

Artificial Intelligence (AI) In Malaysian Schools: A Scoping Review Of Teacher Readiness And Implementation Challenges (2020–2025)

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) is reshaping educational systems globally, raising pressing questions about implementation readiness, governance, and professional capacity. In line with the implementation of the Digital Education Policy by the Ministry of Education Malaysia, there is an increasing need to understand AI implementation readiness and the challenges associated with AI integration in schools. This study aims to map and synthesise existing literature on AI implementation readiness and related issues in Malaysian national schools between 2020 and 2025. A scoping review methodology guided by the PRISMA-ScR framework was employed. Literature was sourced from MyJurnal, Google Scholar, and ERIC databases. Thematic analysis identified three dominant themes: high levels of teacher interest accompanied by moderate technical competence, significant infrastructural disparities between urban and rural schools, and the absence of clear ethical guidelines governing AI use in classrooms. The findings indicate that while Malaysian teachers demonstrate positive attitudes towards the potential of AI to enhance learning, systematic support in terms of professional development, infrastructure, and policy remains insufficient.

Keywords: artificial intelligence (AI); AI implementation readiness; teacher professional capacity; ethical governance; scoping review; Malaysia

INTRODUCTION

Artificial Intelligence (AI) has emerged as a prominent feature of contemporary educational reform, driven by broader processes of digitalisation, automation, and datafication (Williamson & Eynon, 2020; UNESCO, 2021). Within global education discourse, AI is frequently positioned as a means of addressing persistent challenges such as learner diversity, teacher workload, and assessment efficiency. These claims gained renewed prominence



following the COVID-19 pandemic, which accelerated the uptake of digital technologies and intensified interest in data-driven educational solutions. However, the rapid pace of AI adoption has also generated critical concerns regarding pedagogical integrity, professional agency, and ethical governance in school contexts.

Emerging scholarship cautions against treating AI as a neutral or inherently progressive innovation in education. Selwyn (2019) argues that educational technologies often embed assumptions about efficiency, standardisation, and control that may conflict with the relational and context-sensitive nature of teaching. Similarly, AI-enabled systems introduce algorithmic forms of decision-making that can reshape pedagogical practices, redistribute professional authority, and reconfigure accountability structures within schools (Holmes et al., 2022). From this perspective, AI implementation is not merely a technical process, but a socio-technical and ethical endeavour shaped by policy environments, infrastructural conditions, and professional judgement.

In Malaysia, these global developments intersect with national efforts to modernise education through the Digital Education Policy (Dasar Pendidikan Digital), which foregrounds digital competence and technology-enhanced teaching as strategic national priorities (Ministry of Education Malaysia [MOE], 2021). While AI is implicitly embedded within this policy agenda particularly in relation to personalised learning and learning analytics the policy provides limited operational guidance on how AI should be enacted within classrooms characterised by diverse learner needs, uneven infrastructural provision, and varying levels of teacher preparedness. As a result, teachers occupy a pivotal yet under-examined position in translating AI policy aspirations into pedagogical practice.

Although a growing body of Malaysian research has examined aspects of digital readiness, technology acceptance, and innovation adoption, research specifically addressing AI implementation in school contexts remains fragmented and conceptually uneven. Existing studies vary widely in their definitions of AI, methodological approaches, and conceptualisations of teacher readiness, making it difficult to draw coherent conclusions or identify systemic patterns. In such contexts, a scoping review is particularly appropriate, as it enables the systematic mapping and synthesis of heterogeneous literature, clarifies how key concepts are framed, and identifies gaps requiring further empirical and theoretical attention (Arksey & O'Malley, 2005; Peters et al., 2020).

In response to these conceptual and empirical gaps, this study adopts a scoping review approach to map and synthesise literature on Artificial Intelligence (AI) implementation in Malaysian national schools published between 2020 and 2025. The review distinguishes AI from general educational technology by foregrounding algorithmic decision-making, adaptive analytics and data-driven automation as defining features shaping pedagogical practice and professional responsibility. Recognising that much Malaysian research engages with AI-adjacent tools, the analysis retains studies where algorithmic or predictive functions influence teaching and learning, while maintaining conceptual clarity during synthesis. Rather than evaluating intervention effectiveness, the review adopts a conceptual-analytical orientation to examine how teacher readiness is constructed across diverse methodological traditions and policy contexts.

By interpreting the literature through a socio-technical lens, the study aims to illuminate the systemic relationships between professional capacity, infrastructural conditions, ethical governance, and policy coherence that shape AI enactment in schools. The research is guided by the following questions:

- a. How is AI implementation readiness conceptualised in Malaysian school-based literature?
- b. What systemic challenges shape AI implementation in Malaysian national schools?
- c. How do infrastructural conditions and ethical governance interact with teacher readiness in shaping classroom-level AI enactment?

METHODOLOGY

This study employed a scoping review design with a conceptual–analytical orientation to map and synthesise existing literature on Artificial Intelligence (AI) implementation in Malaysian national schools. A scoping review was selected due to the emergent, interdisciplinary, and conceptually fragmented nature of AI-related educational research in Malaysia, where studies vary considerably in focus, methodological design, and theoretical framing (Arksey & O'Malley, 2005; Peters et al., 2020). Consistent with scoping review objectives, the study did not seek to evaluate intervention effectiveness or assess study quality, but rather to clarify how AI implementation and teacher readiness are conceptualised within the literature.

Search Strategy

The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) framework to ensure transparency and methodological rigour (Tricco et al., 2018). Literature searches were conducted across three databases: MyJurnal, Google Scholar, and ERIC, selected to capture both Malaysian-based scholarship and internationally indexed education research. Search terms included combinations of “artificial intelligence”, “AI in education”, “teacher readiness”, “digital education”, “schools”, and “Malaysia”, along with related terms such as “adaptive learning systems” and “intelligent educational technologies”. Searches were limited to publications between 2020 and 2025 to reflect the period of heightened policy attention to digital education and AI adoption following the introduction of Malaysia’s Digital Education Policy (MOE, 2021).

Eligibility Criteria

Studies were included if they (a) focused on school-level educational contexts, (b) examined teachers as primary participants or key stakeholders, (c) explicitly addressed AI or AI-enabled educational technologies, and (d) were situated within or directly relevant to the Malaysian education system. Studies focusing exclusively on higher education, non-AI digital technologies, or non-school contexts were excluded. Only peer-reviewed publications were considered. No formal quality appraisal was conducted, consistent with scoping review methodology.

Screening and Data Charting

Following database searches, retrieved records were screened in accordance with PRISMA-ScR guidance through a staged process involving title and abstract review, followed by full-text assessment against the eligibility criteria. Given the emergent and conceptually diverse nature of Artificial Intelligence (AI) research in Malaysian school contexts, the screening process prioritised conceptual relevance alongside methodological inclusion. Figure 1 illustrates the analytical logic underpinning the scoping process, situating study selection within a broader socio-technical framework that guided subsequent thematic synthesis. Studies meeting inclusion criteria were charted using a structured extraction matrix capturing publication characteristics, methodological approach, and contextual focus. The resulting corpus reflects a combination of empirical, conceptual, and policy-oriented sources, the characteristics of which are summarised in Table 1 to enhance transparency regarding study type, methodological orientation, and school-level focus.

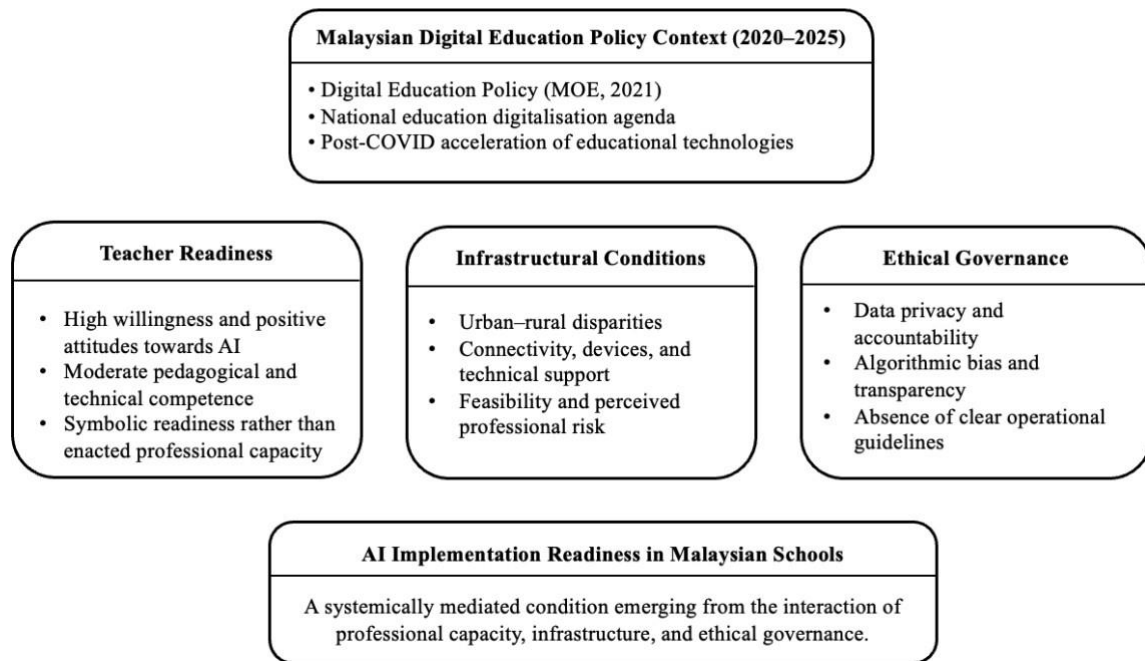


Figure 1. Conceptual Scoping Framework for Mapping AI Readiness and Implementation Challenges

The figure visualises the analytical logic of the scoping review by situating AI readiness and implementation challenges within a Malaysian policy-active context, mapping key conceptual domains identified across the literature, and clarifying the study’s contribution as conceptual synthesis rather than prescriptive modelling.

Conceptual and Thematic Synthesis

Data synthesis was conducted using an inductive thematic approach followed by interpretive conceptual analysis. Given the predominance of conceptual and policy-oriented literature within the corpus ($n = 10$), the objective of synthesis was not to aggregate intervention outcomes or conduct quantitative comparison, but to clarify how teacher readiness and AI implementation challenges are framed across diverse forms of evidence. Initial coding identified recurrent domains related to teacher professional capacity, infrastructural provision, policy coherence, and ethical governance. These domains were examined relationally using a socio-technical lens, which conceptualises AI implementation as shaped through interactions between technological systems, institutional structures, and professional agency (Selwyn, 2019; Williamson & Eynon, 2020). Rather than treating these domains as discrete variables,

The analysis explored how they co-construct conditions of readiness within Malaysian school contexts.

This interpretive process informed the development of a heuristic conceptual synthesis presented later in Figure 2. The model does not represent a validated framework, but rather an analytical abstraction derived from patterns observed across the corpus. Consistent with scoping review methodology, the purpose of synthesis was conceptual clarification and mapping of relationships rather than evaluation of effectiveness or establishment of causal relationships.

The characteristics of the included studies underpinning this synthesis are summarised in Table 1.

Table 1

Author(s) and Year	Study Type	Method / Approach	Context Focus	School Level Focus
Ahmad & Yusof (2022)	Empirical	Survey	AI implementation readiness in Malaysia	Mixed school contexts
Salleh (2023)	Conceptual	Theoretical analysis	Inclusive pedagogy & digital readiness	Mixed
MOE (2021)	Policy	Policy framework analysis	Malaysian Digital Education Policy	System-level
Crompton et al. (2022)	Conceptual	Literature synthesis	Teacher readiness and AI pedagogy	General school education
Holmes et al. (2022)	Conceptual	Ethical framework analysis	AI ethics in education	Cross-level
Holmes, Bialik & Fadel (2019)	Conceptual	Policy/theoretical report	AI implications for teaching	Cross-level
Kong et al. (2021)	Conceptual	Review of teacher development	AI and computational thinking	Mixed
Selwyn (2019)	Conceptual	Critical theoretical analysis	AI and future of education	Cross-level
UNESCO (2021)	Policy/Conceptual	International policy guidance	Human-centred AI in education	System-level
Williamson & Eynon (2020)	Conceptual	Theoretical analysis	Socio-technical AI discourse	Cross-level

The following section presents the thematic patterns emerging from this corpus.

RESULT AND FINDINGS

The final corpus comprised ten sources synthesised across Malaysian contextual studies, international conceptual scholarship, and policy-oriented analyses. Within this dataset, one empirical investigation employed a survey design examining teachers' readiness for Artificial Intelligence (AI) in Malaysian schools, while the remaining sources consisted of conceptual, theoretical, or policy-focused contributions that informed the interpretive framing of the review. Conceptual studies drew primarily on literature synthesis, ethical analysis, and socio-technical perspectives, reflecting the emergent nature of AI research within school contexts. Across the corpus, studies addressed mixed or cross-level educational settings rather than focusing exclusively on a single schooling phase, underscoring the systemic orientation of current AI discourse in education.

This scoping review synthesised literature on AI implementation in Malaysian national schools published between 2020 and 2025. The analysis revealed that AI implementation readiness is consistently framed within the literature as a multi-dimensional and systemically mediated condition rather than an individual attribute. Three interrelated thematic patterns emerged across the reviewed studies: (1) high teacher willingness accompanied by constrained

professional capacity, (2) infrastructural disparities as structural determinants of feasibility, and (3) ethical ambiguity contributing to professional uncertainty. While these themes were derived inductively from the reviewed studies, their interpretation reflects an integrative conceptual synthesis rather than causal inference. The predominance of conceptual sources reflects the early developmental stage of AI research within Malaysian school contexts rather than limitations of the review process.

Teacher Readiness: High Willingness, Constrained Capacity

Across the corpus, AI implementation readiness is most frequently framed through discussions of teacher disposition and openness to innovation. The available Malaysian empirical evidence, supported by conceptual analyses within the corpus, suggests that teachers generally express interest in the pedagogical potential of AI-enabled tools (Ahmad & Yusof, 2022; Salleh, 2023). AI is commonly associated with adaptive learning platforms, automated feedback systems, and analytics dashboards perceived as supporting differentiated instruction and reducing administrative workload. Within these discussions, AI is often aligned with broader aspirations for innovative and student-centred teaching.

However, while attitudinal readiness appears relatively strong, the literature indicates more limited depth in pedagogical and technical understanding. The single empirical study within the Malaysian dataset, together with international conceptual analyses, suggests that teachers may possess only surface-level familiarity with AI concepts, frequently equating AI with general digital tools or platform-based analytics. In several accounts, AI-generated learner performance data are utilised without detailed awareness of how underlying algorithms process, weight, or interpret information (Holmes et al., 2022).

This pattern can be interpreted as a form of symbolic readiness a condition in which teachers express conceptual support for AI and demonstrate willingness to engage, yet lack the professional knowledge, data literacy, and ethical confidence required for sustained pedagogical integration. Under such conditions, AI use risks becoming instrumental and reactive rather than reflective and pedagogically intentional. Importantly, this distinction challenges policy narratives that equate positive teacher attitudes with implementation readiness, underscoring the need to differentiate between willingness and professional capacity within discussions of AI implementation readiness.

Across the reviewed studies, Malaysian teachers consistently expressed positive attitudes and high levels of interest towards the integration of AI in teaching and learning (Ahmad & Yusof, 2022; Salleh, 2023). Teachers commonly associated AI with adaptive learning platforms, automated feedback systems, and analytics dashboards that could support differentiated instruction and reduce administrative workload. In several studies, teachers described AI as aligned with contemporary expectations for innovative and student-centred teaching.

The reviewed studies suggest that many teachers report limited AI-related knowledge, which may constrain their ability to integrate AI effectively into classroom practice. Despite this enthusiasm, readiness at the level of pedagogical and professional capacity was markedly uneven. Many teachers demonstrated only surface-level understanding of AI concepts, frequently equating AI with general digital tools or platform-based analytics. For example, studies reported that teachers used AI-generated learner performance dashboards or automated assessment feedback without fully understanding how data were collected, processed, or weighted by underlying algorithms (Holmes et al., 2022). As a result, AI outputs were often accepted at face value rather than critically interpreted.

This pattern reflects what can be conceptualised as symbolic readiness—a condition in which teachers are conceptually supportive of AI and willing to engage with it, yet lack the professional knowledge and confidence to integrate it meaningfully into pedagogical decision-making. In such cases, AI use becomes reactive and instrumental rather than reflective and

intentional. Importantly, this finding challenges policy narratives that equate positive teacher attitudes with implementation readiness, highlighting the need to distinguish between willingness and capacity.

Infrastructure as a Structural Determinant of Feasibility

Infrastructure emerged across the reviewed studies as a decisive factor shaping not only access to AI tools, but also teachers' perceptions of feasibility, risk, and professional accountability. Multiple studies consistently highlighted significant disparities in internet connectivity, device availability, and technical support between urban and rural schools (MOE, 2021; Ahmad & Yusof, 2022). These disparities had direct implications for teachers' ability to experiment with and sustain AI-enabled practices.

Teachers in well-resourced urban schools reported greater opportunities to pilot AI-based platforms, collaborate with peers, and receive informal technical support. In contrast, teachers in rural or under-resourced schools often described AI initiatives as misaligned with classroom realities, citing unstable connectivity, limited access to devices, and lack of on-site technical assistance. In such contexts, the risk of lesson disruption was commonly perceived as high, leading teachers to adopt cautious or minimal use of AI tools.

Crucially, infrastructure was described in several studies not merely as a technical constraint, but as a structural determinant of pedagogical confidence. Where infrastructure was unreliable, teachers reported perceiving greater professional risk associated with AI use, including the possibility of lesson failure or negative evaluation. Taken together, these findings suggest that AI implementation cannot be meaningfully discussed without addressing systemic inequities in digital provision, particularly if AI is to be positioned as a tool for inclusive and equitable education.

Ethical Ambiguity and Professional Uncertainty

Ethical considerations related to AI use in schools were discussed less explicitly in the reviewed literature yet emerged across several studies as a latent and consequential concern. Teachers were reported to express uncertainty regarding student data privacy, algorithmic bias, and accountability, particularly when AI tools were developed or managed by external vendors (UNESCO, 2021; Williamson & Eynon, 2020). Few studies explicitly reported the existence of school-level or national ethical guidelines governing AI use in classrooms. As a result, teachers were often described as relying on personal judgement when deciding how and when to use AI systems. This lack of ethical clarity was associated in several studies with heightened professional vulnerability, especially in contexts where accountability structures were unclear or where data governance policies were perceived as ambiguous.

The absence of structured ethical guidance was reported to contribute to cautious, selective, or delayed adoption of AI tools. Some studies noted that teachers avoided AI altogether despite recognising its potential benefits, citing concerns about unintended consequences or professional liability. Taken together, these findings suggest that ethical governance functions not merely as an abstract policy issue, but as a practical condition shaping teacher readiness and professional confidence.

Synthesis of Findings

Taken together, the findings indicate that AI implementation in Malaysian schools is characterised by alignment at the level of aspiration but fragmentation at the level of practice. Teachers are willing to engage with AI and largely supportive of its potential, yet their readiness is constrained by uneven professional capacity, infrastructural inequities, and ethical uncertainty. These findings suggest that policy efforts focusing solely on technological provision or attitudinal change are unlikely to yield sustainable outcomes. Instead, AI readiness must be conceptualised as a systemic condition, requiring coordinated and sustained action

across professional development, infrastructure investment, and governance frameworks.

To synthesise the patterns identified across the reviewed studies, the key findings are summarised in Table 2. The table consolidates the three dominant dimensions shaping AI implementation readiness in Malaysian schools—teacher readiness, infrastructure, and ethical governance—and highlights how each dimension manifests in practice. Rather than presenting isolated challenges, the table illustrates the systemic nature of AI implementation, demonstrating how professional capacity, structural conditions, and governance frameworks interact to shape teachers’ engagement with AI.

Table 2 Summary of Key Findings on AI Implementation and Teacher Readiness

Dimension	Key Patterns Identified	Implications for Practice
Teacher Readiness	High interest; limited pedagogical and technical depth	Need for sustained, pedagogy-focused professional development
Infrastructure	Urban–rural disparities in access and support	Risk of inequitable AI adoption across schools
Ethical Governance	Limited guidance on data use and accountability	Professional uncertainty and cautious implementation

As shown in Table 2, challenges associated with AI implementation are systemic rather than individual, reinforcing the argument that teacher readiness cannot be addressed through isolated training initiatives alone. High levels of teacher interest coexist with constrained professional capacity, suggesting that willingness does not automatically translate into effective practice. Similarly, infrastructural disparities shape not only access to AI tools but also teachers’ confidence and perceptions of professional risk. Notably, ethical governance emerges as a cross-cutting concern that amplifies other challenges. In the absence of clear ethical guidance, teachers are more likely to adopt cautious or selective approaches to AI use, even in contexts where infrastructure and professional interest are present. This reinforces the need to conceptualise AI readiness as an integrated condition, a relationship that is further elaborated in the conceptual model presented in Figure 2.

Figure 2 Conceptual Model of AI Implementation Readiness in Malaysian Schools

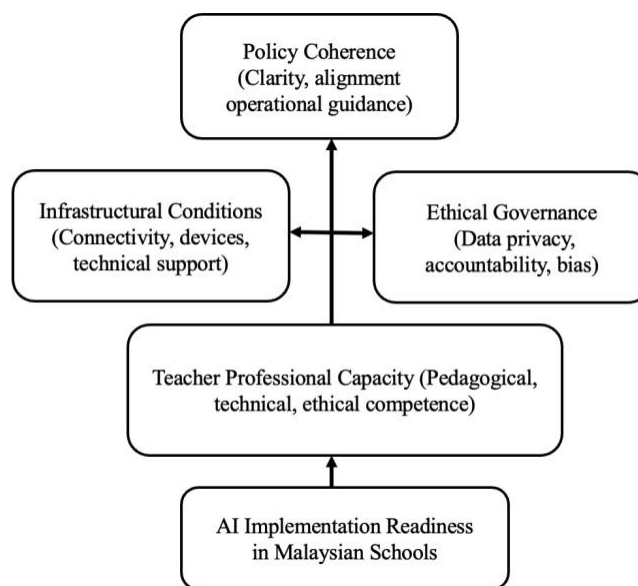


Figure 2 illustrates AI implementation readiness as a dynamic and systemic interaction between four interdependent domains: teacher professional capacity, infrastructural conditions, policy coherence, and ethical governance. Teacher readiness is positioned at the centre, emphasising that meaningful AI integration is shaped not by individual competence alone, but by the alignment of professional, structural, policy, and ethical conditions. Weakness in any single domain constrains sustainable AI enactment in school contexts.

Teacher readiness is positioned at the centre of the model, influenced simultaneously by access to professional development, availability of infrastructure, clarity of policy direction, and the presence of ethical safeguards. The model demonstrates that weaknesses in any single domain constrain meaningful AI adoption, reinforcing the argument that readiness must be addressed systemically rather than through isolated training initiatives. This figure extends existing literature by explicitly integrating ethical governance into models of teacher readiness, aligning with calls for human-centred AI implementation in education (UNESCO, 2021).

DISCUSSION

This scoping review mapped and synthesised literature on AI implementation in Malaysian national schools to clarify how AI implementation readiness is constructed and constrained within existing research. The findings indicate a consistent pattern of alignment at the level of policy aspiration and teacher willingness, alongside fragmentation at the level of professional capacity, infrastructure, and ethical governance. Interpreted through a socio-technical lens, these patterns suggest that challenges associated with AI implementation are systemic rather than individual, and cannot be addressed through isolated training or technology provision alone.

Rethinking Teacher Readiness as a Systemic Professional Condition

One of the key insights arising from this scoping review is the way teacher readiness has been framed across the Malaysian literature. While many studies emphasise digital skills acquisition or positive attitudes towards innovation, the synthesised findings suggest that such framings only partially capture the conditions under which AI can be meaningfully enacted in practice.

As reflected in Table 1, Malaysian teachers are frequently described as demonstrating high levels of interest in AI, yet their pedagogical and interpretive capacity remains uneven across contexts. This pattern aligns with what this review conceptualises as *symbolic readiness* a condition in which teachers express conceptual support for AI but lack the professional knowledge, ethical confidence, and institutional backing required for sustained pedagogical integration. International scholarship similarly cautions that when teachers are positioned primarily as users of AI systems rather than informed decision-makers, professional agency may be constrained (Selwyn, 2019; Crompton et al., 2022).

Taken together, these findings suggest that readiness is more productively understood as a systemic professional condition that emerges through sustained professional learning, supportive infrastructures, and coherent governance arrangements. This interpretation aligns with socio-technical perspectives on educational change, which emphasise that technologies are enacted through professional practice rather than simply adopted as tools.

Infrastructure, Equity, and the Uneven Geography of AI Implementation

The synthesis further highlights infrastructure as a structural determinant shaping the feasibility of AI implementation. As mapped across studies and summarised in Table 1, disparities in connectivity, device availability, and technical support between urban and rural schools are repeatedly reported as influencing teachers' capacity to engage with AI. Importantly, these infrastructural conditions are not presented in the literature as neutral

background factors; rather, they shape perceptions of professional risk, lesson reliability, and accountability.

This pattern resonates with international analyses suggesting that digital innovations may amplify existing inequalities when infrastructural conditions are uneven (Williamson & Eynon, 2020). Within the Malaysian context, where geographical and socio-economic disparities remain pronounced, the reviewed studies suggest that AI initiatives risk reinforcing differentiated opportunities if infrastructural considerations are not explicitly addressed. Rather than positioning AI as inherently inclusive or universally scalable, the mapped literature points to the importance of alignment between technological ambition and contextual capacity. From a scoping perspective, this finding underscores how equity concerns are embedded within implementation conditions, rather than residing solely in the design of AI tools themselves.

Ethical Governance and Professional Vulnerability

A further insight emerging from this review concerns the role of ethical governance in shaping teacher readiness. Although ethical considerations are not always foregrounded in the reviewed studies, teachers' reported uncertainties regarding data privacy, algorithmic bias, and accountability point to a recurrent but underdeveloped dimension of AI implementation research.

International frameworks consistently emphasise the importance of human-centred and ethically governed AI in education (UNESCO, 2021). However, the mapped Malaysian literature suggests that these principles have not yet been consistently translated into operational guidance at the school level. In the absence of clear ethical frameworks, teachers are frequently described as relying on personal judgement when navigating complex decisions related to AI use, a condition associated with heightened professional vulnerability.

Viewed through a scoping lens, these findings indicate that ethical governance functions as a **practical condition shaping confidence and decision-making**, rather than as an abstract policy aspiration. Ethical ambiguity also intersects with other readiness dimensions identified in Table 1, contributing to cautious or selective adoption even in contexts where infrastructure and professional interest are present.

Interpreting the Conceptual Model of AI Implementation Readiness

Figure 1 presents a heuristic conceptual synthesis derived from thematic interpretation of the reviewed literature rather than a validated readiness framework. The model does not propose causal pathways or predictive relationships; instead, it organises recurring patterns identified across studies into an analytical structure that reflects how AI implementation readiness is implicitly constructed within Malaysian scholarship. Drawing on socio-technical perspectives that view educational technologies as embedded within institutional and professional contexts (Selwyn, 2019; Williamson & Eynon, 2020), the model extends existing readiness and technology adoption discussions by integrating ethical governance and policy coherence alongside infrastructural and professional dimensions. In contrast to conventional adoption models that foreground individual attitudes or behavioural intention, this synthesis conceptualises readiness as a relational condition shaped by systemic alignment across domains.

By positioning ethical governance alongside infrastructure and professional capacity, the model extends existing discussions of teacher readiness and responds to calls for more holistic approaches to AI integration in education. From a scoping perspective, it provides a conceptual tool for organising fragmented findings and identifying points of convergence and tension within the literature. The model also helps explain why, as reported across studies, policy enthusiasm and teacher willingness have not consistently translated into sustained AI implementation. Weaknesses in any single domain appear to constrain enactment, reinforcing the need to view readiness as relational and systemic rather than additive. Analytically, the

model may serve as a diagnostic lens for future research and policy analysis, enabling scholars and decision-makers to examine how variations across ethical, infrastructural, and professional domains influence the enactment of AI in school settings.

Contribution to International and Regional Scholarship

Although grounded in the Malaysian context, the findings of this scoping review contribute to broader international discussions on AI in education, particularly within middle-income and policy-active systems where digital ambitions often outpace implementation capacity. By synthesising Malaysian studies through a conceptual scoping lens, the review provides empirical grounding for theoretical debates on teacher agency, socio-technical change, and ethical AI governance.

Rather than offering prescriptive solutions, the contribution of this study lies in clarifying how readiness and implementation challenges have been constructed across existing research. This clarification is particularly relevant for education systems facing similar structural, infrastructural, and governance-related constraints, and it provides a foundation for more focused empirical and policy-oriented research moving forward.

CONCLUSION

This scoping review provides a systematic and conceptually grounded synthesis of literature on Artificial Intelligence (AI) implementation in Malaysian national schools between 2020 and 2025. By examining teacher readiness through a socio-technical and ethical lens, the study moves beyond surface-level accounts of technology adoption to illuminate the structural and professional conditions shaping AI enactment in school contexts.

The findings demonstrate that Malaysian teachers are largely willing and positively disposed towards AI integration. However, willingness alone has not translated into consistent or meaningful classroom practice. Instead, teacher readiness emerges as a multi-dimensional and systemic condition, shaped by professional capacity, infrastructural provision, policy coherence, and ethical governance. As illustrated through Table 1 and conceptualised in Figure 1, weaknesses in any one of these domains constrain sustainable AI implementation, regardless of policy enthusiasm or individual teacher motivation.

Three overarching conclusions can be drawn. First, AI implementation readiness must be understood as a professional capability, not a technical checklist. Teachers require sustained opportunities to develop pedagogical judgement, data literacy, and ethical confidence in relation to AI-supported tools. Second, infrastructural disparities between urban and rural schools play a decisive role in shaping feasibility, professional risk, and equity. Without deliberate corrective measures, AI adoption risks reinforcing existing educational inequalities. Third, ethical governance represents a critical yet underdeveloped dimension of AI readiness. The absence of clear ethical guidance places teachers in professionally vulnerable positions, discouraging confident and responsible innovation.

Implications for Policy and Practice

For policymakers, the findings underscore the need to move beyond aspirational digital agendas towards operationally explicit and ethically grounded frameworks for AI integration. Professional development initiatives should prioritise pedagogical application, critical interpretation of AI outputs, and ethical literacy, rather than focusing narrowly on tool familiarisation. Infrastructural planning must be explicitly aligned with equity objectives to ensure that AI initiatives do not disproportionately benefit already well-resourced schools.

For school leaders, the conceptual model presented in this paper offers a practical diagnostic tool to assess readiness conditions prior to implementation. Rather than adopting AI tools opportunistically, schools should evaluate alignment across professional capacity, infrastructure, policy clarity, and ethical safeguards to support coherent and sustainable

practice.

Implications for Research

From a research perspective, this review highlights the need for longitudinal and classroom-based studies that examine how AI integration reshapes teaching practice, professional identity, and learner outcomes over time. Future research should also investigate teachers' ethical reasoning processes in greater depth, particularly in relation to data governance, accountability, and algorithmic decision-making. Such work is essential to inform contextually responsive and human-centred AI policies in education.

Limitations of the Study

As a scoping review, this study does not evaluate the effectiveness of specific AI interventions or establish causal relationships. The review is also limited to published literature and may not capture unpublished school-based initiatives or emerging practices. Additionally, while the focus on the Malaysian context provides depth and relevance, caution should be exercised in generalising findings to other education systems without consideration of contextual differences.

Scholarly Contribution

Despite these limitations, this study makes a significant contribution to the field in three ways. First, it consolidates fragmented Malaysian research on AI in schools into a coherent and analytically robust synthesis. Second, it reconceptualises teacher readiness as a systemic and professional condition, challenging deficit-oriented and technocentric framings. Third, it foregrounds ethical governance as a central component of sustainable AI implementation, extending existing readiness frameworks and contributing to international debates on responsible and human-centred AI in education.

In doing so, the paper positions AI integration not as a technological inevitability, but as a professional, ethical, and policy-mediated endeavour - one that requires careful alignment between ambition and capacity if it is to meaningfully enhance teaching and learning in Malaysian schools. Future research and policy initiatives should therefore prioritise systemic coherence over isolated innovation, ensuring that technological ambition is matched by professional capacity and ethical clarity.

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REFERENCES

- Ahmad, N. A., & Yusof, M. A. (2022). Teachers' readiness and perceptions towards artificial intelligence in Malaysian schools. *Malaysian Journal of Learning and Instruction*, 19(2), 45–66. <https://doi.org/10.32890/mjli2022.19.2.3>
- Arksey, H., & O'Malley, L. (2005). Scoping studies: Towards a methodological framework. *International Journal of Social Research Methodology*, 8(1), 19–32. <https://doi.org/10.1080/1364557032000119616>
- Crompton, H., Jones, K., & Burke, D. (2022). Artificial intelligence in education: Teacher readiness and pedagogical implications. *Computers & Education*, 182, Article 104458. <https://doi.org/10.1016/j.compedu.2022.104458>
- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos,

- O. C., Rodrigo, M. M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. *International Journal of Artificial Intelligence in Education*, 32(3), 504–526. <https://doi.org/10.1007/s40593-021-00239-1>
- Kong, S. C., Cheung, W. M. Y., Zhang, G., & Li, K. Y. (2021). Teacher development in computational thinking and artificial intelligence education. *Educational Technology & Society*, 24(2), 1–15.
- Ministry of Education Malaysia. (2021). *Digital education policy (Dasar Pendidikan Digital)*. <https://www.moe.gov.my>
- Peters, M. D. J., Godfrey, C., McInerney, P., Munn, Z., Tricco, A. C., & Khalil, H. (2020). Scoping reviews. In E. Aromataris & Z. Munn (Eds.), *JBIM manual for evidence synthesis* (pp. 406–451). JBI. <https://doi.org/10.46658/JBIMES-20-12>
- Salleh, R. (2023). Rethinking teaching strategies: Considerations for promoting equity, diversity, and inclusion. *The International Journal of Education Management and Sociology*, 2(5), 231–244. <https://doi.org/10.58818/ijems.v2i5.70>
- Selwyn, N. (2019). *Should robots replace teachers? AI and the future of education*. Polity Press.
- Tricco, A. C., Lillie, E., Zarin, W., O'Brien, K. K., Colquhoun, H., Levac, D., Moher, D., Peters, M. D. J., Horsley, T., Weeks, L., Hempel, S., Akl, E. A., Chang, C., McGowan, J., Stewart, L., Hartling, L., Aldcroft, A., Wilson, M. G., Garritty, C., ... Straus, S. E. (2018). PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine*, 169(7), 467–473. <https://doi.org/10.7326/M18-0850>
- UNESCO. (2021). *AI and education: Guidance for policy-makers*. UNESCO Publishing. <https://unesdoc.unesco.org>