The Integration of Artificial Intelligence (AI) Technology into Teaching Strategies Among Educators in Vocational Colleges of Johor

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Abstract

The rapid advancement of technology, particularly in the field of artificial intelligence (AI), has paved the way for transformation in the educational sector, including vocational education. This study aims to explore the professionalism of Vocational College (KV) educators in Johor in integrating AI technology into teaching strategies. Specifically, the objectives are to identify the levels of knowledge, professional support needs, and challenges faced by KV educators, as well as to examine the relationships among these three variables and their influence on educators' professionalism. This quantitative study employed a survey method involving 148 educators from three Vocational Colleges in Johor, namely KV Muar, KV Batu Pahat, and KV Segamat. The data collected were analysed using descriptive statistics (mean and standard deviation) and inferential statistics (Spearman correlation) to address all research objectives. Findings indicated that the levels of knowledge and professional support needs were moderately high, whereas the challenges faced by educators were high. Inferential analysis revealed a significant relationship between knowledge and professional support needs, and between professional support needs and challenges. However, no significant relationship was found between knowledge and challenges.The implications of the study highlight that successful integration of AI in teaching does not rely solely on educators' knowledge, but also on sustained professional support and the institution's capacity to address implementation barriers. Therefore, targeted training, technical guidance, and infrastructural support are essential in strengthening educators' professionalism in the digital education era. In conclusion, this study contributes to a deeper understanding of the readiness of TVET institutions to embrace technological transformation in education, and provides a solid foundation for future research and educational policy planning.

1. Introduction

Artificial Intelligence (AI) is rapidly transforming the global education landscape, particularly within the context of the Fourth Industrial Revolution (IR 4.0). In Malaysia, the Technical and Vocational Education and Training

(TVET) system is undergoing a digital shift, where AI is seen as a strategic tool to enhance both teaching effectiveness and student engagement (Hermawan et al., 2024).

AI technologies such as learning analytics and intelligent tutoring systems enable real-time feedback, adaptive content, and data-driven interventions that support individual learning pathways (Vorobyeva et al., 2025). In vocational education, AI-powered simulations offer safe and immersive environments for students to develop technical skills without high operational risks—especially in engineering and automotive fields (Zhu, 2025).

Despite its benefits, the integration of AI in Malaysian TVET institutions faces critical barriers. These include limited educator knowledge, inadequate infrastructure, and resistance to change, particularly in rural areas (Cukurova & Brooker, 2023). Educators' digital readiness and institutional support play a vital role in the success of AI adoption. Therefore, improving AI-related competencies among teachers must be a national priority.

2. Literature Review

The integration of Artificial Intelligence (AI) in education has received increasing global attention due to its capacity to enhance instructional delivery and personalise learning, with researchers such as Holmes (2019) and Vorobyeva et al. (2025) highlighting AI's ability to support adaptive learning, real-time feedback, and industry-aligned training essential for TVET environments. Existing studies consistently emphasise that educators' knowledge plays a crucial role in determining the depth and effectiveness of AI adoption, where teachers with stronger conceptual understanding demonstrate greater confidence and readiness to integrate AI tools into teaching (Mat Yusoff et al., 2025). However, Amdan et al. (2024) identified significant gaps in practical AI competency among Malaysian vocational educators, suggesting that knowledge limitations often restrict integration to surface-level digital tasks rather than embedded pedagogical application.

Beyond individual capability, institutional support is also recognised as a key enabler of successful AI implementation. Ting and Norman (2024) found that organisational encouragement and peer influence significantly shape adoption behaviour, while Ithnian (2022) argues that continuous professional development is necessary to strengthen educators' AI competencies. In the Malaysian TVET context, however, professional training is often inconsistent, limiting teachers' capacity to engage with emerging technologies (Amdan et al., 2024). The literature further identifies several challenges—including insufficient infrastructure, unstable internet connectivity, and limited access to high-performance devices—that hinder widespread and sustained implementation, especially in vocational institutions located in rural regions (Zary & Zary, 2025). Ethical concerns such as data privacy, algorithmic bias, and lack of transparency in AI systems contribute additional layers of complexity, with some educators expressing resistance due to fears of diminished professional autonomy (Reiss, 2021; Kurban & Sahin, 2024).

Collectively, these studies reveal that while AI holds transformative potential for vocational education, its successful adoption depends on the interplay between educator knowledge, institutional support, and the realities of technical and ethical challenges. Despite the growing body of literature, limited empirical research has examined how these factors directly influence AI integration specifically within Malaysian Vocational Colleges, thereby establishing the foundation and necessity for the present study.

3. Methodology

This study employed a quantitative survey approach to examine the integration of Artificial Intelligence (AI) into teaching strategies among educators in Johor's Vocational Colleges. The research was conducted in three systematic phases to ensure methodological rigour and contextual relevance.

In first phase, a comprehensive review of current literature on AI implementation in education was conducted, drawing from studies such as Hermawan et al. (2024), Cukurova and Brooker (2023), and Vorobyeva et al. (2025). These sources provided insight into pedagogical applications of AI, educator readiness, and institutional challenges. Policy documents, national TVET reports, and instructional modules were also analysed to map Malaysia's AI landscape, resulting in the identification of key themes such as professional training needs, infrastructure gaps, and ethical considerations. This phase established the conceptual foundation for instrument development.

In the second phase, the findings from the literature review were used to develop a structured questionnaire designed to measure educators' knowledge of AI, their professional support needs, the challenges they encounter,

and their actual AI integration practices. The instrument comprised five sections covering demographic information, levels of AI knowledge, required institutional support, perceived challenges, and current teaching practices involving AI. Each item was constructed to align closely with the study's objectives, ensuring that the constructs were measured with clarity and precision. The questionnaire underwent content validation by three expert reviewers, who assessed the relevance and accuracy of each item. To further ensure reliability, a pilot study involving 30 respondents was conducted, and the results demonstrated strong internal consistency, with Cronbach's Alpha values exceeding 0.80 across most sections. The finalised questionnaire was distributed using a dual-mode approach: online via Google Forms shared through institutional WhatsApp and Telegram groups, and physically through printed copies distributed during staff meetings and professional development sessions. This distribution strategy ensured broad accessibility and maximised response rates across educators with varying levels of digital readiness.

In the final phase, data were collected from a total of 240 educators across three Vocational Colleges—KV Muar, KV Batu Pahat, and KV Segamat—selected based on institutional accessibility and relevance to the study's context. Convenience sampling was employed to ensure efficient participation from educators directly involved in teaching and potentially engaged with AI-related practices. Once responses were gathered, the data were screened, organised, and analysed using Statistical Package for the Social Sciences (SPSS). Descriptive statistics, including mean, percentage, and standard deviation, were used to examine overall trends in educators' AI knowledge, professional support needs, perceived challenges, and actual integration practices. To explore the relationships between variables, Spearman's correlation analysis was conducted, assessing the extent to which knowledge, support needs, and challenges were associated with the integration of AI into teaching strategies. This analytical approach provided a comprehensive understanding of the factors that influence AI adoption within the vocational education context, ensuring that the findings were both empirically grounded and aligned with the study's objectives.

4. Results and Discussion

The analysis revealed that Educators' knowledge and understanding of Artificial Intelligence (AI) is a key determinant in the successful integration of this technology into teaching strategies at Vocational Colleges (KV). Findings from this study indicate that teachers possess a moderate-to-high level of knowledge, particularly in theoretical concepts such as algorithms, automation, and educational data analysis. However, practical exposure to AI tools especially those related to simulations or intelligent learning platforms remains limited among instructors unfamiliar with such systems. This aligns with Mat Yusoff et al. (2025), who emphasized that teachers' comprehension of AI concepts directly influences their confidence and ability to implement it effectively in vocational classrooms. While Amdan et al. (2024) acknowledge a growing awareness of AI's potential among Malaysian TVET educators, they highlight a gap in technical and practical competencies, leading to AI being used merely as a teaching aid rather than as an integrated pedagogical strategy.

This finding demonstrates a moderate and statistically significant positive relationship between educators' knowledge and AI integration ($r = .42$, $p < .001$). This relationship underscores that educators who possess stronger conceptual understanding of AI about its functions, potential, and limitations are more prepared to use it strategically within their teaching. This aligns with the assertions of Hamzah et al. (2021) and Yusof et al. (2024), who emphasised that knowledge forms the intellectual scaffolding upon which digital pedagogy is built. In the context of KV Johor, this suggests that increasing educators' AI literacy could catalyse deeper, more confident uptake of AI tools, shifting integration from surface-level usage to meaningful pedagogical transformation.

In summary, this discussion confirms that AI knowledge is a fundamental prerequisite for effective integration at vocational institutions. A lack of practical competence can obstruct meaningful implementation. Therefore, professional development programs must focus on building educators' technological literacy, technical competence, and digital pedagogy skills to ensure TVET teaching strategies are truly equipped for the Fourth Industrial Revolution.

Table 1: The relationship between educator's knowledge level and Integration of Artificial Intelligence (AI) Technology

The relationship between educator's knowledge level and Integration of Artificial Intelligence (AI) Technology			Level of Knowledge	Integration of AI
Spearman's rho	Level of Knowledge	Correlation Coefficient (r)	1.000	0.42**
		Significant (p)		<0.001
		N	148	148

For professional support plays a pivotal role in ensuring the effective integration of Artificial Intelligence (AI) into teaching strategies at Vocational Colleges (KV) in Johor. The study found that most vocational educators require structured assistance—including technical training, pedagogical guidance, and institutional policies—to overcome both skill gaps and ambiguity surrounding AI's role in vocational curricula.

This study also reveals that professional support needs are significantly and positively related to AI integration (r = .50, p < .001). This indicates that educators who actively seek training, guidance, and institutional interventions are also those making stronger efforts to integrate AI into their teaching. Such a pattern reflects an important psychological and structural truth: educators are willing to innovate, but they crave a supportive ecosystem that nurtures their competency growth. This resonates with findings by Baharin et al. (2024) and Amdan et al. (2025), which argue that training, technical support, and organisational readiness are critical determinants of successful AI adoption. Thus, the relationship highlights that professional development is not a supplementary element but a central pillar sustaining digital transformation in TVET education.

Thus, this study recommends long-term support strategies such as Professional Learning Communities, AI reference centres, and TVET-aligned training modules. Without these, AI risks being used superficially to meet policy demands rather than driving transformative change. The successful integration of AI in vocational education depends not only on teacher knowledge but on institutional ecosystems that nurture educators as change leaders within the IR4.0 landscape.

Table 2: The relationship between professional's support levels and Integration of Artificial Intelligence (AI) Technology

Relationship Between the Level of Support Needs and the Integration of AI Technology in Teaching Strategies Among Vocational College Educators			Level of Knowledge	Integration of AI
Spearman's rho	Level of Support Needs	Correlation Coefficient (r)	1.000	0.50**
		Significant (p)		<.001
		N	148	148

Despite the transformative promise of Artificial Intelligence (AI) in modernising education, its implementation in Johor Vocational Colleges (KV) remains challenged by complex and multifaceted barriers. This study reveals that educators face high levels of difficulty, particularly in areas such as infrastructure, technical skills, ethical concerns, and existing workload pressure factors that not only slow down the integration of AI but also diminish teacher confidence and motivation. As highlighted by Zary & Zary (2025), a critical barrier is the lack of foundational infrastructure to support effective AI systems. Issues such as weak internet connectivity, outdated devices, and limited lab spaces hinder the consistent and scalable use of AI. In many KVs, digital infrastructure can only support basic applications, making high-level AI tools impractical for daily teaching use.

The third relational finding further adds nuance: a moderate, significant positive relationship exists between the challenges educators face and their integration of AI (r = .42, p < .001). At first glance, this may appear paradoxical one might assume that higher challenges would correlate with lower integration. However, the results suggest a more complex reality: educators who are actively attempting to integrate AI are also the ones most acutely aware of its practical barriers, including technological constraints, workload pressures, and infrastructure

limitations (Hoon & Ibrahim, 2024; Rahman et al., 2023). Rather than discouraging them, these challenges become part of the growth process, illustrating the dynamic tension between ambition and limitation that characterises digital innovation in educational settings.

Taken together, the relationships among knowledge, support needs, and challenges reveal a powerful insight: AI integration in vocational education is a multidimensional process shaped simultaneously by competence, institutional support, and the educator's capacity to negotiate barriers. The findings reaffirm the notion that technological transformation is never linear; instead, it unfolds through the interplay of human readiness and organisational strength, echoing broader theoretical perspectives on educational change (Jam, 2023; Yulianti et al., 2023).

Table 3: The relationship between challenges levels and Integration of Artificial Intelligence (AI) Technology

Relationship Between the Level of Challenges and the Integration of AI Technology in Teaching Strategies Among Vocational College Educators				
			Level of Support Needs	Level of Challenges
Spearman's rho	Level of Challenges	Correlation Coefficient (r)	1.000	0.42**
		cant (p)		<0.001
		N	148	148

5. Conclusion

The integration of Artificial Intelligence (AI) into teaching strategies among vocational educators in Johor is no longer a futuristic aspiration—it is a present necessity. This study underscores that while educators demonstrate a moderate-to-high level of theoretical knowledge about AI, their practical application remains limited due to insufficient technical exposure, lack of institutional support, and unresolved implementation challenges.

The significant correlation between educators' knowledge and their AI integration practices suggests that upskilling efforts are crucial. Moreover, sustained professional support—both technical and pedagogical—is essential to build educators' confidence and competence. Challenges such as inadequate infrastructure, ethical uncertainties, and increased workload highlight the need for a robust institutional ecosystem that supports innovation rather than inhibits it.

Therefore, for AI to be meaningfully embedded into vocational education, systemic transformation is required. This includes clear institutional policies, structured training, professional learning communities, and strategic investments in digital infrastructure. By addressing these core issues, vocational educators can be empowered not just as users of technology, but as leaders of pedagogical innovation—positioning Malaysia's TVET sector at the forefront of Industry 4.0.

Conflict of Interest

There is no conflict of interest regarding the publication of the paper.

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