetings and utilising Notion as a tool for monitoring and evaluating each programme, allowing the team to track progress, address challenges, and improve performance continuously.

4.1.1. The Contribution of the Bogor Waqf Forest to Achieving the Maqashid Syariah Goals

From a governance perspective, the programmes and activities implemented by the Bogor Waqf Forest Foundation contribute significantly to achieving the five maqasid al-shari'ah objectives as outlined by Al-Ghazali. The following are the specific contributions made by the foundation in fulfilling these objectives:

a. Hifz Ad-Din (Preserving Religion)

The Waqf Forest Foundation is an Islamic institution dedicated to developing waqf forests as a means of worship to Allah. As such, waqf forests serve to preserve religion (hifz al-din), aligning with the view of Rahmalina et al. (2023), who argue that waqf, as a form of worship and implementation of Islamic law, contributes to the preservation of religion within society. The foundation's vision— "To realise extensive, productive, and sustainable waqf forests that are beneficial ecologically, economically, socially, and humanely, as well as for Islamic da'wah"—reflects its commitment to Islamic propagation. The element of da'wah in this vision reinforces the role of waqf forests in encouraging religious observance and awareness, thereby supporting the preservation of religion. The foundation actively promotes da'wah by raising awareness about the significance of waqf and the role of waqf forests in everyday life.

In addition, the foundation contributes to religious preservation through regular monthly Qur'an reading programmes for local children. These activities provide early religious education and spiritual guidance. As stated in an interview, "Another regular activity is Qur'an reading for children in one of the zones." This initiative ensures that Islamic teachings are imparted to the younger generation, further supporting hifz al-din. In summary, the waqf forest preserves religion through its function as a form of worship, its support for Islamic da'wah, and its educational activities that nurture the faith of the community—particularly children.

b. Hifz An-Nafs (Protecting the Soul)

Waqf forest provides not only environmental benefits but also contribute significantly to the well-being of surrounding communities through various programmes. The foundation actively works to improve quality of life and address community needs. This aligns with findings by Rahmalina et al. (2023), who emphasise that waqf can serve as a driver for achieving social welfare—an outcome that contributes to the preservation of the human soul (hifz al-nafs).

The principle of amanah (trustworthiness) also plays a key role in protecting the soul, as it ensures that waqf assets are managed in a way that directly benefits the community. Furthermore, waqf forests indirectly promote community health by improving air quality and offering a green environment—both of which support physical and mental well-being. This is consistent with research by Rahman and Widiastuti (2020), which highlights the connection between soul preservation and health. In summary, waqf forests contribute to hifz al-nafs by implementing programmes that support economic empowerment, social welfare, da'wah, and education, all of which are designed to improve the welfare and health of the community.

c. Hifz Al-'Aql (Preserving the Mind)

In support of hifz al-'aql (preservation of the mind), the waqf forest provides various training programmes for the surrounding community, such as stingless bee farming and carp cultivation. These

initiatives aim to enhance practical knowledge and skills. Additionally, the foundation offers financial recording training for its internal team to ensure that information presented to stakeholders is more accurate and detailed. This aligns with the findings of Rahman and Widiastuti (2020), who argue that preserving the mind can be achieved through initiatives that enhance both general and religious knowledge.

Beyond training, the waqf forest also facilitates informal educational activities for children in the village. These activities, as documented in *Waqf Forest: Theory and Practice* (p. 78), focus on instilling a love for nature and environmental awareness from an early age. Moreover, in its governance practices, the foundation conducts consultations (*shura*) to support rational and thoughtful decision-making by considering multiple perspectives. In conclusion, the waqf forest contributes to *hifz al-'aql* by providing capacity-building programmes for both the community and the foundation team, offering informal education for children, and promoting rational thinking through consultative decision-making processes.

d. Hifz An-Nasl (Preserving the Next Generation)

The Waqf Forest Foundation envisions the waqf forest as a sustainable legacy that can be enjoyed by future generations. Its ecological impact contributes to the creation of a healthier and more sustainable environment, thereby supporting *hifz al-nasl* (protection of progeny). By preserving natural resources and ecosystems, the waqf forest ensures that future generations inherit a better quality of life. This aligns with the findings of Setyorini et al. (2021), who state that environmental waqf contributes to sustainable environmental conservation and promotes intergenerational justice, wherein future generations benefit from at least the same—if not better—access to natural resources as the current generation. Beyond ecological preservation, the foundation also fosters moral and spiritual development by providing educational programmes for local children, such as Qur'an reading classes and informal schooling. These initiatives aim to cultivate environmental awareness and Islamic values from an early age, reinforcing the idea that preserving future generations encompasses both physical well-being and spiritual inheritance. Through its environmental efforts and value-based education, the waqf forest serves as a medium for intergenerational preservation. It ensures that future generations inherit not only material and ecological wealth but also strong moral and religious foundations.

e. Hifz Al-Mal (Preserving Wealth)

Waqf is a form of worship that involves the permanent dedication of wealth, whereby the principal must be preserved and protected from damage, while the benefits generated are continuously distributed to the community. As explained by Rahmalina et al. (2023), the perpetual benefits of waqf—if managed effectively and productively—can promote the fair and equitable distribution of wealth. In this regard, waqf plays a vital role in *hifz al-mal* (protection of wealth), as waqf assets are inalienable and must be safeguarded; they cannot be sold, inherited, or repurposed.

Furthermore, accountability in managing resources must be upheld to the highest standards, whether in the context of personal property or communal assets such as zakat, waqf, and infaq. All actions must prioritise the public good and adhere to Islamic ethical values (Lubis & Syam, 2025). At the Waqf Forest Foundation, accountability is demonstrated through the preparation of financial reports and their presentation to stakeholders. Oversight mechanisms are also in place to ensure that waqf assets are maintained and utilised in accordance with their intended purpose. In addition, the foundation ensures that waqf assets are used productively to generate continuous economic benefits. For example, the waqf forest includes clove plantations, which provide substantial economic returns. As noted by Mr. Khalifah, "Currently, we have a clove plantation, and its production even reaches hundreds of tons." In conclusion, waqf serves as a form of worship that protects community assets through the preservation and productive management of endowed wealth, aligning with the objectives of *hifz al-mal*.

5. CONCLUSION

The Bogor Waqf Forest Foundation demonstrates sound governance by implementing Islamic principles in its operations. These principles are reflected in various practices, such as: establishing legal status

(reflecting *tawhid* and *amanah*), maintaining an organisational structure (*mas'uliyah*), conducting financial record-keeping (*amanah, mas'uliyah*), separating waqf and non-waqf funds (*amanah*), delivering training programmes (*mas'uliyah*), preparing and submitting financial reports (*mas'uliyah*), disseminating information transparently (*'adalah*), setting programme plans and targets (*shura*), holding weekly meetings (*shura, hisbah*), using Notion for task tracking (*mas'uliyah, hisbah*), and running diverse programmes that integrate *amanah, 'adalah*, and *taqwa*. Additionally, the foundation has developed standard operating procedures (*taqwa*), collaborates with various stakeholders (*shura*), maintains internal oversight mechanisms (*hisbah*), and actively engages in outreach activities (*tawhid, taqwa*). The foundation's vision also embodies the principle of *tawhid*. Overall, the implementation of these Islamic governance principles supports the fulfilment of the five objectives of *maqasid al-shari'ah*: *hifz al-din* (protection of religion), *hifz al-nafs* (protection of life), *hifz al-'aql* (protection of intellect), *hifz al-nasl* (protection of progeny), and *hifz al-mal* (protection of wealth). It can therefore be concluded that the management of the Bogor Waqf Forest Foundation has successfully incorporated Islamic principles and contributed meaningfully to the realisation of the objectives of *maqasid al-shari'ah*.

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From Classroom to Chatbot: What Motivates Accounting Students to Use CHATGPT in Learning?

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ABSTRACT

The rapid advancement of artificial intelligence (AI) technologies, particularly large language models such as ChatGPT, has significantly transformed educational practices across disciplines, including accounting education. While these tools offer potential benefits such as improved accessibility, personalized learning, and enhanced writing skills, their integration into academic settings raises critical concerns regarding academic integrity, over-reliance on technology, and the erosion of fundamental analytical and critical thinking abilities among students. This study aims to address a critical gap in the literature: the lack of empirical investigation into how students perceive and utilize AI tools like ChatGPT in the context of accounting education, particularly in developing countries where digital literacy and access vary widely. This study investigates the drivers behind ChatGPT adoption among Indonesian accounting students, utilizing the Technology Acceptance Model (TAM) to analyze how perceived ease of use (PEOU) and perceived usefulness (PU) influence learning behavior. A structured survey was conducted involving 720 accounting students from state polytechnics across Indonesia. The results reveal that both PEOU and PU have a statistically significant and positive effect on students' intention to use (ITU) ChatGPT, reinforcing the applicability of TAM in understanding AI technology adoption in educational contexts. These findings highlight that ChatGPT is perceived not only as an accessible and user-friendly platform but also as a valuable educational aid that enhances learning efficiency, comprehension, and adaptability in the digital era. The study contributes to theory by validating the TAM framework in AI-enhanced learning and practically by offering insights for educators, institutions, and developers to integrate AI tools responsibly, ethically, and effectively into higher education. As digital transformation continues to reshape the educational landscape, this research underscores the need to align pedagogical strategies with emerging technologies to foster adaptive, inclusive, and future-ready learning environments. It also identifies avenues for further research on the long-term implications of AI use in education, particularly in terms of academic integrity, data privacy, and skill development.

Keywords: ChatGPT, accounting education, technology acceptance model, intention to use

1. BACKGROUND

The rapid proliferation of digital technology in education has ushered in a paradigm shift, challenging traditional pedagogical approaches and redefining the boundaries of student learning (Holmes & Tuomi, 2022). Among the most disruptive innovations in this domain is Artificial Intelligence (AI), which has introduced new paradigms for teaching and learning. One of the most prominent AI tools that has gained global traction among students is ChatGPT, a generative language model developed by OpenAI. Its ability to generate contextually relevant responses, assist in problem-solving, and provide instant explanations has made it a valuable learning companion across diverse academic disciplines, including accounting.

Accounting students often face challenges in mastering complex subjects such as financial reporting, taxation, budget planning, and auditing. These topics require a deep conceptual understanding, analytical skills, and timely access to accurate information. In this context, ChatGPT offers a promising solution by serving as a supplemental learning tool that aids students in clarifying difficult concepts, completing academic tasks, and accessing references efficiently. Research by Setiawan & Luthfiyani

(2023), for instance, highlights how ChatGPT enhances students' ability to grasp challenging accounting materials independently. The widespread adoption of ChatGPT is evident from recent data. According to the Katadata Insight Center (2023), over 50% of respondents in Indonesia have utilized ChatGPT for educational purposes. Similarly, the Cloudflare Radar (2025) ranks ChatGPT as the most trafficked AI platform globally. Despite its popularity, a critical gap persists in understanding the motivational factors that drive students, particularly accounting students in Indonesia, to adopt this technology.

While ChatGPT offers instant access to explanations, problem-solving assistance, and personalized learning experiences, its integration into academic settings raises fundamental questions: What motivates accounting students to adopt this technology? And how do their perceptions shape their use in academic contexts? To address these questions, this study anchors its investigation in the Technology Acceptance Model (TAM) (Davis, 1989), a robust framework for examining user behavior toward new technologies. TAM posits that perceived ease of use (PEOU) and perceived usefulness (PU) are pivotal determinants of technology adoption (Venkatesh & Davis, 2000). Prior research has validated TAM in diverse educational technologies (e.g., e-learning platforms), but its applicability to generative AI tools like ChatGPT—particularly in non-Western, vocational education settings—remains underexplored (Al-Abdullatif & Alsubaie, 2024; Le et al., 2024).

This study contributes to both theory and practice. Theoretically, it enriches the body of knowledge on technology acceptance in educational contexts, particularly in the emerging field of AI-driven learning. Practically, it offers actionable insights for educators, institutions, and technology developers to integrate AI tools like ChatGPT into curricula effectively and ethically. Ultimately, this research aims to support the development of adaptive and future-ready learning environments in the digital age. As AI becomes entrenched in educational ecosystems, understanding its drivers and implications is no longer optional—it is imperative. This study not only illuminates the psychological and behavioral factors behind ChatGPT adoption but also sets a foundation for future research on AI's long-term impact on skill development, academic integrity, and equitable access in global higher education.

2. THEORETICAL FRAMEWORK

This study is grounded in the Technology Acceptance Model (TAM) (Davis, 1989), a seminal framework for predicting user adoption of new technologies. TAM has been extensively applied in various domains, particularly in the context of information systems and educational technology, due to its ability to explain how users form behavioral intentions to use a particular system based on their perceptions (Venkatesh & Davis, 2000). TAM posits that two key cognitive constructs, Perceived Ease of Use (PEOU) and Perceived Usefulness (PU), directly influence users' behavioural Intention to Use (ITU) a technology, which in turn predicts actual usage.

PEOU refers to the degree to which an individual believes that using a particular system would be free of effort (Davis, 1989). In the context of education, a tool that is intuitive, accessible, and requires minimal technical skill is more likely to be adopted by students. For accounting students, who often face cognitively demanding material, the ease of accessing explanations or solving problems using ChatGPT can significantly influence their willingness to integrate such tools into their learning routines. Prior studies (e.g., Al-Abdullatif & Alsubaie, 2024; Venkatesh & Davis, 2000) have consistently shown that PEOU has a direct and indirect effect on users' behavioral intention through its influence on perceived usefulness.

PU is defined as the extent to which a person believes that using a system will enhance their performance (Davis, 1989). In educational contexts, this refers to students' perceptions that a technology aids them in understanding course material, completing assignments efficiently, or achieving better academic outcomes. ChatGPT's capacity to provide real-time, contextually relevant feedback and explanations aligns well with these expectations. In accounting education—where accuracy, relevance, and timely support are vital—PU is a critical determinant of students' acceptance and sustained use of AI-based platforms (Le et al., 2024).

ITU represents the motivational factor that captures the likelihood of a person employing a technology in the future (Ajzen, 1991). According to TAM, PEOU, and PU jointly shape ITU, which in turn predicts actual system usage. Several empirical studies within the domain of educational technology have confirmed the significant influence of these two constructs on students' behavioral intentions (e.g., Tarhini et al., 2017). However, the specific context of generative AI in accounting education—especially in developing countries and vocational settings—remains relatively underexplored.

2.1. Application of TAM to ChatGPT in Accounting Education

While TAM has been validated in various educational technologies such as learning management systems, mobile learning, and online tutorials, its application to generative AI like ChatGPT is still emerging. Generative AI presents a different user experience compared to static or pre-programmed learning systems, offering dynamic, human-like interaction. This raises novel considerations related to cognitive trust, personalization, and ethical boundaries in usage. By applying TAM to the context of ChatGPT use among accounting students in Indonesia, this study aims to bridge a gap in the literature and provide evidence on how PEOU and PU operate in the acceptance of cutting-edge AI tools. Understanding these relationships is essential for educators, policymakers, and system developers who aim to harness the potential of AI while ensuring responsible and pedagogically sound integration into the curriculum.

3. HYPOTHESES DEVELOPMENT

Prior research consistently demonstrates that systems perceived as easy to use are also considered more useful by users (Davis, 1989; Venkatesh & Davis, 2000). In the context of higher education, if students perceive ChatGPT as effortless and intuitive to operate, they are more likely to recognize its practical value in enhancing their academic performance. Recent empirical studies by Sundkvist & Kulset (2024) and Nugroho et al. (2024) highlight that accessibility and flexibility are among the primary reasons students adopt AI-based platforms like ChatGPT for learning. Similarly, research by Erizal et al. (2024) and Albayati (2024) emphasizes that a simple, intuitive interface increases students' willingness to use AI tools without requiring formal training. Based on the Technology Acceptance Model (TAM) and empirical support from prior studies, this study formulates the following hypotheses:

H1: Perceived Ease of Use (PEOU) has a positive effect on accounting students' intention to use (ITU) ChatGPT as a learning aid.

Within the TAM framework, PU consistently emerges as the most robust predictor of technology adoption intentions (Venkatesh & Davis, 2000). Empirical evidence supports a strong relationship between perceived benefit and the intention to use information technology (Mutiah et al., 2024). The more students perceive ChatGPT as beneficial for understanding accounting concepts, solving problems, and completing academic tasks efficiently, the stronger their intention to adopt the tool in future learning activities. This hypothesis aligns with TAM's core proposition that PU serves as a strong predictor of behavioral intention (Davis, 1989; Le et al., 2024). Therefore, the second hypothesis is formulated as follows:

H2: Perceived Ease of Use (PEOU) has a positive effect on accounting students' Intention to Use (ITU) ChatGPT as a learning aid.

4. RESEARCH METHODS

This study employs a quantitative approach using a survey method to analyze the factors motivating accounting students in Indonesia to use ChatGPT as a learning tool. The quantitative method was selected due to its ability to statistically examine relationships between variables and provide representative empirical findings based on numerical data collected from respondents.

Primary data were collected through a 5-point Likert scale questionnaire (1 = strongly disagree to 5 = strongly agree) distributed online via Google Forms. The survey instrument was developed based on constructs from the Technology Acceptance Model (TAM), specifically measuring Perceived Ease of Use, Perceived Usefulness, and Intention to Use. The questionnaire was structured into two main sections: (1) respondent demographic information, and (2) construct measurement items. All questionnaire items were adapted from Le et al. (2024) with contextual modifications tailored to the learning environment of accounting students in Indonesia.

The study population included all diploma and undergraduate Accounting students from State Polytechnics across Indonesia, totaling 18,590 students. A non-probability convenience sampling technique was employed, considering accessibility and feasibility across different regions. Using Slovin's formula with a 5% margin of error, the minimum required sample size was calculated as 392 respondents. However, the study ultimately collected valid responses from 720 participants, significantly exceeding the minimum threshold.

Data analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM) with SmartPLS version 4.1 software. The analytical process included both outer model testing (assessing construct validity and reliability) and inner model testing (examining relationships between latent variables). PLS-SEM was selected because it is well-suited for predictive and exploratory models, especially when dealing with complex indicator sets. Additionally, PLS-SEM allows for the inclusion of formative measurement models, which are often necessary in technology acceptance studies.

5. RESULT AND DISCUSSION

5.1. Respondent Characteristics

This study involved 720 accounting students from 25 State Polytechnics in Indonesia. Based on demographic data, the majority of respondents were female (570 respondents, 79.17%), while male students accounted for 150 respondents (20.83%). Most respondents were enrolled in semesters 2–8, with an age range of 16 to 25 years, representing the active phase of academic engagement, including the completion of coursework and final projects.

5.2. Descriptive Statistics by Research Variables

Student responses to the ChatGPT platform were analyzed based on the three main constructs in the TAM model: Perceived Usefulness (PU), Perceived Ease of Use (PEOU), and Intention to Use (ITU). All constructs were measured using a Likert scale (1–5). The results are summarized in the following tables.

Table 1: Descriptive Statistics of Perceived Usefulness (PU)

Indicator statement	SDA (%)	DA (%)	N (%)	A (%)	SA (%)
ChatGPT helps me acquire information faster than traditional media.	0.69	2.64	22.92	43.89	29.86
ChatGPT has enriched my learning experience.	0.69	4.58	30.00	46.53	18.19
With a good Wi-Fi or internet connection, I can access information from ChatGPT wherever I want.	0.28	2.36	15.14	46.25	35.97

According to table 1, the majority of students indicated agreement or strong agreement that ChatGPT is beneficial for their learning. On average, 73.5% of respondents stated that ChatGPT helps them understand course material, complete assignments, and enhance learning efficiency. These results suggest that the perceived usefulness of ChatGPT is recognized in the academic activities of accounting students. The results are summarized in the following tables.

Table 2: Descriptive Statistics of Perceived Ease of Use (PEOU)

Indicator statement	SDA (%)	DA (%)	N (%)	A (%)	SA (%)
I would find using ChatGPT for learning flexible and easy	0.83	1.53	22.08	45.14	30.42
Getting information through text, images, and videos on ChatGPT is easy for me.	1.25	2.64	21.81	43.33	30.97
I find it easy to read information on ChatGPT on my phone, tablet, etc.	0.42	2.08	17.64	40.56	39.31

Approximately 76.6% of respondents indicated that ChatGPT is easy to use. Students reported that they did not require specialized training to operate the platform due to its simple, text-based interface and accessibility across various devices. The results are summarized in the following tables.

Table 3: Descriptive Statistics of Intention to Use (ITU)

Indicator statement	SDA (%)	DA (%)	N (%)	A (%)	SA (%)
I plan to use ChatGPT to support my learning in the future	0.83	1.67	25.28	47.36	24.86
I predict that I will use ChatGPT extensively to support my learning	0.69	4.03	34.03	44.44	16.81
I will always enjoy using ChatGPT to support my learning.	0.97	3.06	23.33	48.89	23.75
I will recommend others to use ChatGPT to support learning	1.25	6.25	34.03	39.31	19.17

According to table 3, the results indicate that the majority of students express a strong intention to continue using ChatGPT in their academic learning process. Moreover, they are likely to recommend the platform to their peers, suggesting a high level of satisfaction and perceived value. The results are summarized in the following tables.

Table 4: Loading Factor AVE

Variable	Indicator statement	Loading Factor	AVE
Intention to Use (ITU)	I plan to use ChatGPT to support my learning in the future	0.874	0.734
	I predict that I will use Chat GPT extensively to support my learning	0.847	
	I will always enjoy using ChatGPT to support my learning.	0.889	
	I will recommend others to use ChatGPT to support learning	0.815	
Perceived Ease of Use (PEOU)	I would find using ChatGPT for learning flexible and easy	0.872	0.714
	Getting information through text, images, and videos on ChatGPT is easy for me.	0.799	
	I find it easy to read information on ChatGPT on my phone, tablet, etc	0.862	
Perceived Usefulness (PU)	ChatGPT helps me acquire information faster than traditional media.	0.848	0.713
	ChatGPT has enriched my learning experience.	0.842	
	With a good Wi-Fi or internet connection, I can access information from ChatGPT wherever I want.	0.843	

All factor loadings exceeded the threshold of 0.7, and AVE values were above 0.5, indicating good convergent validity. This suggests that each indicator consistently and accurately represents its corresponding latent construct, supporting the reliability of the measurement model. The results are summarized in the following tables.

Table 5: R-square and Q-square

Endogenous Construction	R-square	Q-square
Intention to Use	0.613	0.610

According to table 5, the R-square value of 0.613 indicates that 61.3% of the variance in Intention to Use ChatGPT is explained by the independent variables: Perceived Usefulness and Perceived Ease of Use. Meanwhile, the Q-square value of 0.610 confirms the model's predictive relevance, demonstrating that the model has sufficient explanatory and predictive power. The results are summarized in the following tables.

Table 6: Hypothesis Testing Results

Hyphoteses	Path Coefficient	t-Statistic	p-Value	Decision
Perceived Ease of Use → Intention to Use	0.462	11.955	0.000	Accepted
Perceived Usefulness → Intention to Use	0.378	9.402	0.000	Accepted

According to table 6, both hypotheses were supported, as indicated by p-values less than 0.05 and t-statistics greater than 1.96. This confirms that both perceived ease of use and perceived usefulness of ChatGPT significantly influence students' intention to adopt it for learning purposes.

5.3. Interpretation and Discussion of Findings

The findings of this study reinforce the validity of the Technology Acceptance Model (TAM) in explaining the adoption of AI-based technologies among accounting students. Both PEOU and PU were found to significantly influence ITU, with PEOU having a slightly stronger impact. This suggests that the simplicity and accessibility of ChatGPT play a crucial role in shaping students' behavioral intention to use it as a learning aid. These results align with previous studies, including Le et al. (2024), which found that AI-based tools are increasingly accepted in higher education due to their ease of use and practical benefits. The high level of agreement among respondents regarding the usefulness and ease of ChatGPT further supports the relevance of TAM in analyzing AI adoption in educational contexts.

The positive perception of ChatGPT's utility and usability reflects the readiness of accounting students in Indonesia to integrate AI tools into their academic activities. This finding has important implications for educators, institutions, and technology developers aiming to design adaptive and effective digital learning environments. However, while the results highlight the positive acceptance of ChatGPT, the study also underscores the need for further research into ethical considerations, data privacy, and long-term impacts of AI on academic integrity and skill development.

6. CONCLUSION

This study aimed to analyze the factors that motivate accounting students to use ChatGPT as a learning aid, adopting the Technology Acceptance Model (TAM) as a theoretical framework. The model focuses on two key constructs—Perceived Ease of Use (PEOU) and Perceived Usefulness (PU)—and their influence on Intention to Use (ITU). Based on data collected from 720 accounting students across 25 State Polytechnics in Indonesia, the findings reveal that both PEOU and PU have a positive and statistically significant effect on ITU. The findings validate the Technology Acceptance Model (TAM) in the context of generative AI for vocational education, while revealing distinctive adoption patterns specific to accounting disciplines and Indonesia's digital learning ecosystem.

Three key theoretical contributions emerge: (1) confirmation of TAM's applicability to AI-powered learning tools in developing countries, (2) demonstration of PEOU's heightened importance during early adoption phases, and (3) empirical documentation of mobile-first adoption behaviors in polytechnic education. The practical implications are particularly relevant for accounting education. First, the strong preference for intuitive interfaces suggests that AI tool developers should prioritize frictionless user experiences with discipline-specific adaptations (e.g., accounting standards databases). Second, educators can leverage ChatGPT's strengths by designing scaffolded activities that utilize its explanatory capabilities while maintaining academic rigor. Third, institutions must establish ethical use frameworks addressing accounting-specific concerns like financial calculation accuracy and data privacy.

Notably, the gender disparity in responses (79.17% female respondents) invites further investigation into the gender dimensions of AI tool adoption in STEM education. While this study focused on behavioral intentions, future research should employ longitudinal designs to assess ChatGPT's actual impact on accounting learning outcomes and professional competency development. Comparative studies across cultural contexts and educational levels would further refine our understanding of generative AI's role in global accounting education. As AI becomes increasingly embedded in educational practice, this study offers both a methodological framework and empirical benchmarks for evaluating technology acceptance in vocational settings. The results underscore that successful AI integration requires balancing technological accessibility with pedagogical value – a consideration as crucial for tomorrow's accounting professionals as their technical training itself.

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Design of Sitting Posture Detection for Employee Using Microcontroller

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ABSTRACT

Sitting for a long time with improper posture can cause various serious health problems such as Low Back Pain (LBP), Deep Vein Thrombosis (DVT), type 2 diabetes and obesity. To overcome this, an employee sitting posture detector was developed that monitors and analyzes sitting posture and duration. This tool uses eight load cell sensors as weight gauges and uses an SD card module for data storage and a high-accuracy RTC timer connected to a microcontroller. The load cell sensor data received by the microcontroller is sent via Bluetooth module to the smartphone application. This tool can detect 8 sitting postures: ergonomically, overlap left back, overlap right back, overlap left, overlap right, sit all, sit front, and sit front back up and this tool is also equipped with an alarm as a reminder to employees to avoid health risks due to prolonged sitting. The result show the system can detect the sitting postures and send the result to the application in 10 meters without obstruction and 8 meters with obstruction. Generally speaking, can be concluded the system has been operating in alignment with the predetermined objectives.

Keywords: Microcontroller, bluetooth, RTC, SD card module, smartphone

1. BACKGROUND

Sedentary behavior especially for employee who working using the computer or most sitting along their working where sitting with a straight back, shoulders back, and buttocks touching the back of the chair because this can reduce the amount of static muscle load on the legs [1]. Spending a long time sitting in the same position can contribute to the appearance of Low Back Pain (LBP)[2]. In addition it also has significant risk factor for Deep Vein Thrombosis (DVT), type 2 diabetes and obesity. Lack of rest during work can disrupt blood circulation and damage muscles in the body which can ultimately reduce body function and cause pain in some parts of the body [3].

Lower Back Pain (LBP) conditions can be caused by work positions that are less ergonomic and cause increased fatigue in the body [4]. Low back pain can be prevented by doing a good and correct sitting work posture according to ergonomics, namely sitting upright not tense better if there is a chair back, the head does not lean forward > 15°, thighs parallel to the floor, arms and hands supported and better feet have a foothold [5]. One example of a less ergonomic work position is when someone performs the same task repeatedly over a long period of time or holds a certain body position, such as a twisting motion position, working with a tilted body position, kneeling, squatting, holding, and clamping with hands for a long time [6].

Therefore, a tool is needed "Design of Sitting Posture Detection for Employees Using Microcontroller" which can provide warnings to employees to be more aware of body health due to sitting too long. This tool can detect 8 sitting postures, namely Ergonomically, Over Lap Right Back, Over Lap Left Back, Over Lap Right, Over Lap Left, Sit All, Sit Front, and Sit Front Back Up. This tool will detect the position of employee or the user position using the load cell sensor which put in the seat cushion and back cushion. The procedure of the system will explain in the research methodology

2. RESEARCH METHODOLOGY

This section describes the design and manufacturing procedures used in the design of a sitting posture detector for employees using a microcontroller.

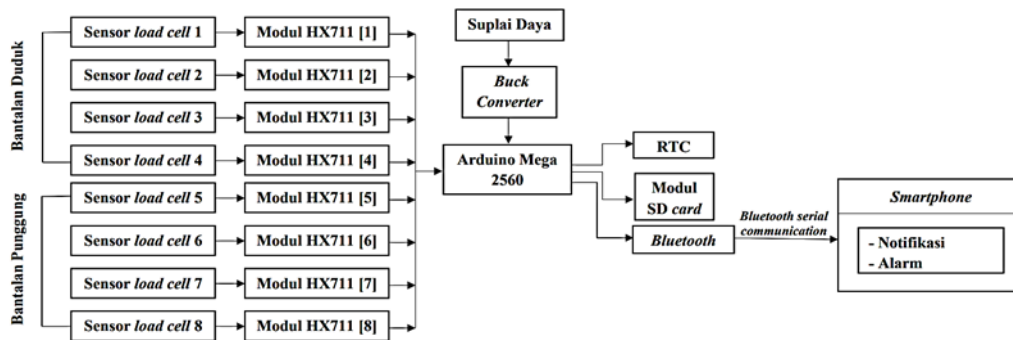


FIG 1: Block Diagram of the System

In Figure 1, it can be seen that this sitting posture detection system uses eight load cell sensors mounted on the chair. Four sensors are placed on the seat cushion, and the other four sensors on the back cushion. Load cells function to detect the load or pressure of the employee's body which shows the weight distribution during sitting. Because the signal generated by the load cell is very small, the HX711 module is used as an amplifier as well as a signal converter from analog to digital so that it can be processed by the microcontroller [7] [8].

Arduino Mega 2560 microcontroller is used as a data processing center, with the support of Real-Time Clock (RTC) to record the time of each measurement. All posture detection data and time are stored on the SD card module, so that they can be accessed at any time for further analysis [9] [10] [11].

To facilitate real-time monitoring, data is sent to a smartphone application via a Bluetooth module. The app, developed using Massachusetts Institute of Technology App Inventor or familiar with MIT App Inventor, displays information about sitting postures and notifies employees of any unergonomic sitting positions. Every 30 minutes, an alarm sounds as a reminder to take a break and will remain active for one minute if not turned off [12] [13].

2.1. Mechanical Designing

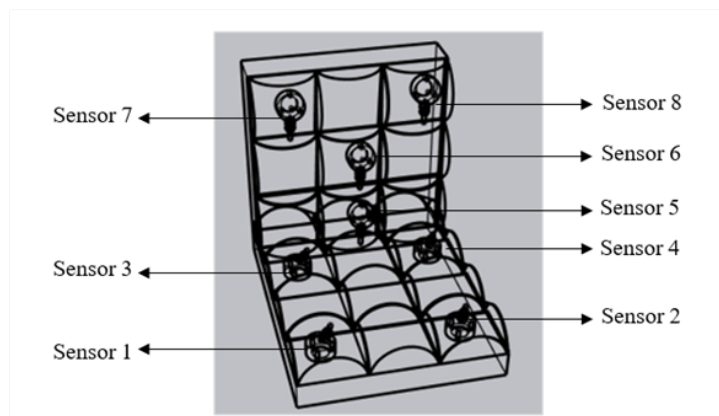


FIG 2: Sensor Positioning Plan

Figure 2 shows the layout of the eight load cell sensors mounted on the chair to detect the employee's sitting posture. These sensors are divided into two groups: four sensors are placed on the seat cushion (sensor 1 to sensor 4) and the other four sensors are installed on the back cushion (sensor 5 to sensor 8).

Sensors 1 to 4 detect the load distribution on the seat cushion, where the main body weight is usually focused when the employee is seated. Sensors 5 to 8 are mounted on the backrest to detect the pressure applied by the employee's back. The combination of these two groups of sensors allows the device to detect a more detailed weight distribution, both in the pelvis and legs and in the back. This configuration aims to provide an accurate picture of the employee's sitting posture and detect uneven loads. A detected load imbalance may indicate an unergonomic sitting posture, potentially causing discomfort or health problems in the long run.

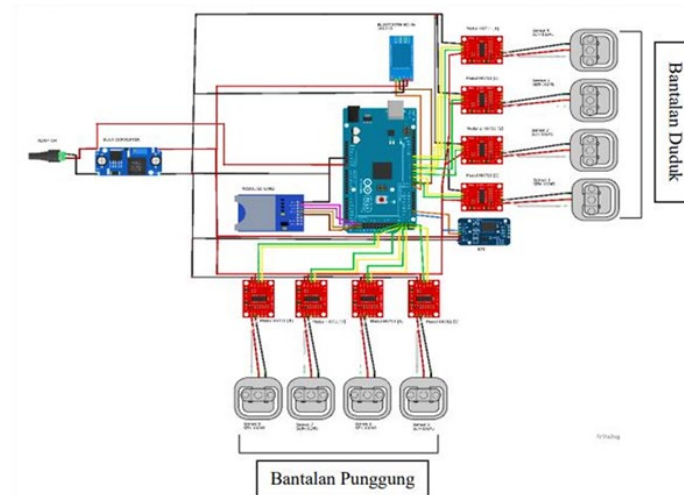


Fig 3: The circuit of tool

The circuit of the tool to position detection can be seen in figure 3. There are four sensor on seat cushion and another four sensor in the back cushion. This sensor will send the data to microcontroller and process this data. The result of the data send to the MIT App Inventor in the handphone to display the position of user.

2.2. Software Designing

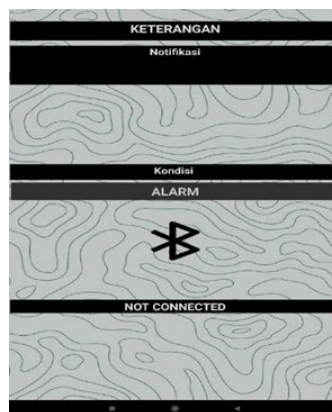


FIG 4: MIT APP Inventor Application System Design on Smartphone

The display of load cell sensor data on the smartphone can be seen in Figure 2. There is some information that will be displayed by the MIT App Inventor application, including:

Table 1: Explanation of the System Design of MIT APP Inventor Applications on Smartphones

Design	Description
Notification	Displays alerts to employees for each movement
Results	Shows sitting posture results during the use of the tool
Alarm	Reminds employees every 30 minutes
Bluetooth	Connects the system to the smartphone

The results will display symbols indicating the employee's sitting posture, which can be seen in Table 2 below.

Table 2: Seating Position Symbols

Symbol	Description
	Ergonomically
	Overlap Right Back
	Overlap Left Back
	Overlap Right
	Overlap Left
	Sit All
	Sit Front
	Sit Front Back Up

3. RESULTS AND DISCUSSION

3.1. Bluetooth Module Testing Results

The Bluetooth module used in this test is the HC-06 Bluetooth module. The purpose of this test is to determine the range at which the connection between the HC-06 Bluetooth module and the smartphone remains stable, ensuring that the posture detection application using the MIT App Inventor functions optimally. This test was conducted by measuring the maximum distance at which the Bluetooth connection remained stable before it was lost. Two testing conditions were evaluated: one without any obstructions and the other with physical obstructions.

Table 3: Results of Bluetooth Testing Without Obstruction

Distance	Condition
0 meters	Detected
1 meter	Detected
2 meters	Detected
3 meters	Detected
4 meters	Detected
5 meters	Detected
6 meters	Detected
7 meters	Detected
8 meters	Detected

9 meters	Detected
10 meters	Detected

This test aims to determine the maximum range of the HC-06 Bluetooth module in an open environment without physical interference. The HC-06 Bluetooth module and smartphone were placed in an open area. The test started at a distance of 0 meters and was gradually increased until the connection was lost. The stable connection range was recorded between 0 meters and 10 meters.

Table 4: Results of Bluetooth Testing with Obstruction

Distance	Condition
0 meters	Detected
1 meter	Detected
2 meters	Detected
3 meters	Detected
4 meters	Detected
5 meters	Detected
6 meters	Detected
7 meters	Detected
8 meters	Not Detected
9 meters	Not Detected
10 meters	Not Detected

The test with physical obstructions aims to assess the maximum range of the HC-06 Bluetooth module in an environment with physical barriers such as walls or partitions. The HC-06 Bluetooth module was placed in one room, and the smartphone in another, separated by a wall or other obstacles. The test started at a distance of 0 meters and was gradually increased until the connection was lost. The stable connection range was recorded between 0 meters and 7 meters.

These test results show that the maximum range of the HC-06 Bluetooth module is affected by the presence of physical obstructions. In an environment without obstructions, the range is wider compared to conditions with barriers.

3.2. Sensor Reading Test Results on the Smartphone

In the load cell sensor readings, the weight measurement is converted into values of 0 and 1. The sensor reading will display a value of 0 if the weight detected by the sensor is less than 200 grams, and it will display a value of 1 if the weight is equal to or greater than 200 grams. This conversion helps determine the sitting posture of employees, as shown in Table 5 below.

Table 5: Seating Posture Specifications

Table 37: Seating Posture Specifications										
Posture	Position	Sensor								Description
		Seat Pad				Back Pad				
		S1	S2	S3	S4	S5	S6	S7	S8	
P1	Ergonomically	1	1	1	1	1	1	1	1	All seat sensors receive equal pressure.
P2	Over Lap Right Back	1	0	1	1	1	1	1	1	Right leg crossed, back pad sensors receive equal pressure.
P3	Over Lap Left Back	0	1	1	1	1	1	1	1	Left leg crossed, back pad sensors receive equal pressure.
P4	Over Lap Right	1	0	1	1	0	0	0	0	Right leg crossed, without using the back pad.
P5	Over Lap Left	0	1	1	1	0	0	0	0	Left leg crossed, without using the back pad.
P6	Sit All	1	1	1	1	0	0	0	0	Seat cushion sensors receive equal pressure, without using the back pad.
P7	Sit Front	1	1	0	0	0	0	0	0	Only the front part of the seat is used, without using the back pad.

P8	Sit Front Back Up	1	1	0	0	0	0	1	1	Only the front part of the seat and the upper back pad are used.
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This test aims to assess how the system works as a whole using the MIT APP Inventor application. During the test, the sitting posture of employees is displayed on the smartphone. The system interface before activation can be seen in Figure 4.

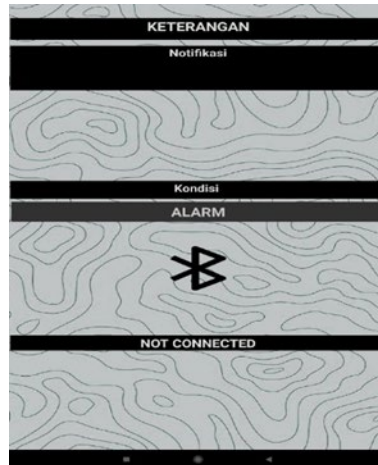


FIG 4: Initial Display of Smartphone Application

The next test involves reading the sitting posture of employees. This test can be seen in Figure 5, where the sitting posture of the employees is in an ergonomic position, with the recorded value being (1111 1111). In this case, the audio output on the smartphone is turned off.

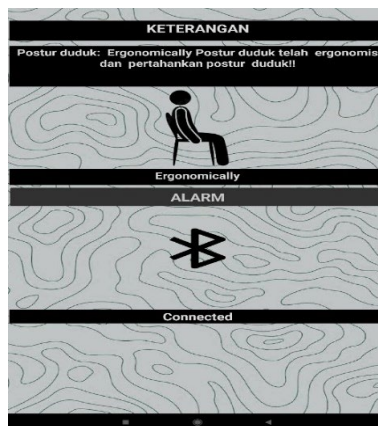


FIG 5: Ergonomic Seating Posture Display

The display when the sitting posture of employees shows a postural error, which is non-ergonomic, can be seen in Figures 6 through 12.

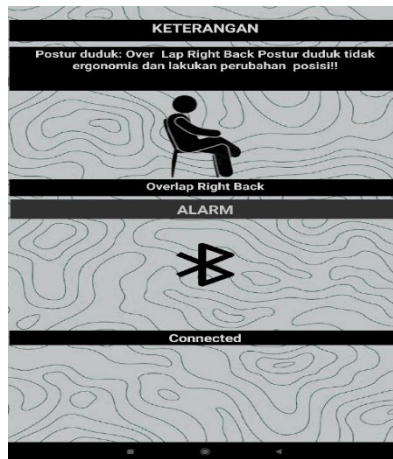


FIG 6: Overlap Right Back Seating Posture Display

In Figure 6, the sitting position of the employee is displayed as Overlap Right Back, with the recorded value being (1011 1111). The system will send the data and display the sitting position as Overlap Right Back. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Overlap Right Back. This posture is non-ergonomic, please change your position!'.

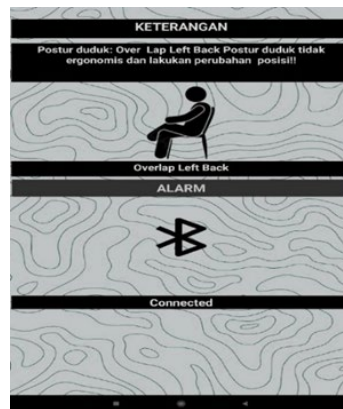


FIG 7: Overlap Left Back Seating Posture Display

In Figure 7, the sitting position of the employee is displayed as Overlap Left Back, with the recorded value being (0111 1111). The system will send the data and display the sitting position as Overlap Left Back. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Overlap Left Back. This posture is non-ergonomic, please change your position!'.

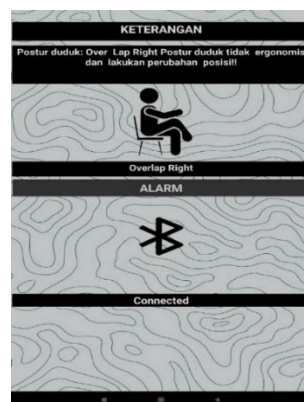


FIG 8: Overlap Right Seating Posture Display

In Figure 8, the sitting position of the employee is displayed as Overlap Right, with the recorded value being (1011 000). The system will send the data and display the sitting position as Overlap Right. The

audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Overlap Right. This posture is non-ergonomic, please change your position!'.

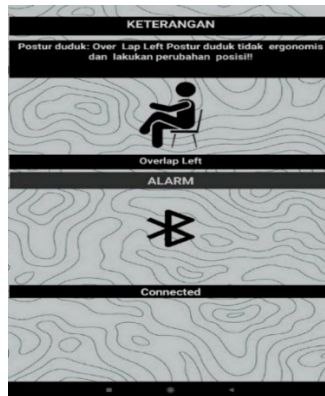


FIG 9: Overlap Left Seating Posture Display

In Figure 9, the sitting position of the employee is displayed as Overlap Left, with the recorded value being (0111 000). The system will send the data and display the sitting position as Overlap Left. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Overlap Left. This posture is non-ergonomic, please change your position!'.

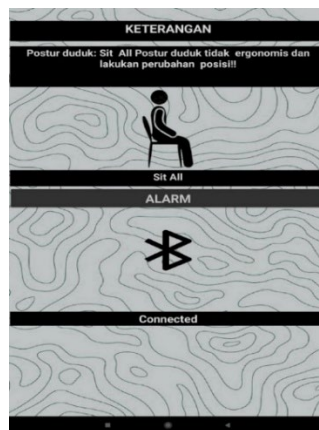


FIG 10: Sit All Seating Posture Display

In Figure 10, the sitting position of the employee is displayed as Seat All, with the recorded value being (1111 000). The system will send the data and display the sitting position as Seat All. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Seat All. This posture is non-ergonomic, please change your position!'.

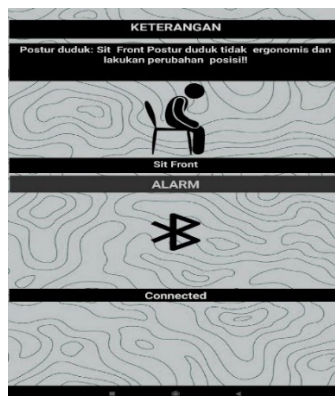


FIG 11: Sit Front Seating Posture Display

In Figure 11, the sitting position of the employee is displayed as Seat Front, with the recorded value being (1100 000). The system will send the data and display the sitting position as Seat Front. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Seat Front. This posture is non-ergonomic, please change your position!'.

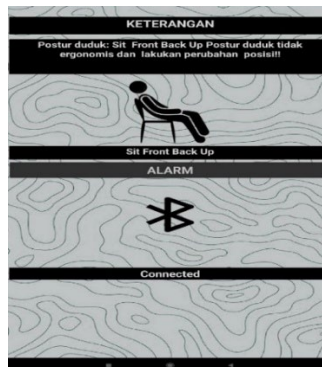


FIG 12: Sit Front Back Up Seating Posture Display

In Figure 12, the sitting position of the employee is displayed as Seat Front Back Up, with the recorded value being (1100 0011). The system will send the data and display the sitting position as Seat Front Back Up. The audio output and notification on the smartphone will provide the warning: 'Sitting Posture: Seat Front Back Up. This posture is non-ergonomic, please change your position!'.

3.3. Alarm Testing

The application also includes alarm settings. This alarm serves as a reminder for employees to stretch and take short breaks every 30 minutes. Short breaks can last about 1-2 minutes to reduce the risk of Lower Back Pain (LBP), Deep Vein Thrombosis (DVT), muscle atrophy, osteoporosis, and heart disease.

Table 6: Results of Alarm Testing Every 30 Minutes

Time	Description
30 minutes	Alarm On
60 minutes	Alarm On
90 minutes	Alarm On
120 minutes	Alarm On

This test aims to ensure that the alarm in the application functions according to the established settings. Based on Table 6, the test results indicate that the alarm works well, sounding every 30 minutes. Thus, the alarm feature in the application can be relied upon to help maintain employee health by reducing the risks associated with prolonged sitting.

4. CONCLUSION

This tool is designed to convert the measured weight values into binary values of 0 and 1, where if the weight detected by the load cell sensor is greater than 200 grams, the conversion result is 1, and it will be 0 if the weight detected by the load cell sensor is less than 200 grams. This tool can detect 8 sitting postures: Ergonomically, Overlap Right Back, Overlap Left Back, Overlap Right, Overlap Left, Sit All, Sit Front, and Sit Front Back Up. The readings will be displayed in the MIT APP Inventor application based on the specified posture values set in the Arduino IDE program.

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