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The Influence of Instructional Leadership on the Use of Artificial Intelligence Applications among Vocational College Lecturers in the Sarawak Zone: A Systematic Literature Review

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ABSTRACT –
The integration of artificial intelligence (AI) has transformed teaching and learning practices, particularly within technical and vocational education and training (TVET). Despite its potential to enhance instructional effectiveness, assessment accuracy, and skills-based learning, the adoption of AI among vocational college lecturers remains uneven and highly context-dependent. Instructional leadership has been increasingly recognised as a key factor influencing educators' readiness and willingness to integrate emerging technologies; however, empirical evidence on its role in AI adoption within vocational education remains fragmented.
This study presents a systematic literature review (SLR) examining the influence of instructional leadership on the use of AI applications among vocational college lecturers, with particular relevance to the Sarawak Zone and comparable TVET contexts. Using a structured review protocol aligned with PRISMA principles, peer-reviewed journal articles published between 2019 and 2025 were systematically identified, screened, and synthesised from major academic databases. The review focuses on studies addressing instructional leadership practices, AI adoption, technology acceptance, and lecturers' self-efficacy.
The findings indicate that instructional leadership influences AI adoption through direct mechanisms, such as vision setting, instructional support, and professional development, as well as indirect mechanisms involving perceived usefulness, ease of use, self-efficacy, and organisational support. Technological infrastructure and institutional readiness further moderate this relationship. Notably, the review reveals a significant lack of context-specific studies focusing on vocational colleges in peripheral and rural regions, including Sarawak. This SLR consolidates existing evidence and identifies critical research gaps to inform leadership practices, institutional policies, and future research on sustainable AI integration in TVET.
KEYWORDS
Instructional Leadership; Artificial Intelligence; Systematic Literature Review; Vocational Education; TVET; Vocational College Lecturers

INTRODUCTION

The rapid development of artificial intelligence (AI) is increasingly transforming teaching and learning practices across global education systems, particularly through adaptive learning systems, automated assessment tools, and data-driven instructional analytics. Recent studies highlight that artificial intelligence is increasingly transforming instructional practices and learning analytics across educational systems (Holmes et al., 2023). In technical and vocational education and training (TVET), AI applications such as adaptive learning systems, automated assessment tools, intelligent tutoring platforms, and learning analytics have demonstrated strong potential to enhance instructional effectiveness, personalise learning, and align skills development with evolving industry demands (Zawacki-Richter et al., 2019; Hwang et al., 2021; Chen et al., 2023). Given the close linkage between TVET and workforce readiness, the integration of AI is increasingly viewed as a strategic priority for future-oriented vocational education systems (Zhang et al., 2021).

Despite this potential, empirical studies indicate that the adoption of AI among vocational college lecturers remains uneven. Prior research highlights that lecturers' engagement with AI is influenced by multiple interrelated factors, including digital competence, perceived usefulness and ease of use of AI applications, access to technological infrastructure, instructional leadership support, and institutional support mechanisms (Davis, 1989; Venkatesh et al., 2003; Rahman & Ismail, 2023). These challenges are particularly pronounced in vocational institutions located outside major metropolitan areas, where infrastructural constraints and contextual limitations may further hinder technology integration (Hassan et al., 2023; Ridzuan, 2025).

Instructional leadership has been widely recognised as a critical factor in shaping educators' readiness to adopt and sustain innovative instructional practices. Instructional leadership emphasises leadership actions that prioritise teaching and learning improvement through the articulation of clear instructional vision, continuous professional development, and the cultivation of supportive learning environments (Hallinger & Murphy, 1985; Hallinger & Wang, 2020). Leaders who actively promote instructional innovation and provide pedagogical guidance have been shown to influence teachers' motivation, self-efficacy, and openness to emerging technologies, particularly AI applications (Leithwood et al., 2021; Sun et al., 2021).

Although a growing body of literature has examined instructional leadership and educational technology adoption, existing research remains fragmented. Many studies focus on general digital technologies rather than AI-specific applications, while others are concentrated in higher education or general school settings (Nguyen et al., 2022; Sun & Medaglia, 2024). Moreover, limited attention has been given to vocational education contexts, particularly in peripheral or rural regions such as the Sarawak Zone. Consequently, there is a lack of systematic synthesis that consolidates existing evidence on how instructional leadership influences the use of AI applications among vocational college lecturers. The growing integration of artificial intelligence technologies is reshaping instructional design, assessment practices, and personalised learning environments (Luckin et al., 2024).

To address this gap, a systematic literature review (SLR) is necessary to provide a comprehensive and transparent synthesis of prior research. Systematic reviews enable the identification of dominant research themes, patterns of findings, and unresolved issues through rigorous and replicable procedures (Zawacki-Richter et al., 2019; Rajapakse et al., 2024). Accordingly, this review aims to synthesise existing studies examining the influence of instructional leadership on the use of AI applications among vocational college lecturers, with particular relevance to vocational education contexts in the Sarawak Zone and comparable peripheral TVET environments. Through this synthesis, the review seeks to inform leadership practices, institutional strategies, and future research directions for sustainable AI integration in vocational education.

Accordingly, this review addresses the following research question: How does instructional leadership influence the adoption and use of artificial intelligence applications among vocational college lecturers?

METHODOLOGY

This study employs a systematic literature review (SLR) methodology to synthesise existing research on the influence of instructional leadership on the use of artificial intelligence (AI) applications among vocational college lecturers. The SLR approach was selected to ensure a transparent, rigorous, and replicable process for identifying, evaluating, and synthesising prior studies, in line with established guidelines for evidence-based educational research (Kitchenham & Charters, 2007; Petticrew & Roberts, 2008). Compared to narrative reviews, an SLR enables a more structured examination of fragmented literature and reduces selection bias through explicit and predefined procedures. Following the screening and eligibility assessment, a final set of 48 studies was retained for thematic synthesis. These studies represent the body of literature examining instructional leadership, artificial intelligence adoption, and related educational technology integration across diverse educational contexts. In the Table 1 shown below is the summary of selected studies in SLR for this article. To enhance the credibility of the synthesis, the methodological

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quality of the included studies was evaluated based on relevance to the research objective, methodological clarity, and contribution to the understanding of leadership-driven technology adoption.

The final synthesis included 48 studies, reflecting the emerging yet expanding body of research connecting instructional leadership, artificial intelligence adoption, and educational technology integration. Previous reviews in AI-in-education have similarly reported limited empirical studies focusing specifically on leadership-driven AI integration (Zawacki-Richter et al., 2019).From the 48 studies included in the final synthesis, several representative studies are summarised in Table 1 to illustrate the diversity of research contexts, methodologies, and key findings relevant to instructional leadership and AI adoption.

Table 1 : Selected Representative Studies Included in the Systematic Literature Review

Author	Year	Research Context	Methodology	Focus of Study	Key Findings
Zawacki-Richter et al.	2019	Higher Education	Systematic Review	AI in education	AI enables adaptive learning, automated assessment, and learning analytics
Hwang et al.	2021	Education Technology	Conceptual analysis	AI development in education	AI supports personalised learning and data-driven teaching
Chen et al.	2023	Global education	Literature review	AI applications in education	AI enhances learning analytics and instructional decision-making
Nguyen et al.	2022	Educational institutions	Quantitative study	Leadership and technology adoption	Leadership vision significantly influences technology adoption
Sun et al.	2021	Vocational education	Empirical study	Technology integration in TVET	Instructional leadership encourages instructional innovation
Basir et al.	2023	Malaysian education	Survey research	Self-efficacy and AI readiness	Teacher confidence strongly predicts AI adoption
Rahman & Ismail	2023	Malaysian TVET	Empirical study	Digital competence and AI adoption	Digital literacy influences lecturers' readiness for AI integration
Rajapakse et al.	2024	Global education	Systematic review	Teachers' perspectives on AI	Institutional support and training influence AI adoption
Kim et al.	2023	International schools	Mixed methods	Teachers' perceptions of AI	Professional development improves AI readiness
Leithwood et al.	2021	Educational leadership	Conceptual review	Leadership and digital transformation	Leadership practices shape technology integration
Sun & Medaglia	2024	Education policy	Review study	Digital transformation in education	Institutional leadership is key for sustainable innovation
Zhang et al.	2021	Vocational education	Literature review	AI in TVET	AI supports competency-based learning and industry alignment

Review Design and Protocol

The review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework, which provides a widely accepted standard for reporting systematic reviews across disciplines, including education and social sciences (Moher et al., 2009; Page et al., 2021). The PRISMA framework guided the review process across four main stages: identification, screening, eligibility assessment, and inclusion of studies. Adopting this protocol enhanced methodological transparency and strengthened the reliability of the review outcomes.The review design focused on synthesising both empirical and conceptual studies that examined instructional leadership, educational leadership, or related leadership constructs in relation to AI adoption or advanced educational technologies. Given the emerging nature of AI in education, this inclusive approach allowed for a more comprehensive understanding of leadership-driven technology integration within vocational and comparable educational contexts.

Data Sources and Search Strategy

A systematic search was conducted across major academic databases that are widely recognised for their coverage of high-quality education and technology research, namely Scopus, Web of Science (WoS), ERIC, and Google Scholar. These databases were selected to ensure broad coverage of peer-reviewed literature on educational leadership, technology acceptance, AI in education, and TVET-related studies (Zawacki-Richter et al., 2019; Rajapakse et al., 2024). The search strategy utilised combinations of keywords and Boolean operators to capture relevant studies, including: (*"instructional leadership" OR "educational leadership") AND ("artificial intelligence" OR "AI applications") AND ("technology adoption" OR "technology integration") AND ("vocational education" OR "TVET" OR "lecturers")*. Search strings were refined iteratively to balance sensitivity and specificity, and database-specific syntax was applied to optimise retrieval accuracy (Kitchenham & Charters, 2007).

Inclusion and Exclusion Criteria

Clear inclusion and exclusion criteria were established prior to the screening process to ensure consistency and relevance. Studies were included if they:

(a) were peer-reviewed journal articles,

(b) were published between 2019 and 2025, reflecting recent developments in AI and digital leadership,

(c) examined instructional leadership or related leadership constructs in relation to AI or advanced educational technologies, and

(d) were situated within vocational education, TVET, higher education, or comparable instructional contexts.

Studies were excluded if they consisted of conference proceedings, book chapters, dissertations, technical AI design papers without educational focus, or non-peer-reviewed reports. This selection strategy aligns with best practices for SLR in education research to ensure methodological robustness and academic credibility (Petticrew & Roberts, 2008; Snyder, 2019).

Study Selection Process

The study selection process followed a multi-stage screening procedure consistent with PRISMA guidelines. Initially, duplicate records were removed. Titles and abstracts were then screened to assess relevance based on the predefined criteria. Subsequently, full-text articles were reviewed to confirm eligibility and alignment with the review objectives. Only studies that explicitly addressed leadership-related factors influencing AI or advanced technology adoption in educational settings were retained for final synthesis. This systematic screening process resulted in a refined corpus of studies suitable for in-depth thematic analysis. The overall selection flow is summarised using a PRISMA flow diagram, which visually represents the number of records identified, excluded, and included at each stage of the review process.

Data Extraction and Analysis

Relevant data were extracted systematically from the final set of studies, including publication year, research context, methodological approach, leadership constructs examined, types of AI applications, and key findings. A thematic synthesis approach was employed to identify recurring patterns, dominant themes, and relationships across studies (Thomas & Harden, 2008). This approach enabled the integration of findings from diverse methodological designs while maintaining conceptual coherence. The synthesis focused on identifying how instructional leadership influences AI adoption through direct leadership practices, as well as indirect mechanisms such as technology acceptance factors, lecturers' self-efficacy, and organisational support. This analytical strategy provided a structured foundation for the presentation of results in the subsequent section.

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RESULTS

This section presents the findings from the systematic synthesis of the included studies. Guided by the PRISMA selection process (Figure 1), 48 studies were included in the final synthesis and analysed using thematic synthesis to identify recurring patterns regarding leadership influence, technology acceptance mechanisms, and contextual moderating factors. Consistent with prior SLR practices in education and technology research, the synthesis prioritised convergence of evidence across studies rather than reporting study-by-study summaries (Thomas & Harden, 2008; Zawacki-Richter et al., 2019; Rajapakse et al., 2024).

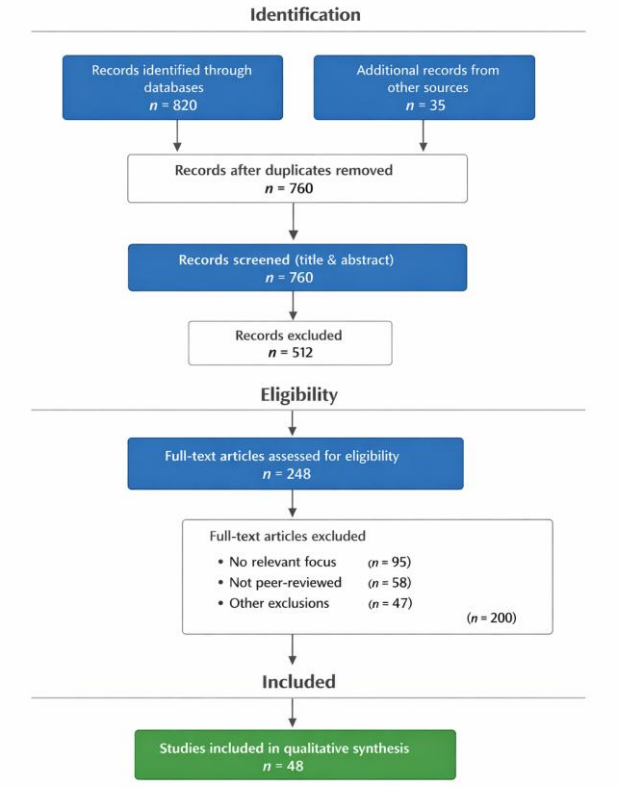

Figure 1 : PRISMA Flow Diagram of the Study Selection Process

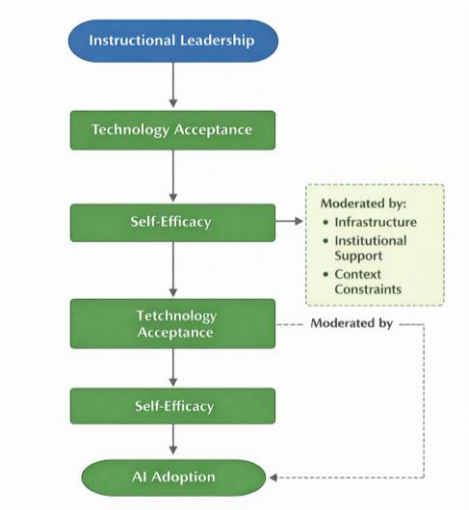

Figure 2 : Integrated SLR Framework of Instructional Leadership and AI Adoption

Descriptive Overview of the Included Studies

Three overarching patterns emerged from the reviewed literature. First, the evidence base remains methodologically heterogeneous, combining quantitative survey-based research (commonly using acceptance/usage constructs), qualitative case studies capturing educators' lived experiences, and conceptual discussions focused on leadership and policy implications. This heterogeneity is typical of emerging domains such as AI-in-education, where empirical maturity is still developing and research agendas remain dispersed (Hwang et al., 2021; Chen et al., 2023).

Second, while the topic of instructional leadership is well-established, studies that explicitly connect instructional leadership to AI-specific adoption are fewer when compared to research on general educational technology, digital platforms, or learning management systems. This supports the broader argument that the AI adoption literature in education is still consolidating and often overlaps conceptually with "technology integration" research more generally (Zawacki-Richter et al., 2019; Sun & Medaglia, 2024).

Third, contextual coverage is uneven: a substantial portion of leadership–technology studies are situated in urbanised, digitally advanced, or higher education contexts, while evidence for vocational education—especially peripheral or rural contexts—is comparatively limited. This aligns with the concern raised in the base paper that AI utilisation among vocational college lecturers can be inconsistent and shaped by readiness, infrastructure, and institutional support.

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Table 2 : Thematic Synthesis of Leadership Factors Influencing AI Adoption

Theme	Description
Instructional leadership influence	Leadership vision, instructional support, and innovation-oriented culture encourage lecturers' adoption of AI applications
Technology acceptance	Perceived usefulness, ease of use, and social influence shape lecturers' acceptance of AI tools
Self-efficacy	Lecturers' confidence in using AI technologies mediates the relationship between leadership and AI adoption
Institutional readiness	Digital infrastructure, technical support, and institutional resources moderate the implementation of AI in vocational education
Context constraints	Variations in digital literacy, rural institutional contexts, and resource limitations affect lecturers' readiness to adopt AI
Implementation risks	Ethical concerns, data privacy issues, and resistance to organisational change may hinder AI integration

The themes identified in Table 2 provide the conceptual structure for the subsequent thematic discussion.

Theme 1: Instructional Leadership as a Direct Driver of AI Adoption

A dominant theme across the literature is that instructional leadership exerts a direct influence on educators' technology adoption by shaping institutional expectations, instructional priorities, and the perceived legitimacy of technology use within teaching practice. This aligns with the classical instructional leadership model, where leaders define mission, manage instructional programmes, and promote a conducive learning climate (Hallinger & Murphy, 1985; Hallinger & Wang, 2020).

Within AI adoption contexts, instructional leadership is most consistently reflected in three practice clusters:

(a) Vision-setting and goal alignment**.**

Studies converge on the idea that leaders who articulate an explicit instructional vision for digital transformation (including AI) reduce ambiguity and increase lecturers' willingness to experiment with new tools. This is particularly relevant in TVET environments where instructional objectives must align with competency standards and workplace demands (Zhang et al., 2021; Sun et al., 2021).

(b) Instructional guidance and supervision.

Evidence suggests that supportive supervision—focused on pedagogical improvement rather than compliance—encourages trial, refinement, and sustained adoption. In technology integration research, such supervisory support is associated with stronger teacher engagement and openness to innovation (Leithwood et al., 2021; Zulkifli & Razali, 2024).

(c) Building an innovation-oriented learning climate.

Leaders who cultivate collaborative cultures (peer mentoring, professional learning communities, recognition of innovation) create social conditions that normalise experimentation and reduce perceived risk of adopting AI applications. In vocational contexts, this climate is consistently linked to stronger adoption readiness because lecturers often require both pedagogical and technical confidence to integrate AI meaningfully (Sun et al., 2021; Basir et al., 2023).

Theme 2: Leadership Influence Operates Through Acceptance Mechanisms (TAM/UTAUT Pathways)

A second central theme is that instructional leadership rarely "causes" AI adoption in a simple linear way. Instead, leadership influences adoption primarily by shaping technology acceptance beliefs and use intentions, which are extensively explained by TAM and UTAUT constructs (Davis, 1989; Venkatesh et al., 2003).

Across the synthesised findings, four acceptance pathways appear repeatedly:

(a) Perceived usefulness (PU).

Leadership actions that connect AI applications to tangible instructional benefits—better feedback, improved assessment efficiency, enhanced personalisation—strengthen lecturers' perceptions that AI is useful for instructional work (Davis, 1989; Chen et al., 2023). This pathway is particularly salient in TVET, where lecturers value tools that support competency assessment and practical skill development.

(b) Perceived ease of use (PEOU) and usability support.

Lecturers' adoption is strongly constrained when AI applications are perceived as complex or time-consuming. Leadership that ensures hands-on training, on-demand technical assistance, and incremental implementation reduces perceived complexity, thereby improving acceptance (Davis, 1989; Kim et al., 2023).

(c) Social influence and normative cues.

UTAUT highlights the importance of perceived expectations from leadership and peers. The reviewed literature indicates that leaders influence adoption by setting norms—through policy, encouragement, modelling use, and recognition systems—so that AI adoption becomes institutionally endorsed rather than optional or risky (Venkatesh et al., 2003; Nguyen et al., 2022).

(d) Facilitating conditions as "organisational readiness".

The evidence consistently reinforces that acceptance beliefs translate into actual use only when enabling conditions exist (infrastructure, access, support). This is especially pronounced in vocational institutions facing infrastructural constraints.

Collectively, this theme suggests that instructional leadership can be understood as a "lever" that shapes the acceptance ecosystem—beliefs, norms, and enabling conditions—rather than functioning solely as top-down enforcement.

Theme 3: Self-Efficacy and Professional Confidence as a Key Mediator

A highly consistent mediator identified across the literature is lecturer self-efficacy referring to confidence in one's capability to use AI applications effectively. Self-efficacy is repeatedly linked to educators' willingness to experiment, persist despite challenges, and integrate technology beyond superficial usage (Bandura, 1977; Basir et al., 2023).

The synthesis indicates that instructional leadership strengthens self-efficacy through:

(a) Structured professional development.

Training that is continuous, practice-oriented, and aligned with instructional needs consistently raises confidence. This is explicitly emphasised in vocational settings where lecturers may need targeted support to translate AI affordances into authentic skills-based pedagogy.

(b) Coaching and peer-supported learning.

Mentoring, PLCs, and collaborative lesson design reduce anxiety and help lecturers build competence incrementally (Kim et al., 2023). These mechanisms are also aligned with instructional leadership's climate-building role (Hallinger & Wang, 2020).

(c) Recognition and psychological safety.

Lecturers are more likely to persist with AI integration when leadership legitimises trial-and-error and recognises innovation, reducing fear of failure. This is crucial because AI applications often evolve rapidly and require iterative learning.

This theme supports the argument that even if lecturers perceive AI as useful, adoption may remain limited unless leaders actively build professional confidence and reduce psychological barriers.

Theme 4: Moderators—Infrastructure, Institutional Support, and Context Constraints

While leadership matters, the literature strongly converges that leadership influence is conditioned by moderating factors—particularly infrastructure and institutional support.

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(a) Technological infrastructure.

Access to stable connectivity, suitable hardware, licensed platforms, and reliable systems consistently moderates adoption outcomes. Where infrastructure is weak, AI adoption tends to remain sporadic despite positive leadership intentions.

(b) Institutional support mechanisms.

Technical helpdesks, clear guidelines, time allocation, and workload management repeatedly emerge as crucial enabling conditions. Without institutional arrangements, adoption competes with existing teaching loads and administrative demands, leading to "surface adoption" rather than meaningful integration.

(c) Digital literacy variability.

The evidence indicates that lecturer readiness varies, producing uneven adoption across departments and institutions—particularly within vocational education contexts.

From an SLR standpoint, these moderators help explain why some contexts show strong adoption effects of leadership while others show limited or inconsistent outcomes.

Theme 5: Implementation Risks—Ethics, Privacy, and Resistance to Change

Beyond readiness and infrastructure, the synthesis identifies recurring risks that shape adoption trajectories.

(a) Ethical, privacy, and data governance concerns.

AI implementation often involves data collection and analytics, raising concerns about privacy, consent, and potential bias. These concerns can generate resistance unless institutional policies and safeguards are clear.

(b) Resistance to organisational change.

Studies repeatedly note that entrenched pedagogical norms, scepticism toward technological innovation, and perceptions of top-down imposition reduce adoption sustainability.

(c) Practical constraints in vocational settings.

Because TVET prioritises hands-on competency learning, lecturers may resist AI if tools are perceived as misaligned with practical workshop-based teaching. Conversely, adoption improves when AI is positioned as enhancing assessment fidelity, simulation, and feedback rather than replacing practical instruction (Zhang et al., 2021; Che Mat & Abd Aziz, 2024).

Synthesis of Research Gaps Emerging From the Review

Across themes, the SLR identifies several gaps that are especially relevant to the Sarawak Zone focus:

1. AI-specific leadership evidence remains limited compared to general technology integration studies, indicating a need for more targeted empirical work (Sun & Medaglia, 2024; Rajapakse et al., 2024).
2. Vocational and peripheral-region contexts are underrepresented, limiting generalisability of findings to regions such as Sarawak.
3. Mechanism-testing is still weak. Many studies report correlations between leadership and adoption but provide limited modelling of mediators (self-efficacy, motivation) and moderators (infrastructure, support), even though the conceptual logic is repeatedly proposed (Bandura, 1977; Davis, 1989; Venkatesh et al., 2003).
4. Outcome focus is often adoption-centric rather than impact-centric. More studies measure intention or frequency of use than pedagogical quality, learning outcomes, or employability alignment—an important issue for TVET.

DISCUSSION

The findings of this systematic literature review provide important insights into how instructional leadership influences the adoption and use of artificial intelligence (AI) applications in educational contexts, particularly within technical and vocational education and training (TVET). By synthesising evidence from multiple studies, this review highlights the multidimensional role of leadership in shaping lecturers' technological readiness, institutional culture, and the broader conditions that support AI integration. The discussion interprets the findings in relation to existing theoretical frameworks and explores their implications for vocational education contexts such as the Sarawak Zone.

Instructional Leadership as a Catalyst for AI Integration

One of the most consistent findings emerging from the review is that instructional leadership functions as a key catalyst in facilitating AI adoption within educational institutions. Instructional leaders play a strategic role in aligning institutional goals with technological innovation, thereby establishing a clear direction for digital transformation in teaching and learning. This finding aligns with the classical instructional leadership framework proposed by Philip Hallinger and Joseph Murphy, which emphasises the importance of defining instructional mission, managing instructional programmes, and promoting a supportive learning climate. The synthesis indicates that instructional leadership functions as a catalyst for AI adoption by shaping institutional expectations, promoting professional development, and establishing organisational norms that legitimise technology-supported teaching practices.

Within AI adoption contexts, instructional leadership extends beyond traditional supervisory roles to include strategic guidance for technology integration. Leaders who communicate a clear vision for AI-supported teaching practices help reduce uncertainty among lecturers and encourage experimentation with innovative instructional tools. This leadership behaviour is particularly important in vocational education settings, where technological change often occurs rapidly and educators must continuously update both pedagogical strategies and technical competencies. Studies consistently indicate that leadership support, professional encouragement, and strategic vision significantly influence educators' willingness to adopt emerging technologies (Leithwood et al., 2021; Nguyen et al., 2022).

Furthermore, instructional leadership contributes to the development of institutional cultures that value innovation and continuous improvement. When leaders promote collaborative professional learning environments, lecturers are more likely to engage in knowledge sharing and collective problem-solving related to AI integration. Such cultures reduce resistance to technological change and support sustained adoption of new instructional approaches.

The Mediating Role of Technology Acceptance and Self-Efficacy

The synthesis of findings also indicates that the influence of instructional leadership on AI adoption is rarely direct; rather, it operates through several mediating mechanisms. Among these, technology acceptance constructs and lecturers' self-efficacy emerged as the most frequently reported mediators.The Technology Acceptance Model developed by Fred Davis and the Unified Theory of Acceptance and Use of Technology proposed by Viswanath Venkatesh provide a strong explanatory foundation for understanding lecturers' engagement with AI applications. According to these models, individuals are more likely to adopt technology when they perceive it as useful, easy to use, and supported by their organisational environment (Davis, 1989; Venkatesh et al., 2003).

In the context of vocational education, instructional leaders influence these perceptions by providing training opportunities, demonstrating practical applications of AI applications, and ensuring that technological initiatives are aligned with instructional goals. When lecturers recognise the instructional value of AI applications—such as automated feedback systems, adaptive learning platforms, or intelligent simulations—they are more likely to integrate these tools into their teaching practices.

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Self-efficacy also plays a critical mediating role. Drawing on the theory developed by Albert Bandura, self-efficacy refers to an individual's belief in their capability to perform specific tasks successfully. In educational technology contexts, lecturers with higher self-efficacy demonstrate greater confidence in experimenting with new technologies and are more resilient when facing technical challenges. Instructional leadership contributes to the development of this confidence through structured professional development programmes, mentoring initiatives, and supportive institutional environments. The interaction between leadership practices, technology acceptance beliefs, and self-efficacy highlights the importance of viewing AI adoption as a social and organisational process, rather than merely a technical one.

The Importance of Organisational and Technological Readiness

Another important finding emerging from the review concerns the moderating influence of organisational and technological readiness. While instructional leadership can create favourable conditions for innovation, the success of AI integration also depends on broader institutional factors, including digital infrastructure, technical support systems, and resource availability.

In many vocational education institutions, especially those located in peripheral regions, limitations in infrastructure remain a significant barrier to technology adoption. Insufficient internet connectivity, outdated hardware, and limited access to AI-enabled platforms can restrict lecturers' ability to experiment with advanced digital tools. Consequently, even strong leadership support may have limited impact if the necessary technological environment is not adequately developed.Institutional support mechanisms also play a crucial role in sustaining AI adoption. Technical assistance, administrative encouragement, and access to professional learning opportunities collectively create enabling conditions that translate leadership vision into practical implementation. These findings reinforce the argument that digital transformation in education requires coordinated efforts across leadership, infrastructure, and institutional policy domains.

Implications for Vocational Education and the Sarawak Context

The findings of this review carry several important implications for vocational education systems, particularly within the Sarawak Zone. Vocational colleges are uniquely positioned at the intersection of education and industry, requiring lecturers to integrate emerging technologies into skills-based teaching practices. In such environments, instructional leadership becomes a critical driver of innovation.

For vocational institutions in Sarawak, strengthening instructional leadership capacity could play a key role in supporting AI adoption among lecturers. Leaders must not only provide strategic direction but also create professional development structures that help educators translate AI capabilities into meaningful pedagogical practices. This may include training workshops, collaborative curriculum design sessions, and partnerships with industry stakeholders to ensure that AI applications align with real-world vocational skills.Additionally, policymakers and institutional administrators should prioritise investments in digital infrastructure and institutional support systems. Without adequate technological resources, leadership initiatives alone may not be sufficient to sustain AI integration in vocational education.

Contributions of the Review

This systematic literature review contributes to the existing body of knowledge in several ways. First, it consolidates fragmented research on instructional leadership and AI adoption into a coherent analytical framework. Second, it highlights the complex interaction between leadership practices, individual psychological factors, and organisational conditions in shaping technology adoption. Third, the review identifies important research gaps related to vocational education contexts and peripheral regions such as Sarawak.By synthesising existing evidence, the review provides a stronger conceptual foundation for future empirical research examining the role of instructional leadership in facilitating digital transformation in vocational education systems.

THEORETICAL IMPLICATIONS

The findings of this systematic literature review offer several important theoretical contributions to the literature on educational leadership, technology adoption, and artificial intelligence integration in education. By synthesising research across multiple studies, the review provides a clearer understanding of how instructional leadership interacts with technological, psychological, and organisational factors to influence the adoption of AI applications in vocational education contexts.First, this review extends the theoretical scope of instructional leadership by situating it within the broader discourse of digital transformation in education. Traditionally, instructional leadership has focused on improving teaching quality, curriculum alignment, and student learning outcomes through leadership practices that support pedagogical improvement. However, the growing integration of artificial intelligence in education suggests that instructional leadership must also encompass the strategic facilitation of technological innovation within instructional environments. The findings therefore support the reconceptualisation of instructional leadership as a form of technology-oriented instructional leadership, where leaders actively guide the integration of advanced technologies into teaching and learning processes.Second, the synthesis highlights the relevance of technology adoption theories in explaining leadership-driven AI adoption among educators. The interaction between instructional leadership and technology acceptance constructs demonstrates that leadership influence is mediated through lecturers' perceptions of usefulness, ease of use, and organisational support. These findings reinforce the explanatory value of established models such as the Technology Acceptance Model and the Unified Theory of Acceptance and Use of Technology in educational technology research. By linking instructional leadership with these technology acceptance frameworks, this review contributes to a more integrated theoretical understanding of how leadership behaviours shape educators' engagement with emerging technologies.

Third, the review underscores the importance of psychological constructs, particularly self-efficacy, in mediating the relationship between leadership and technology adoption. The findings suggest that lecturers' confidence in their ability to use AI applications significantly influences whether leadership initiatives translate into actual instructional practice. This supports existing theoretical perspectives that emphasise the role of self-beliefs in shaping technology adoption behaviour among educators.Finally, the review highlights the importance of considering organisational and contextual factors within leadership and technology adoption frameworks. Technological infrastructure, institutional support mechanisms, and professional development opportunities consistently emerge as moderating variables that shape the effectiveness of instructional leadership in promoting AI integration. These findings support the need for more multidimensional theoretical models that integrate leadership practices, individual psychological factors, and institutional conditions when examining digital transformation in educational institutions.Collectively, these theoretical implications contribute to the advancement of research on instructional leadership and technology integration by offering a more comprehensive conceptual perspective that is particularly relevant to vocational education and emerging AI-driven learning environments.

PRACTICAL IMPLICATIONS

The findings of this systematic literature review also provide several practical implications for educational leaders, policymakers, and vocational education institutions seeking to strengthen the integration of artificial intelligence in teaching and learning.First, the review highlights the critical role of instructional leadership in facilitating technology adoption among lecturers. Vocational college leaders should therefore prioritise leadership practices that emphasise instructional improvement and technological innovation simultaneously. This includes establishing clear institutional visions for digital transformation, encouraging experimentation with AI-supported teaching strategies, and creating environments where lecturers feel supported in adopting new technologies.Second, professional development emerges as a key mechanism through which leadership can influence AI adoption. Institutions should implement structured training programmes that focus not only on technical skills but also on pedagogical applications of AI in teaching and assessment. Hands-on training, peer mentoring, and collaborative professional learning

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communities can help lecturers develop both competence and confidence in using AI applications effectively.Third, the review emphasises the importance of institutional readiness. Successful integration of AI technologies requires adequate digital infrastructure, reliable internet connectivity, and accessible technical support systems. Policymakers and institutional administrators must therefore ensure that investments in technological infrastructure accompany leadership initiatives aimed at promoting digital innovation.Fourth, vocational education institutions should encourage collaborative leadership practices that involve lecturers in decision-making processes related to technology adoption. When lecturers participate in discussions about digital transformation initiatives, they are more likely to develop a sense of ownership and commitment toward implementing new technologies in their instructional practices.Finally, the integration of AI in vocational education should be aligned with industry needs and competency-based learning frameworks. AI-supported learning environments, simulations, and automated assessment tools have the potential to enhance practical skill development and improve students' readiness for the evolving labour market. Instructional leaders therefore play a strategic role in ensuring that AI applications support both pedagogical innovation and workforce relevance within vocational education systems.

CONCLUSION AND FUTURE RESEARCH

This systematic literature review examined the influence of instructional leadership on the use of artificial intelligence applications among vocational college lecturers, with particular relevance to vocational education contexts such as the Sarawak Zone. By synthesising existing research on instructional leadership, technology adoption, and AI integration in education, the review provides a comprehensive understanding of the factors that shape lecturers' engagement with AI-supported instructional practices.

The findings indicate that instructional leadership plays a significant role in facilitating AI adoption by shaping institutional vision, supporting professional development, and fostering organisational cultures that encourage innovation. However, the effectiveness of leadership practices is also influenced by mediating and moderating factors such as lecturers' technology acceptance beliefs, self-efficacy, technological infrastructure, and institutional support mechanisms.Despite growing scholarly attention to artificial intelligence in education, the review reveals several important research gaps. In particular, empirical studies that specifically examine the relationship between instructional leadership and AI adoption within vocational education contexts remain limited. Furthermore, much of the existing research has been conducted in higher education or general school environments, with relatively little focus on vocational institutions and peripheral regions such as Sarawak.

Future research should conduct empirical investigations examining the causal relationships between instructional leadership practices, lecturers' technology acceptance beliefs, and AI adoption behaviour in vocational education contexts. Quantitative studies could explore the relationships among leadership practices, technology acceptance factors, and AI adoption behaviour, while qualitative approaches could provide deeper insights into lecturers' experiences and challenges when integrating AI applications into vocational teaching practices.Additionally, future studies should examine the long-term impact of AI-supported instructional practices on student learning outcomes, skill development, and graduate employability in vocational education. Such research would contribute to a more comprehensive understanding of how leadership-driven digital transformation can enhance the effectiveness and relevance of vocational education systems in the era of artificial intelligence.

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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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