

Readiness to Implement Artificial Intelligence (AI)-Based Learning: A Case Study among Teachers at the Faculty of Technical and Vocational, UPSI

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ABSTRACT

This study explores the readiness of pre-service teachers to implement Artificial Intelligence (AI)-based learning within the Faculty of Technical and Vocational Education at Sultan Idris Education University (UPSI). Despite the increasing integration of AI into Malaysia's national education curriculum by 2027, many pre-service teachers demonstrate limited knowledge, technical skills, and positive attitudes toward AI adoption in educational settings. Employing a quantitative research design, data were collected through a structured questionnaire distributed to 184 purposively selected respondents. The study aimed to examine the relationships between knowledge, skills, and attitudes, and their influence on pre-service teachers' readiness to apply AI in teaching and learning. Findings revealed significant positive correlations between readiness and knowledge ($r = 0.822$), skills ($r = 0.795$), and attitudes ($r = 0.792$), with all results statistically significant at $p < 0.001$. These results underscore the importance of equipping future educators with foundational AI competencies. The study recommends structured training programs and early exposure to AI technologies to enhance the digital teaching capabilities of future educators.

Keywords: Artificial Intelligence, Pre-Service Teacher Readiness, Knowledge, Skills, Attitudes, TVET Education, Social Cognitive Theory

INTRODUCTION

The integration of technology into education has become a central focus for nations striving to align their educational systems with global advancements. Among the emerging technologies, Artificial Intelligence (AI) stands out for its potential to transform teaching and learning through more flexible, personalized, and effective approaches (Rahmiyanti, 2024). In the context of the Fourth Industrial Revolution and the rise of Education 4.0, the demand for AI literacy in education is increasingly urgent. This aligns with the Malaysian Ministry of Education's (MOE) strategic plan to introduce a new curriculum by 2027 that emphasizes digital literacy and foundational AI competencies (Fadhlina Sidek, 2024).

Despite these forward-looking initiatives, the readiness of pre-service teachers to implement AI in classroom settings remains moderate. Jalil (2024) highlights that limited knowledge about AI contributes to a lack of confidence among pre-service teachers, hindering their ability to integrate the technology effectively. Additionally, insufficient training opportunities and a lack of relevant resources further impede the development of AI-related skills (Samsudin et al., 2024).

Attitudinal factors also play a critical role. Negative perceptions and self-doubt regarding the use of AI in teaching can undermine its successful adoption. Yusof and Yaacob (2022) found that many teachers lack confidence in their technological capabilities, while Aziz and Maat (2021) noted that concerns about AI's effectiveness and acceptance present significant barriers to its integration. These findings underscore the importance of addressing not only cognitive and technical competencies but also affective dimensions such as attitudes.

In response to these challenges, this study investigates the readiness of pre-service teachers to implement AI-based learning, focusing on three key dimensions: knowledge, skills, and attitudes. Understanding these factors

is essential to ensure that future educators are well-prepared to embrace AI in the classroom, in line with the goals of 21st-century education and the digital transformation outlined in the Malaysia Education Blueprint 2013–2025.

Problem Statement

Artificial Intelligence (AI) is increasingly being introduced at the early stages of education in Malaysia as part of the Ministry of Education's (MOE) strategic planning (Ministry of Education Malaysia, 2024). A new curriculum is set to launch in 2027, emphasizing students' fluency in digital skills. Recognizing the importance of AI in the national education system, the MOE has proposed a new subject called "Technology and Digital," which focuses on introducing foundational AI concepts to school students. This curriculum is one of seven core competencies that students are expected to master. According to the Minister of Education, Fadhlina Sidek (2024), the primary goal of introducing AI at the school level is to equip students with the ability to apply knowledge and skills to solve problems and create new solutions using computational thinking. This approach aims to ensure that students are exposed to essential technological elements from an early age, preparing them for a rapidly evolving digital world.

However, the question remains: to what extent are pre-service teachers prepared in terms of knowledge, skills, and attitudes to effectively integrate AI technology into classroom teaching and learning? This readiness is crucial to ensure that students can achieve the digital fluency envisioned in the upcoming 2027 curriculum. Therefore, this study seeks to raise awareness and deepen understanding of AI integration in classroom instruction, particularly among pre-service teachers, as they prepare to implement the new school curriculum.

The limited application of AI in classrooms by teachers is a frequently discussed issue in the education sector. This challenge is largely attributed to a lack of knowledge about AI among school teachers. Jalil (2024) found that limited understanding of AI's potential in education leads to low confidence and perceived inadequacy among pre-service teachers, hindering their ability to effectively utilize this technology in their teaching. Knowledge is a key factor in determining their readiness to adopt AI in the classroom. Although AI is increasingly introduced in education, many future teachers still lack a deep understanding of its basic functions and how it can be leveraged to enhance classroom learning (Samsudin et al., 2023). This gap includes not only technical aspects such as algorithms and AI applications but also strategic uses of AI to support more interactive, personalized, and effective learning. The lack of exposure to specialized training on AI in teacher education programs and the scarcity of relevant local educational resources contribute to this deficiency. As a result, the potential of AI to streamline tasks such as automated assessments, adaptive content delivery, and student performance analytics remains underutilized. It is therefore essential to focus on developing AI-related knowledge among future educators to ensure they are equipped for the demands of 21st-century, technology-driven education.

In addition to knowledge gaps, many pre-service teachers lack the necessary skills to operate existing AI technologies during the teaching and learning process. Mastura and Santaria (2020) reported that some teachers are not proficient in using technology. Teachers with limited technological skills face challenges such as technical difficulties, uncertainty in preparing digital teaching materials, and a lack of creative integration in their instruction. Similarly, Alimunir (2023) found that the use of AI by history teachers in classroom instruction remains low due to insufficient technical skills and inadequate training. Pre-service teachers require practical skills to operate AI-based tools in teaching. However, many teacher training programs still lack components that provide direct exposure to technologies like AI. This lack of hands-on training prevents future teachers from acquiring the skills needed to apply AI effectively in real teaching scenarios, ultimately hindering their ability to use the technology successfully. Therefore, AI-related skills are critical for pre-service teachers to ensure successful implementation.

Moreover, Yusof and Yaacob (2022) found that teachers' confidence in their ability to use technology in the classroom is only moderate. This is largely due to a lack of self-confidence in applying AI in teaching. Negative attitudes often serve as a major barrier to the adoption of new technologies in education. Some teachers fear that AI may replace their roles as educators or feel threatened by the changes it brings. Aziz and Maat (2021) also noted that concerns about readiness and the effectiveness of AI implementation are significant issues. Majid and Ismail (2018) similarly observed that weaknesses in teachers' knowledge,

instructional methods, technology use, and trust in technology, as well as their attitudes, contribute to the infrequent use of AI. Therefore, these attitudes must be addressed by providing deeper exposure to the benefits of AI in enhancing teaching and learning quality.

Despite the rapid advancement and widespread application of AI across various sectors, there remains a lack of in-depth research specifically examining the impact and implications of AI on teaching and learning within the Malaysian education context (Niam & Nordin, 2024). Many pre-service teachers in Malaysia have yet to receive adequate training on AI use in teaching, limiting the potential of this technology to improve educational quality. This shortfall not only affects teaching effectiveness but also hinders the education system's ability to compete globally in an increasingly digital era. Consequently, this study aims to assess the readiness of future teachers to implement AI-based learning, focusing on their knowledge, skills, and attitudes toward the technology as a step toward maximizing AI's potential in Malaysia's education system.

This research is therefore vital in evaluating pre-service teachers' readiness to apply AI in learning. The findings are expected to contribute to the broader educational transformation efforts outlined in the Malaysia Education Blueprint (PPPM) 2013–2025. Additionally, the study aims to propose more targeted strategies for developing technological literacy among pre-service teachers and strengthening their preparedness to effectively adapt to AI technologies.

LITERATURE REVIEW

The Application of Artificial Intelligence in Education

Artificial Intelligence (AI) is playing an increasingly important role in education by enabling personalized, interactive, and responsive learning tailored to students' needs. AI can analyze student data to identify individual strengths and weaknesses, allowing for adaptive content delivery (Jiali et al., 2024). This technology not only enhances comprehension but also accelerates learning and boosts student motivation. At the university level, AI supports the development of more responsive curricula based on student performance (Rios-Campos et al., 2024) and contributes to informal learning through educational social media platforms (Chomiak-Orsa et al., 2024). In teacher education, structured and specialized training is essential to ensure that educators understand both the technical and pedagogical aspects of AI and can apply it effectively (Waritsman & Hariyanti, 2024). A lack of training often results in AI being used only at a basic level, which can widen learning gaps among students (Rahmat Ramadhan et al., 2024). AI also has the ability to detect learning patterns and behaviors that are difficult to observe manually, enabling more accurate, efficient, and relevant instructional design for today's generation of learners.

Knowledge of Artificial Intelligence

Knowledge of AI is a fundamental requirement for pre-service teachers to effectively adapt educational technologies. Teachers with sufficient knowledge are not only able to integrate AI into instruction but also enhance the effectiveness of teaching and learning through more interactive and personalized methods (Gunawan et al., 2024). Studies show that early exposure through digital media workshops can help teachers understand AI concepts, build confidence, and reduce hesitation in using the technology (Hakeu et al., 2023). According to the Technology Acceptance Model (TAM), higher levels of knowledge improve perceptions of ease of use and the effectiveness of technology (Tripathi, 2024). Conversely, a lack of knowledge often leads to negative attitudes and resistance toward AI (Bond et al., 2024). Therefore, knowledge not only influences the acceptance of AI but also forms a strong foundation for its implementation in today's digital education landscape.

Skills in Artificial Intelligence

Proficiency in using AI is a critical component to ensure that pre-service teachers can apply this technology effectively in their teaching. According to the International Society for Technology in Education (2016), technological competence involves the ability to use digital tools to support personalized learning, solve problems creatively, and innovate in instructional practices. Teachers skilled in AI can analyze student performance data, provide real-time feedback, and design more effective, personalized learning strategies

(Genua et al., 2024). Additionally, technical problem-solving skills help pre-service teachers overcome challenges related to AI use in the classroom (Samsudin et al., 2024). Structured training and continuous exposure to AI technologies have been shown to enhance professionalism and confidence in using smart learning platforms (Bunyamin, 2021). Thus, mastering AI-related skills not only improves teaching effectiveness but also prepares pre-service teachers to meet the demands of today's digital education environment.

Attitudes Toward Artificial Intelligence

Pre-service teachers' attitudes toward AI play a significant role in determining the level of acceptance and effectiveness of its use in instruction. A positive attitude encourages teachers to explore AI's potential and motivates them to use it to make learning more interactive, relevant, and inclusive (Ummah & Husnan, 2024). Teachers who view AI as a beneficial tool are more likely to adopt adaptive learning systems and smart applications to support student achievement (Sihotang & Apriadi, 2023). Research indicates that positive attitudes can be cultivated through exposure and hands-on training that provide direct experience with AI, thereby increasing teachers' confidence and competence (Sumarni & Muhibbin, 2024). Therefore, fostering a positive attitude toward AI requires ongoing efforts such as practical training, institutional support, and a clear understanding of the benefits this technology offers in 21st-century education.

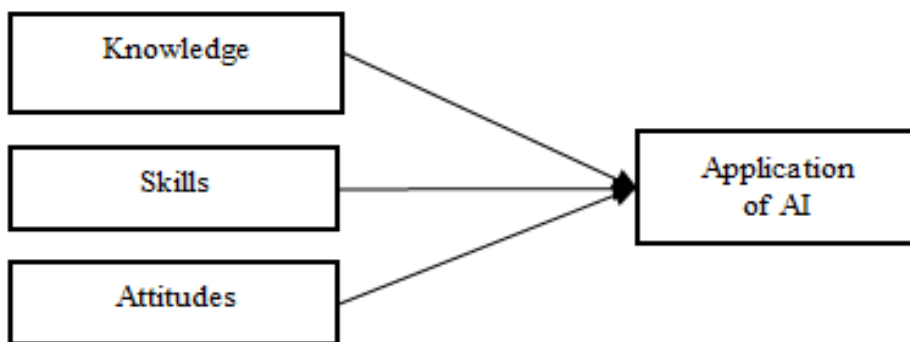


Fig. 1 Conceptual Framework

METHODOLOGY

This study employed a quantitative research design. The sample was drawn from a defined population of pre-service teachers in the Faculty of Technical and Vocational Education who are enrolled in the Bachelor of Education program. A questionnaire was used as the primary data collection instrument. The study was conducted descriptively to identify the levels of knowledge, skills, attitudes, and readiness of pre-service teachers toward the application of Artificial Intelligence (AI)-based learning. It also addressed issues related to pre-service teachers' preparedness in facing technological changes in education. Data collected through the questionnaire were analyzed using both descriptive and inferential statistics to answer the research questions. The distribution of the questionnaire also aimed to obtain more detailed information regarding the factors contributing to pre-service teachers' readiness to apply AI in teaching and learning.

The research adopted a quantitative approach, with the questionnaire serving as the main instrument to address the study objectives. The data were analyzed using SPSS software. Descriptive statistics—percentages, means, and standard deviations—were employed to illustrate the levels of knowledge, skills, attitudes, and readiness toward AI integration in teaching. To interpret mean scores, a five-point Likert scale was applied, ranging from 5 (Strongly Agree) to 1 (Strongly Disagree). The mean values were then classified into five levels, from very low to very high, to determine the actual position of each variable.

This approach enabled the researcher to examine respondent response patterns in detail. To address the research questions, the relationships between knowledge, skills, and attitudes with AI application were analyzed using Spearman's correlation. This test was chosen because the data were found to be non-normal, and Spearman's correlation is suitable for assessing non-linear relationships. The correlation coefficient (r) was used to determine the strength and direction of the relationship, while a significance value of $p < 0.05$

indicated the existence of a statistically significant relationship. The results provided a clear picture of the extent to which each factor influences pre-service teachers' readiness. These findings are crucial for planning appropriate training and support, thereby strengthening the integration of AI in technical and vocational education.

FINDINGS

Of the study participants, 38 percent were male and 62 percent were female, mostly aged between 20 to 25 years (66.8 percent). The majority of respondents have access to internet for AI application by using their own device (61.4 percent).

To confirm the level of agreement for the variables, mean scores were referenced. A mean score of 1.99 and below was rated as 'low,' while a mean score between 2.00 and 3.99 was classified as 'moderate,' and a mean score of 4.00 and above was rated as 'high.' The results showed that the means for AI application ($m = 3.81$), knowledge ($m = 3.82$), skills ($m = 3.73$), and attitudes ($m = 3.92$). It can be concluded that all variables had moderate scores (Shahzada, Khan, Noor, & Rahman, 2014).

Table 1 Pearson Correlation Values

Variables	Pearson Correlation
Knowledge	.822**
Skills	.795**
Attitudes	.792**

The AI knowledge variable demonstrated a very strong and significant correlation with AI application ($r = 0.822$, $p < 0.001$). This indicates that the higher the respondents' level of knowledge about AI, the greater their application of AI in the learning process. This relationship highlights the fundamental importance of knowledge as a key factor in enabling the effective use of AI technology.

Furthermore, there was also a very strong positive correlation between AI skills and AI application ($r = 0.795$, $p < 0.001$). This finding suggests that proficiency in using and implementing AI significantly contributes to the level of AI application among respondents. Although slightly lower than the knowledge variable, skills remain a crucial component in the practical use of AI technology.

A similarly strong positive correlation was found between attitudes toward AI and AI application ($r = 0.792$, $p < 0.001$). This suggests that pre-service teachers' positive attitudes toward AI play an important role in motivating them to apply AI in their teaching. An open and optimistic attitude toward technology can enhance both the willingness and readiness to use it actively.

Overall, all three independent variables; AI knowledge, AI skills, and attitudes toward AI showed very strong and significant relationships with AI application. However, AI knowledge emerged as the most dominant factor influencing the level of AI application, followed by AI skills and attitudes.

CONCLUSIONS

Overall, in today's fast-paced digital era, AI plays an increasingly vital role in education, including in the preparation of relevant teaching materials, monitoring student achievement, and implementing more interactive and personalized instructional methods. Therefore, this study is significant as it explores the extent to which pre-service teachers are prepared to meet the emerging demands of the digital education landscape.

The primary objective of this study was to identify the relationship between pre-service teachers' knowledge, skills, and attitudes and their level of AI application in T&L. Using a quantitative approach with both descriptive and inferential methods, data were collected through a questionnaire distributed to 184 pre-service teachers from the Faculty of Technical and Vocational Education at Sultan Idris Education University. The research design enabled the identification of general patterns among respondents and allowed for correlation analysis to determine the strength of relationships between variables. The questionnaire underwent content validation and reliability testing to ensure the accuracy and trustworthiness of the findings.

The analysis revealed that pre-service teachers demonstrated high levels of knowledge, skills, and positive attitudes toward AI use. This indicates that they are not only aware of the importance of the technology but also possess technical proficiency and a favorable outlook on integrating AI into T&L. The correlation values further support these findings, with knowledge showing the highest correlation ($r = .822$), followed by skills ($r = .795$), and attitudes ($r = .792$). All three correlations fall within the “very strong” category, confirming that pre-service teachers’ readiness to use AI is significantly influenced by their mastery of these dimensions.

These results validate the study’s hypothesis that there is a significant relationship between pre-service teachers’ readiness and their knowledge, skills, and attitudes toward AI. Strong knowledge enables teachers to understand basic AI concepts, recognize its potential in the classroom, and plan its effective use. Skills refer to the practical ability to operate AI-based software, applications, or platforms in delivering instruction. Meanwhile, a positive attitude serves as a key driver for technology acceptance, including the willingness to try new approaches and adapt to change. Together, these aspects are interdependent and essential for empowering pre-service teachers to face future educational challenges.

The study also recommends that, despite the high levels of readiness observed, there is an urgent need for teacher education institutions to provide more training, workshops, and hands-on exposure to AI. This includes collaborative and experiential activities that help pre-service teachers apply AI in real classroom contexts. Teacher training curricula should also be reviewed to ensure they comprehensively incorporate current educational technologies. This is crucial to ensure that every pre-service teacher is not only digitally literate but also capable of integrating technology critically and creatively into their teaching practices.

Overall, the findings of this study present an optimistic outlook on pre-service teachers’ readiness to adopt AI in T&L. It emphasizes that knowledge, skills, and attitudes form a strong foundation for a teacher’s ability to use technology effectively. This study contributes to the educational literature by offering empirical evidence that AI integration in the education system can be more effectively realized if it begins at the teacher training level. Therefore, it is essential for stakeholders such as the Ministry of Education, higher education institutions, and teacher training agencies to play a proactive role in strengthening the digital readiness of future educators.

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