Instructional Leadership and Artificial Intelligence Integration in TVET : A Conceptual Paper

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ABSTRACT

This conceptual paper examines the influence of instructional leadership on the use of artificial intelligence (AI) applications among vocational college lecturers in the Sarawak Zone within the context of the Fourth Industrial Revolution (IR 4.0). While AI technologies are increasingly recognised for their potential to enhance teaching and learning, the actual use of AI applications among vocational lecturers remains inconsistent and relatively limited. Existing studies have predominantly focused on technological readiness and digital literacy, with limited attention given to how instructional leadership shapes lecturers' adoption of AI, particularly within vocational education contexts in Sarawak.

Addressing this research gap, this conceptual paper proposes a conceptual framework that integrates Instructional Leadership Theory with the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Self-Efficacy Theory. The framework explains how leadership practices may influence lecturers' use of AI applications through mediating factors such as self-efficacy, intrinsic motivation, and job satisfaction, as well as moderating factors including technological infrastructure and institutional support. The proposed framework provides a theoretical foundation for future empirical studies and offers insights for strengthening leadership-driven digital transformation in vocational education institutions.

Keywords: Instructional Leadership; Artificial Intelligence; Vocational Education; Vocational College Lecturers; use of AI Applications in Teaching

INTRODUCTION

The Fourth Industrial Revolution (IR 4.0) has accelerated the transformation of global education systems through the integration of advanced digital technologies, particularly artificial intelligence (AI). In contemporary educational environments, AI is increasingly recognised as a strategic tool that can enhance teaching and learning by enabling adaptive instruction, automated assessment, and data-driven learning analytics (Zawacki-Richter et al., 2019; Hwang et al., 2021). Through intelligent algorithms and real-time data analysis, AI applications allow educators to personalise learning experiences, monitor student progress more effectively, and provide timely feedback that improves learning outcomes (Tsai et al., 2022; Chen et al., 2023).

In recent years, AI-powered technologies such as intelligent tutoring systems, educational chatbots, predictive learning analytics, and automated grading platforms have been increasingly adopted in educational institutions worldwide. These technologies have demonstrated considerable potential in improving instructional efficiency, reducing administrative workload, and supporting differentiated learning approaches (Rajapakse et al., 2024; Nguyen et al., 2022). Such developments are particularly relevant to education systems that emphasise digital literacy, competency-based learning, and future workforce readiness in the IR 4.0 era.

Within the context of technical and vocational education and training (TVET), the integration of AI technologies offers significant opportunities to enhance skills-based learning and industry-relevant competencies. Vocational education institutions are expected to continuously adapt their instructional approaches to align with rapid technological changes in the workplace (Zhang et al., 2021; Rahman & Ismail,

2023). AI-supported simulation environments, intelligent assessment systems, and virtual laboratories enable students to develop technical skills in realistic and interactive learning environments. These innovations are consistent with the competency-oriented nature of TVET, which emphasises practical learning experiences and workplace readiness (Che Mat & Abd Aziz, 2024).

Despite these promising developments, the adoption of AI applications among vocational lecturers remains inconsistent. Previous studies have primarily focused on technological readiness, digital literacy, and infrastructure availability as key determinants of AI integration in education (INJET, 2021; Rahman & Ismail, 2023). While these factors are important, the role of leadership in shaping lecturers' willingness and readiness to adopt AI technologies has received relatively limited scholarly attention. In particular, the influence of instructional leadership in guiding lecturers' engagement with AI applications remains insufficiently explored in the existing literature.

This gap is particularly evident in the Malaysian TVET context, especially within vocational colleges located in the Sarawak Zone. Although national policies have increasingly emphasised digital transformation and the integration of emerging technologies in education, empirical evidence on how leadership practices influence lecturers' adoption of AI applications in vocational colleges remains scarce (Ahmad et al., 2024; Zulkifli & Razali, 2024). Variations in institutional support, technological infrastructure, and professional development opportunities may further contribute to differences in lecturers' readiness to adopt AI technologies across institutions.

Given these challenges, understanding how instructional leadership influences lecturers' use of AI applications is critical for supporting sustainable digital transformation in vocational education. Instructional leaders play an important role in shaping institutional vision, fostering supportive learning environments, and guiding lecturers in integrating innovative technologies into their instructional practices (Hallinger & Wang, 2020; Sun et al., 2021). Effective leadership may therefore serve as a key enabling factor that strengthens lecturers' confidence, motivation, and readiness to adopt AI technologies in teaching and learning.

Therefore, this conceptual paper aims to examine the influence of instructional leadership on the use of artificial intelligence applications among vocational college lecturers in the Sarawak Zone. By integrating Instructional Leadership Theory with the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Self-Efficacy Theory, conceptual paper proposes a comprehensive conceptual framework that explains how leadership practices, individual psychological factors, and institutional conditions interact to shape the adoption of AI in vocational education. The proposed framework contributes to the growing literature on leadership and digital transformation while providing theoretical guidance for future empirical research in Malaysian TVET institutions.

LITERATURE REVIEW

Instructional Leadership

Instructional leadership has long been recognised as one of the most influential leadership approaches in improving teaching quality and student learning outcomes across educational institutions (Hallinger & Murphy, 1985; Hallinger & Wang, 2020). The concept emphasises the active role of institutional leaders in guiding instructional processes, establishing academic goals, and creating supportive learning environments that enhance teaching effectiveness. According to the instructional leadership framework developed by Hallinger and Murphy (1985), leadership practices are generally organised into three key dimensions: defining the institutional mission, managing instructional programmes, and promoting a positive learning climate.

These leadership practices enable educational leaders to align instructional activities with institutional goals while fostering a culture of continuous improvement among educators. Empirical studies have demonstrated that effective instructional leadership contributes to higher levels of teacher commitment, professional collaboration, and instructional innovation (Leithwood et al., 2021; Zulkifli & Razali, 2024). Leaders who actively support instructional improvement often encourage educators to experiment with new pedagogical approaches and integrate emerging technologies into teaching and learning processes.

Within the context of technical and vocational education and training (TVET), instructional leadership becomes particularly significant due to the dynamic and technology-driven nature of vocational curricula. Vocational lecturers are required not only to deliver theoretical knowledge but also to facilitate practical skills development aligned with evolving industry standards (Zhang et al., 2021; Rahman & Ismail, 2023). Consequently, instructional leaders in TVET institutions play an important role in encouraging the adoption of innovative instructional practices, including the integration of digital technologies and artificial intelligence in teaching.

Artificial Intelligence Application in TVET

Artificial intelligence has increasingly become an important component of educational innovation, offering new possibilities for improving instructional effectiveness and learning outcomes. AI applications in education include intelligent tutoring systems, adaptive learning platforms, automated grading systems, educational chatbots, and predictive learning analytics (Zawacki-Richter et al., 2019; Chen et al., 2023). These technologies enable educators to personalise learning experiences, analyse student performance data, and provide timely feedback that supports students' learning progress.

In vocational education, the integration of AI is particularly valuable because it supports skills-based and experiential learning. AI-driven simulation environments and virtual laboratories allow students to practise technical procedures in safe and controlled environments while receiving immediate feedback on their performance (Zhang et al., 2021; Che Mat & Abd Aziz, 2024). Such technologies are highly compatible with the competency-based orientation of TVET, which emphasises practical learning experiences and industry-relevant skill development.

Despite these advantages, the adoption of AI applications in vocational education remains uneven. Studies indicate that lecturers' use of AI technologies is influenced by several factors, including digital literacy, access to technological infrastructure, availability of training, and institutional support (INJET, 2021; Rahman & Ismail, 2023). Importantly, organisational leadership also plays a significant role in shaping lecturers' attitudes towards technology adoption by providing guidance, resources, and encouragement for instructional innovation (Basir et al., 2023; Zhang et al., 2021).

Technology Acceptance

Understanding educators' adoption of AI technologies requires a strong theoretical foundation related to technology acceptance and behavioural intention. The Technology Acceptance Model (TAM) developed by Davis (1989) explains technology adoption through two key determinants: perceived usefulness and perceived ease of use. These perceptions influence individuals' attitudes toward technology and their intention to use it.

The Unified Theory of Acceptance and Use of Technology (UTAUT) further extends this perspective by incorporating additional determinants such as social influence and facilitating conditions (Venkatesh et al., 2003). In educational settings, these models have been widely applied to explain teachers' acceptance and use of digital technologies, including artificial intelligence tools (Sun et al., 2020; Rajapakse et al., 2024).

Complementing these models, Self-Efficacy Theory highlights the importance of individuals' beliefs in their ability to perform specific tasks successfully (Bandura, 1977). In the context of educational technology integration, teachers with higher self-efficacy are generally more willing to adopt innovative teaching approaches and experiment with new digital tools (Basir et al., 2023; Mohd Faizal & Norita, 2024). Lecturers who believe in their ability to learn and use AI technologies are more likely to integrate these tools into their instructional practices.

The interaction between leadership practices, technology acceptance, and self-efficacy is particularly relevant in vocational education institutions. Instructional leaders who provide professional development opportunities, technical support, and positive encouragement can significantly strengthen lecturers' perceptions of AI usefulness and increase their confidence in using emerging technologies (Sun et al., 2021; Kim et al., 2023). Therefore, integrating instructional leadership with technology acceptance and self-efficacy perspectives

provides a comprehensive foundation for understanding the adoption of AI applications in vocational education.

THEORITICAL AND CONCEPTUAL FRAMEWORK

This conceptual paper is grounded in an integrated theoretical and conceptual framework that explains how instructional leadership may influence lecturers' use of artificial intelligence (AI) applications in teaching within vocational colleges in the Sarawak Zone. The framework was developed to address the multidimensional nature of AI adoption in vocational education, where leadership practices, individual beliefs, motivational factors, and institutional conditions interact simultaneously. In this conceptual paper, instructional leadership is positioned as the main independent variable, while lecturers' use of AI applications in teaching is specified as the dependent variable. This alignment is important to ensure consistency with the title, focus, and purpose of the manuscript.

From a theoretical perspective, the framework is informed by Instructional Leadership Theory, the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Self-Efficacy Theory. Instructional Leadership Theory, as advanced by Hallinger and Murphy (1985), provides the leadership foundation of the study by explaining how leaders influence instructional direction, pedagogical improvement, and the overall learning climate within educational institutions. In the context of AI integration, instructional leadership is conceptualised as a strategic form of leadership that shapes institutional vision, supports innovation in teaching, and encourages lecturers to adopt emerging digital tools as part of instructional practice (Hallinger & Wang, 2020; Sun et al., 2021).

TAM and UTAUT strengthen the explanatory basis of the framework by clarifying how lecturers form acceptance toward AI technologies. TAM explains that technology use is influenced by perceived usefulness and perceived ease of use (Davis, 1989), while UTAUT extends this perspective through constructs such as social influence and facilitating conditions (Venkatesh et al., 2003). In this conceptual paper, these models do not function as separate dependent variables; rather, they provide the behavioural and cognitive logic explaining why leadership support may enhance lecturers' willingness to use AI applications. In other words, instructional leadership may shape a more positive environment in which lecturers perceive AI as useful, manageable, and institutionally supported.

To improve conceptual clarity and reduce theoretical redundancy, this study synthesises TAM and UTAUT into a unified technology acceptance construct. Rather than treating them as separate frameworks, overlapping elements such as perceived usefulness (TAM) and performance expectancy (UTAUT), as well as perceived ease of use (TAM) and effort expectancy (UTAUT), are conceptually integrated. This consolidation enhances parsimony while retaining the explanatory strength of both models. By streamlining these constructs, the framework becomes more practical, interpretable, and applicable for future empirical testing.

Self-Efficacy Theory adds an important psychological dimension to the framework. According to Bandura (1977), individuals are more likely to perform a task when they believe they are capable of carrying it out successfully. In the present context, lecturers with stronger self-efficacy are more likely to explore, learn, and use AI applications in teaching. Self-efficacy is therefore positioned as a mediating mechanism through which instructional leadership may influence AI usage. Supportive leaders who provide training, encouragement, and professional guidance are likely to strengthen lecturers' confidence in using AI-related tools (Basir et al., 2023; Kim et al., 2023).

In addition to self-efficacy, this conceptual paper proposes intrinsic motivation and job satisfaction as mediating variables. Intrinsic motivation is included because lecturers who feel encouraged, valued, and inspired by leadership are more likely to engage voluntarily with instructional innovation, including AI-based teaching tools. Leadership that promotes professional autonomy, recognition, and innovation may strengthen lecturers' internal drive to experiment with new technologies in teaching and learning (Mohd Faizal & Norita, 2024). Job satisfaction is also relevant because positive leadership practices can create a more supportive and meaningful work environment, which may increase lecturers' openness to pedagogical change and reduce resistance toward technological innovation. In this sense, self-efficacy, intrinsic motivation, and job

satisfaction are not treated as isolated psychological states, but as plausible pathways through which instructional leadership may influence lecturers' actual use of AI applications.

The framework also recognises that the relationship between instructional leadership and AI usage does not occur in a vacuum. Two moderating variables are therefore included, namely technological infrastructure and institutional support. Technological infrastructure refers to the availability and quality of digital facilities such as devices, internet access, AI-enabled platforms, and technical systems required for implementation. Institutional support refers to organisational assistance such as policy direction, technical help, training opportunities, and administrative encouragement. These moderators are important because even strong instructional leadership may not produce meaningful AI usage when lecturers operate in environments with inadequate infrastructure or weak organisational support (INJET, 2021; Ahmad et al., 2024; Hassan et al., 2023). Conversely, when infrastructure and institutional support are strong, the influence of leadership on lecturers' AI use is likely to become more substantial and sustainable.

Based on this logic, the proposed framework suggests both a direct and an indirect relationship between instructional leadership and lecturers' use of AI applications in teaching. The direct relationship reflects the possibility that leadership practices can immediately influence lecturers' adoption behaviour through vision, expectations, and instructional guidance. The indirect relationship reflects the view that leadership also operates through mediating psychological and motivational mechanisms, particularly self-efficacy, intrinsic motivation, and job satisfaction. At the same time, the strength of these relationships may vary depending on the level of technological infrastructure and institutional support available within the institution.

Overall, the proposed framework provides a coherent explanation of how leadership, behavioural acceptance, psychological readiness, and contextual support interact in shaping the use of AI applications among vocational college lecturers. It also offers a stronger basis for future empirical research examining how leadership-driven digital transformation can be strengthened in Malaysian TVET institutions, particularly in the Sarawak Zone.

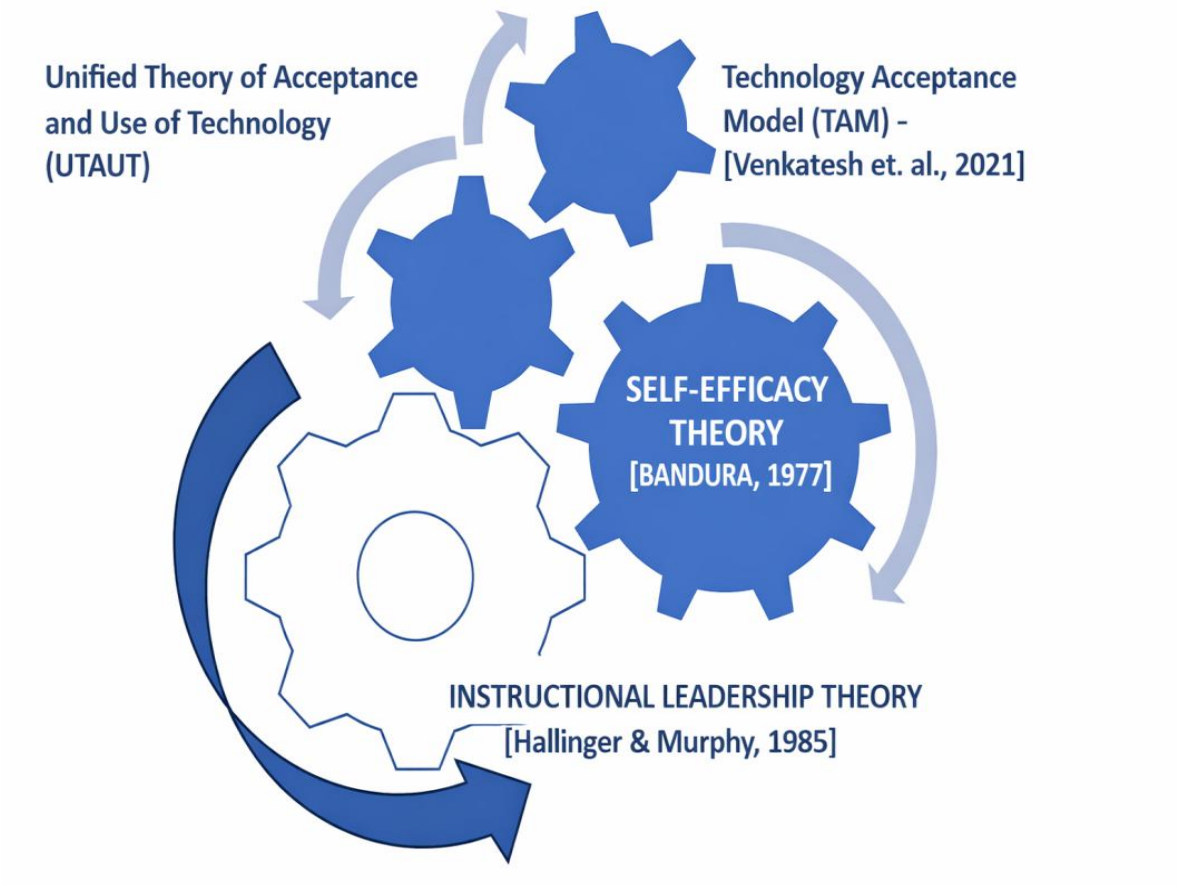

Figure 1 : The proposed Theory Framewor

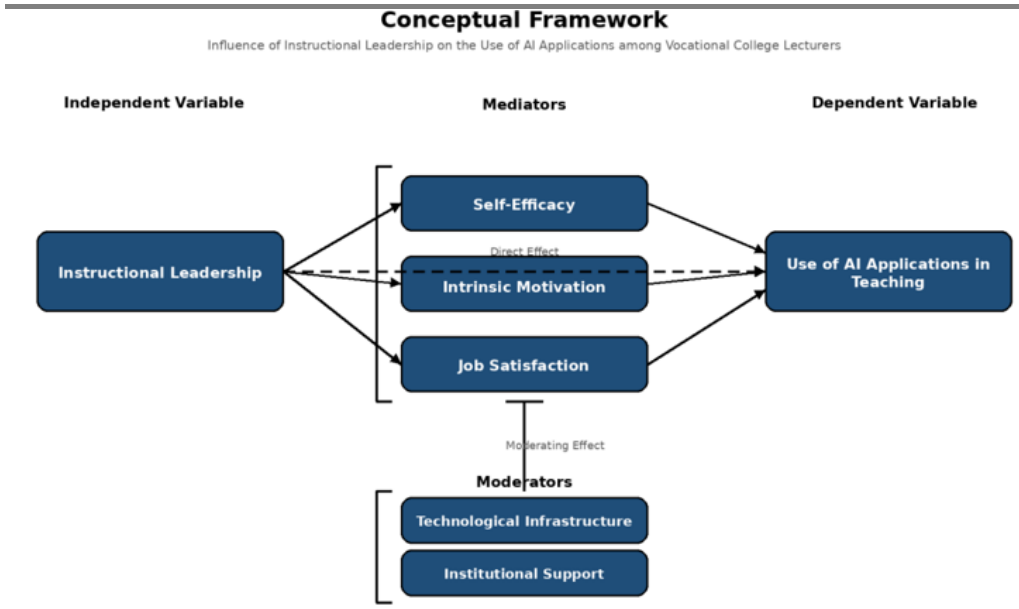

Figure 2: The proposed Conceptual Framework

THEORETICAL IMPLICATIONS

The proposed conceptual framework offers several important theoretical contributions to the literature on educational leadership, technology adoption, and digital transformation in vocational education. First, this conceptual paper extends the theoretical scope of instructional leadership by situating it within the context of artificial intelligence (AI) integration in technical and vocational education and training (TVET). Traditionally, instructional leadership has been associated with curriculum supervision, instructional monitoring, and the development of positive learning environments (Hallinger & Murphy, 1985; Hallinger & Wang, 2020). By linking instructional leadership with the adoption of AI applications in teaching, this conceptual paper reconceptualises instructional leadership as a form of digital transformation leadership that actively supports technological innovation in educational institutions.

Second, this conceptual paper contributes to the technology adoption literature by integrating leadership theory with established models of technology acceptance. While the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) have been widely used to explain individual technology adoption behaviours, they often focus primarily on cognitive and behavioural determinants such as perceived usefulness, perceived ease of use, and social influence (Davis, 1989; Venkatesh et al., 2003). The present framework complements these models by introducing instructional leadership as a contextual and organisational factor that may shape lecturers' perceptions and attitudes toward AI technologies. This integration provides a more comprehensive theoretical explanation of how leadership practices can influence the adoption of emerging educational technologies.

Third, the framework contributes to the growing body of research on psychological factors in technology integration by emphasising the mediating roles of self-efficacy, intrinsic motivation, and job satisfaction. These mediators explain the mechanisms through which instructional leadership may influence lecturers' use of AI applications. Self-efficacy highlights the role of confidence and perceived capability in adopting innovative teaching tools, while intrinsic motivation and job satisfaction reflect lecturers' internal willingness to engage with instructional innovation. By incorporating these psychological constructs, the framework advances theoretical understanding of how leadership influence operates through individual cognitive and motivational processes.

Finally, the proposed framework contributes to the literature by introducing contextual moderating factors, namely technological infrastructure and institutional support. These moderators acknowledge that the effectiveness of instructional leadership in promoting AI adoption may depend on the broader institutional environment. In vocational education institutions, where technological resources and organisational support

may vary significantly, the presence of adequate infrastructure and institutional support can strengthen or weaken the relationship between leadership practices and lecturers' use of AI technologies. This multidimensional perspective aligns with contemporary calls for more integrated theoretical models that consider leadership, psychological readiness, and organisational context simultaneously.

Overall, the framework proposed in this conceptual paper advances existing theories by integrating leadership perspectives, technology acceptance models, and psychological constructs within a single explanatory model. This integrated approach provides a stronger theoretical foundation for future empirical research examining leadership-driven digital transformation in vocational education institutions, particularly within the context of Malaysian TVET.

PRACTICAL IMPLICATIONS

The proposed conceptual framework offers several practical implications for educational leaders, policymakers, and vocational education institutions seeking to promote the effective integration of artificial intelligence (AI) applications in teaching and learning. As digital technologies increasingly reshape educational environments, understanding the organisational and psychological conditions that support technology adoption becomes essential for ensuring successful digital transformation in vocational education institutions.

First, the framework highlights the critical role of instructional leadership in encouraging lecturers to adopt and utilise AI applications in their teaching practices. Institutional leaders, such as college directors, deputy directors, and heads of department, play an important role in shaping institutional culture and influencing lecturers' attitudes toward educational innovation. By demonstrating strong instructional leadership practices—such as providing guidance on digital pedagogy, encouraging experimentation with AI tools, and supporting professional learning—leaders can create an environment that fosters innovation and technological adoption among lecturers. In the context of vocational education, where teaching often involves practical and technical skills, leadership support becomes particularly important in motivating lecturers to explore AI-assisted instructional strategies.

Second, the findings implied by the conceptual framework emphasise the importance of developing lecturers' psychological readiness for technology adoption. The mediating constructs identified in this framework—self-efficacy, intrinsic motivation, and job satisfaction—suggest that lecturers are more likely to adopt AI technologies when they feel confident in their technological abilities, internally motivated to innovate in their teaching, and satisfied with their professional roles. Therefore, vocational education institutions should invest in continuous professional development programmes that strengthen lecturers' technological competencies and digital confidence. Training workshops, peer mentoring, and collaborative learning communities can help lecturers develop the skills and confidence needed to integrate AI applications effectively into their teaching practices.

Third, the framework highlights the significance of institutional conditions in supporting technology adoption. The moderating roles of technological infrastructure and institutional support indicate that leadership initiatives alone may not be sufficient to ensure successful AI integration. Vocational colleges must ensure that adequate technological resources—such as reliable internet connectivity, AI-supported educational platforms, and digital learning tools—are available to lecturers and students. In addition, institutional policies that encourage innovation, provide technical support, and recognise lecturers' efforts in digital teaching practices can strengthen the relationship between leadership and technology adoption.

Fourth, the framework offers practical insights for policymakers responsible for vocational education development. As governments and educational authorities increasingly emphasise digital transformation and the integration of emerging technologies in education, understanding the organisational factors that influence technology adoption becomes essential. The conceptual model proposed in this conceptual paper can serve as a reference for policymakers in designing leadership development programmes, digital competency training initiatives, and institutional policies that support the effective implementation of AI technologies in vocational education institutions.

Finally, the framework provides practical guidance for vocational education institutions seeking to enhance the quality of teaching and learning through AI-supported instructional practices. By recognising the combined influence of leadership, psychological readiness, and institutional support, educational institutions can adopt a more comprehensive strategy for promoting digital innovation. Rather than focusing solely on technological tools, institutions should develop holistic strategies that integrate leadership development, lecturer training, and organisational support systems. Such an integrated approach can contribute to more sustainable and effective AI adoption in vocational education.

In addition to technological and organisational considerations, ethical dimensions of AI integration must be carefully addressed. Issues such as data privacy, algorithmic bias, responsible AI use, and digital equity are increasingly significant in educational contexts. Institutions must ensure that AI systems comply with data protection regulations and safeguard student and lecturer information. Furthermore, efforts should be made to minimise bias in AI-driven decision-making processes to ensure fairness and inclusivity. Digital equity is also essential, as unequal access to AI technologies may widen existing educational disparities. Therefore, ethical governance frameworks should be integrated into institutional policies to ensure that AI adoption is not only effective but also responsible and sustainable.

These practical insights are particularly important for vocational education institutions undergoing rapid digital transformation, where leadership support, lecturer readiness, and institutional resources must operate in synergy to ensure successful AI integration.

CHALLENGES AND LIMITATIONS

Despite the theoretical contributions of this conceptual study, several challenges and limitations should be acknowledged. Recognising these limitations is important for providing a balanced interpretation of the proposed framework and for guiding future empirical investigations.

First, this conceptual paper adopts a conceptual research design, which means that the proposed relationships among instructional leadership, psychological mediators, and the use of AI applications have not yet been empirically tested. While the conceptual framework is grounded in established theories such as instructional leadership theory, the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and self-efficacy theory, empirical validation is required to confirm the strength and direction of the relationships proposed in the model. Future studies should therefore employ quantitative or mixed-method research approaches to test the conceptual model and examine the relationships among the variables in real educational settings.

Second, the discussion of artificial intelligence applications in this conceptual paper remains relatively broad and does not focus on specific AI tools or platforms used in vocational education. AI technologies encompass a wide range of applications, including intelligent tutoring systems, automated assessment tools, learning analytics platforms, and generative AI systems that support instructional design and content development. Because the present study aims to develop a conceptual framework rather than examine specific technological implementations, the pedagogical implications of particular AI tools are not explored in depth. Future research may therefore investigate how specific AI applications influence teaching practices and learning outcomes in vocational education contexts.

Third, the framework proposed in this conceptual paper focuses primarily on organisational leadership, psychological readiness, and institutional conditions as determinants of AI adoption. However, technology adoption in education may also be influenced by other factors that are not explicitly included in the present model. For instance, lecturers' digital literacy, prior experience with educational technologies, and students' readiness to engage with AI-supported learning environments may also shape the effectiveness of AI integration. Future research could expand the framework by incorporating additional variables that capture these dimensions of technology adoption.

Finally, the conceptual framework is discussed primarily within the context of vocational education institutions. While the proposed relationships may be applicable to other educational settings, the specific

organisational structures, technological conditions, and instructional practices found in vocational colleges may differ from those in general academic institutions. As such, caution should be exercised when generalising the framework to other educational contexts. Empirical studies conducted in different institutional settings would help determine the broader applicability of the model.

Despite these limitations, the conceptual framework proposed in this conceptual paper provides an important foundation for understanding how instructional leadership may influence the use of AI applications in teaching. By integrating leadership perspectives, psychological constructs, and institutional factors, the framework offers a comprehensive theoretical basis that can guide future empirical investigations on digital transformation in vocational education.

In addition, although this conceptual paper focuses on vocational colleges in the Sarawak Zone, the proposed framework has potential applicability across broader educational contexts, including other regions in Malaysia and international TVET and higher education institutions. Future research should therefore extend the model across diverse geographical and institutional settings to examine its generalisability and contextual adaptability. Comparative studies across regions and countries would provide valuable insights into how cultural, organisational, and technological differences influence AI adoption in education.

Implementation Challenges in AI Integration

Beyond conceptual limitations, several practical challenges may affect the successful implementation of AI applications in vocational education. One major challenge is infrastructural limitation, particularly in institutions with inadequate internet connectivity, limited access to AI-enabled platforms, and insufficient digital resources. Such constraints may hinder lecturers' ability to effectively integrate AI into teaching practices despite strong leadership support.

Another critical challenge is the need for continuous professional development. Many lecturers may lack the necessary technical competencies and pedagogical knowledge required to utilise AI tools effectively. Without structured training programmes and ongoing support, the integration of AI may remain superficial or underutilised.

Resistance to technological change also presents a significant barrier. Lecturers may exhibit reluctance due to fear of complexity, concerns about increased workload, or uncertainty regarding the effectiveness of AI in improving teaching outcomes. Organisational culture and change management strategies therefore play a crucial role in addressing such resistance.

These challenges highlight that AI adoption is not solely a technological issue but a multidimensional process requiring alignment between leadership, infrastructure, training, and institutional readiness.

CONCLUSION AND FUTURE RESEARCH

This study proposes a conceptual framework explaining how instructional leadership may influence lecturers' use of artificial intelligence (AI) applications in teaching within vocational education institutions. Drawing upon instructional leadership theory, the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and self-efficacy theory, the framework integrates leadership, psychological, and organisational perspectives to explain technology adoption in educational settings. The model suggests that instructional leadership may influence lecturers' use of AI applications both directly and indirectly through the mediating roles of self-efficacy, intrinsic motivation, and job satisfaction, while contextual factors such as technological infrastructure and institutional support may moderate these relationships.

Future research should move beyond conceptual development by empirically validating the proposed framework using robust research designs. Quantitative approaches such as Structural Equation Modeling (SEM) could be employed to test the direct and indirect relationships among instructional leadership, mediating variables (self-efficacy, intrinsic motivation, and job satisfaction), and AI adoption. In addition,

qualitative approaches, including phenomenological or case study methods, may provide deeper insights into lecturers' lived experiences in integrating AI technologies. A mixed-method approach is particularly recommended, as it allows for triangulation of findings and enhances the explanatory power of the model. Empirical validation would significantly strengthen the credibility, applicability, and generalisability of the proposed framework in real educational settings.

Future studies may also investigate specific AI applications used in teaching, such as intelligent tutoring systems, automated assessment tools, learning analytics platforms, and generative AI technologies. In addition, researchers may extend the framework by considering other factors that influence AI adoption, including digital literacy, organisational culture, and lecturers' prior experience with educational technologies.

In conclusion, this study provides a theoretical foundation for understanding how instructional leadership can support the adoption of AI applications in teaching. By integrating leadership theory, psychological constructs, and institutional factors within a single framework, the study offers a comprehensive perspective that can guide future research and support digital innovation in vocational education institutions.

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CONFLICT OF INTEREST

The authors declare no conflict of interest with any party throughout the research and writing process of this paper.

AUTHOR CONTRIBUTIONS

1) Azri bin Said: conceptualized the study, developed the methodology, conducted the formal analysis, and wrote the original draft of the manuscript
2) Md. Rosli bin Ismail: provided supervision, guidance on the research design, and critical review of the manuscript

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