Artificial Intelligence in Malaysian Higher Education: A Critical Review of Lecturers' Challenges, Readiness and Pedagogical Transformation in Teaching and Learning

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI), particularly generative AI technologies, has significantly transformed teaching and learning practices in higher education. While AI offers substantial opportunities to improve instructional efficiency, personalized learning, and assessment automation, its integration also introduces multidimensional challenges for lecturers. This study critically reviews global and Malaysian literature on the issues and challenges faced by lecturers in adapting AI technologies within higher education teaching and learning environments. A qualitative critical literature review approach was employed through systematic searching and thematic synthesis of scholarly publications indexed in academic databases between 2019 and 2026. The analysis identified five major themes affecting lecturers' adaptation to AI: academic integrity and assessment transformation, pedagogical restructuring, AI literacy and competency gaps, ethical and privacy concerns, and institutional readiness. The findings indicate that although these challenges are globally prevalent, they are more pronounced within the Malaysian context due to uneven technological infrastructure, limited institutional policies, insufficient professional training, and varying levels of digital readiness among educators. Furthermore, the increasing dependence of students on generative AI tools raises concerns regarding critical thinking, authentic learning, and independent knowledge construction. This paper argues that AI integration should not be viewed merely as a technological issue but as a broader pedagogical and institutional transformation process. The study contributes to the growing discourse on AI in higher education by proposing an AI Adaptation Readiness Framework consisting of technological, pedagogical, ethical, and institutional dimensions. The framework provides a contextual reference for policymakers and higher education institutions in designing sustainable AI integration strategies. Ultimately, successful AI implementation requires a holistic and human-centered approach that balances technological innovation with educational integrity and pedagogical quality.

Keywords: (Artificial Intelligence (AI), Higher Education, Generative AI, Lecturers, Teaching and Learning, Academic Integrity)

INTRODUCTION

Artificial Intelligence (AI) has emerged as one of the most transformative technologies influencing contemporary higher education. AI refers to the capability of computer systems and machines to perform tasks that typically require human intelligence, including reasoning, learning, decision making, problem solving, and natural language processing (Russell & Norvig, 2021). In recent years, rapid advancements in AI technologies, particularly generative AI applications such as ChatGPT, Gemini, and Copilot, have significantly reshaped educational practices worldwide. The integration of AI into higher education has expanded beyond administrative support systems into core teaching and learning processes. AI technologies are increasingly utilized for automated assessment, intelligent tutoring systems, personalized learning environments, predictive learning analytics, and instructional content generation (Zawacki-Richter et al., 2019). These developments have introduced substantial opportunities to improve instructional efficiency, enhance student engagement, and facilitate personalized learning experiences.

Globally, higher education institutions are actively exploring the potential of AI to transform pedagogical practices and institutional operations. Studies indicate that AI enables lecturers to automate repetitive tasks, generate teaching materials efficiently, and provide timely feedback to students (Chu et al., 2022). Furthermore, AI-driven systems support adaptive learning environments capable of accommodating diverse student needs and learning styles. Such innovations have accelerated the transition toward more flexible, student centered, and data driven educational ecosystems. Despite these benefits, the rapid adoption of AI has also generated complex pedagogical, ethical, and institutional concerns. One of the most debated issues involves academic integrity, particularly the increasing use of generative AI tools by students to produce assignments with minimal cognitive engagement (UNESCO, 2023). The emergence of AI generated academic content challenges conventional assumptions regarding originality, authorship, and assessment authenticity. Consequently, lecturers are increasingly required to redesign assessment methods to ensure meaningful learning and academic credibility.

In addition, the integration of AI requires significant pedagogical transformation among lecturers. Traditional lecture oriented teaching approaches are becoming less effective in AI enhanced learning environments where information can be generated instantly through AI systems. This transformation shifts lecturers' roles from knowledge transmitters to facilitators of learning, requiring new competencies in digital pedagogy, critical facilitation, and AI supported instruction. Another major concern relates to AI literacy and professional readiness among lecturers. Existing studies demonstrate that many educators lack sufficient technical knowledge, pedagogical understanding, and confidence to integrate AI effectively into teaching practices (Akinwalere & Ivanov, 2022). The rapid evolution of AI technologies further intensifies professional pressure on lecturers, who must continuously adapt to changing technological environments.

Within the Malaysian context, AI integration in higher education remains at a developing stage. Malaysian higher education institutions have increasingly adopted digital transformation initiatives aligned with national educational modernization agendas. However, the readiness of institutions and lecturers to integrate AI effectively remains uneven. Previous studies indicate that lecturers face multiple barriers, including inadequate AI-related training, insufficient institutional support, limited policy guidance, and disparities in technological infrastructure (Pitchan & Azmi, 2025). Moreover, the increasing dependence of students on generative AI tools has raised concerns regarding the development of critical thinking, independent learning, and analytical reasoning skills. This situation challenges the fundamental objectives of higher education, which emphasize intellectual development, reflective thinking, and authentic knowledge construction.

Although numerous studies have examined AI implementation in education, most existing literature focuses primarily on technological adoption, student perceptions, or generalized educational applications. Limited studies critically synthesize the multidimensional challenges faced specifically by lecturers within Malaysian higher education institutions. Furthermore, previous discussions often examine AI integration from isolated perspectives without comprehensively addressing the interconnected pedagogical, ethical, institutional, and technological dimensions involved. Therefore, this study aims to critically review the issues and challenges faced by lecturers in adapting AI technologies within higher education teaching and learning practices, with emphasis on both global and Malaysian contexts. Specifically, the study seeks to:

1. Examine the current landscape of AI integration in higher education;
2. Identify major challenges faced by lecturers in adapting AI technologies;
3. Compare global and Malaysian perspectives regarding AI implementation;
4. Propose a conceptual framework for AI adaptation readiness in Malaysian higher education.

This study contributes to the growing discourse on AI in education by providing a critical thematic synthesis of global and local literature while proposing a contextualized framework that may support sustainable and ethical AI integration in Malaysian higher education institutions.

METHODOLOGY

This study employed a qualitative critical literature review approach to examine the issues and challenges faced by lecturers in adapting AI technologies within higher education teaching and learning environments. A critical literature review was selected because it enables the synthesis, interpretation and evaluation of existing scholarly

discussions while identifying emerging patterns, contextual differences and research gaps. The literature search was conducted systematically using several academic databases, including Scopus, Web of Science, Google Scholar, ScienceDirect, SpringerLink, and ERIC. Relevant publications between 2019 and 2026 were identified using combinations of keywords such as "Artificial Intelligence in Higher Education," "Generative AI," "AI Challenges in Teaching and Learning," "AI Literacy," "Academic Integrity and AI," "Lecturers and AI," and "AI in Malaysian Higher Education."

To ensure relevance and academic quality, several inclusion criteria were applied. The review included peer reviewed journal articles, conference proceedings, scholarly reports and institutional publications focusing specifically on higher education, lecturers' experiences, AI implementation, pedagogical transformation, academic assessment, and educational ethics. Studies unrelated to higher education or focusing solely on technical AI development without educational implications were excluded. A thematic analysis approach was employed to analyse and synthesize the selected literature. The reviewed studies were categorized into recurring themes, including academic integrity, pedagogical transformation, AI literacy, ethical concerns, student dependency and institutional readiness. Comparative analysis was subsequently conducted to identify similarities and contextual differences between global and Malaysian educational settings.

The critical review approach enabled the study not only to summarize existing findings but also to evaluate conceptual limitations, contextual gaps and emerging implications associated with AI integration in higher education. This methodology supports the development of a broader understanding of how AI technologies influence lecturers' professional practices, pedagogical adaptation and institutional transformation.

AI TRANSFORMATION IN HIGHER EDUCATION

The Evolution of ai in Teaching and Learning

The rapid advancement of AI technologies has transformed higher education from traditional teacher centered instruction toward more intelligent, adaptive and technology driven learning ecosystems. AI applications such as intelligent tutoring systems, predictive learning analytics, adaptive learning platforms and generative AI tools are increasingly integrated into academic environments worldwide (Zawacki-Richter et al., 2019). Recent developments in generative AI have accelerated this transformation significantly (Batista et al., 2024). Tools such as ChatGPT and Gemini are capable of generating human like text, summarizing information, producing educational content and assisting students with academic tasks. These capabilities have expanded AI utilization beyond administrative efficiency into direct pedagogical applications.

AI technologies offer several potential advantages for higher education institutions. AI supported systems improve instructional efficiency through automated grading, rapid content generation and personalized feedback mechanisms (Chu et al., 2022). Schmidt et al. (2025) further emphasize that AI technologies significantly support academic innovation by assisting lecturers in instructional planning, assessment preparation, and student engagement activities. Lecturers can allocate more time toward higher order teaching activities, including mentoring, facilitation and critical discussion. In addition, AI contributes to personalized learning by tailoring educational materials according to students' learning styles, abilities and progress. Predictive analytics systems also allow institutions to identify at risk students and provide timely interventions to improve learning outcomes.

However, the integration of AI in higher education should not be interpreted solely as technological enhancement. Instead, it represents a broader structural transformation affecting pedagogy, assessment practices, institutional governance and lecturer identity. The emergence of AI challenges conventional assumptions regarding knowledge production, classroom interaction, and educational authenticity.

AI in Malaysian Higher Education

In Malaysia, the adoption of AI technologies within higher education institutions has increased alongside national digital transformation initiatives. Universities and polytechnics have begun incorporating AI supported systems into teaching, learning, and administrative practices.

Studies indicate that Malaysian students actively utilize generative AI tools such as ChatGPT, Gemini and QuillBot for academic writing, content summarization and assignment completion (Muslimin & Jamian, 2025). Similar concerns regarding the disruptive influence of generative AI on higher education have also been highlighted by Selvanathan and Narayanan (2024), who argue that AI technologies simultaneously present opportunities and threats to academic quality and assessment authenticity within Malaysian higher education institutions. Furthermore, lecturers increasingly use AI applications to generate instructional materials, prepare assessments, and support classroom engagement. Despite these developments, AI integration within Malaysian higher education remains inconsistent. Institutional readiness varies significantly depending on infrastructure availability, digital competency levels, policy implementation, and professional development support. The Malaysian context demonstrates that AI adoption is not merely a technological issue but also a socio-pedagogical challenge. Lecturers are required to balance technological innovation with educational ethics, assessment validity, and student intellectual development.

Key Issues and Challenges Faced by Lecturers

Academic Integrity and Assessment Transformation

Academic integrity has emerged as one of the most critical challenges associated with AI integration in higher education. Generative AI tools are capable of producing sophisticated academic content that closely resembles human generated writing. Consequently, distinguishing between authentic student work and AI generated outputs has become increasingly difficult (Batista et al., 2024; Weng et al., 2024). The emergence of generative AI challenges traditional assessment approaches that rely heavily on written assignments and information reproduction. Existing assessment models often emphasize content production rather than authentic understanding and applied critical thinking. As a result, AI technologies expose structural weaknesses within conventional educational assessment systems.

Although many discussions frame AI primarily as a threat to academic honesty, this perspective may oversimplify the issue. The increasing reliance on AI among students also reflects the limitations of traditional pedagogical approaches that prioritize memorization and task completion over analytical engagement. To address these concerns, lecturers are increasingly required to redesign assessment strategies using more authentic and reflective approaches. Alternative assessment methods such as project based learning, oral presentations, reflective writing, portfolio assessment and in class problem solving activities are becoming increasingly important in ensuring meaningful learning outcomes (Mulaudzi & Hamilton, 2025; Weng et al., 2024). Nevertheless, redesigning assessments requires substantial pedagogical adaptation, time investment and institutional support. Many lecturers face difficulties balancing assessment innovation with existing academic workloads and institutional expectations.

Pedagogical Transformation

AI integration has fundamentally transformed the pedagogical role of lecturers within higher education. Traditional lecturer centered instruction is increasingly challenged by AI supported environments where information can be accessed instantly through generative technologies. This transformation shifts lecturers' responsibilities from knowledge transmission toward facilitation, mentorship and critical guidance. Lecturers are now expected to cultivate higher order thinking, ethical reasoning and AI literacy among students. However, pedagogical transformation involves more than technological adoption. It requires lecturers to redesign instructional approaches, classroom interaction and learning activities in alignment with AI enhanced educational environments. Many lecturers experience uncertainty and resistance during this transition, particularly those accustomed to conventional teaching practices. The rapid pace of AI development intensifies pressure on educators to continuously adapt their pedagogical strategies. Furthermore, excessive dependence on AI supported learning environments may unintentionally reduce direct intellectual engagement among students. Without appropriate pedagogical guidance, students may become passive consumers of AI generated information rather than active participants in knowledge construction.

AI Literacy and Professional Competency Gaps

The lack of AI literacy among lecturers represents another significant barrier to effective AI integration in higher education. Many educators possess limited understanding of how AI systems operate, their pedagogical applications and their ethical implications. The rapid emergence of generative AI technologies has widened the competency gap between technological innovation and educators' professional readiness (AlBlooshi, 2026). Although lecturers may recognize the potential benefits of AI, many remain uncertain regarding its appropriate integration into teaching and learning processes. The issue extends beyond technical competency alone. Effective AI integration also requires pedagogical literacy, ethical awareness and critical digital understanding. Lecturers must be capable of evaluating AI generated content critically, identifying biases and guiding students toward responsible AI usage. In the Malaysian context, studies indicate that structured AI related professional development remains limited across many higher education institutions. As a result, lecturers often rely on self learning approaches, leading to inconsistent levels of competency and confidence. Without systematic professional training and institutional support, AI adoption risks becoming fragmented and superficial rather than pedagogically meaningful.

Ethical, Privacy and Data Security Concerns

The integration of AI technologies in higher education also introduces significant ethical and privacy related challenges. AI systems frequently require access to extensive amounts of student data, including academic records, behavioral patterns and learning analytics. This raises important concerns regarding data privacy, security, transparency and ethical governance. Inadequate protection of student information may expose institutions to cybersecurity risks and ethical controversies. In addition, algorithmic bias represents another major concern associated with AI implementation (AlBlooshi, 2026; Katsamakas et al., 2024). AI systems are developed based on datasets that may contain embedded biases, potentially producing unfair or discriminatory outcomes in educational decision making processes. Ethical concerns also extend to issues of accountability and transparency. Many AI systems function as "black box" technologies where decision making processes remain unclear to both lecturers and students. Therefore, ethical AI integration requires institutions to establish clear governance frameworks, responsible usage guidelines and transparent policies regarding data protection and educational accountability.

Student Dependency on AI

Another growing concern involves students' increasing dependence on AI technologies to complete academic tasks. Generative AI tools enable students to generate essays, summarize articles, solve problems and produce academic responses with minimal intellectual effort. Although AI can support learning efficiency, excessive dependency may weaken students' critical thinking, creativity, analytical reasoning and independent learning skills. This issue is particularly concerning because higher education aims not merely to produce information but to cultivate intellectual development, reflective thinking and problem-solving capabilities. The challenge therefore lies in balancing AI assisted learning with meaningful cognitive engagement. AI should function as a support mechanism rather than a substitute for intellectual effort. Lecturers play a crucial role in guiding students toward responsible AI usage while encouraging reflective, inquiry based and critical learning practices.

Institutional Readiness and Policy Limitations

Successful AI integration depends significantly on institutional readiness, governance structures and policy support. However, many higher education institutions remain insufficiently prepared to manage the complexities associated with AI adoption. Existing institutional limitations include inadequate technological infrastructure, inconsistent AI policies, insufficient training opportunities and unclear ethical guidelines. In Malaysia, disparities in institutional readiness are particularly evident between institutions with varying levels of digital resources and technological investment. Some universities demonstrate advanced AI integration initiatives, while others remain in the early stages of digital transformation. The absence of standardized institutional frameworks creates uncertainty among lecturers regarding acceptable AI practices, assessment policies and ethical boundaries. Consequently, institutional support systems must evolve alongside technological advancement to ensure sustainable and responsible AI integration within higher education.

Critical Comparative Analysis of Global and Malaysian Contexts

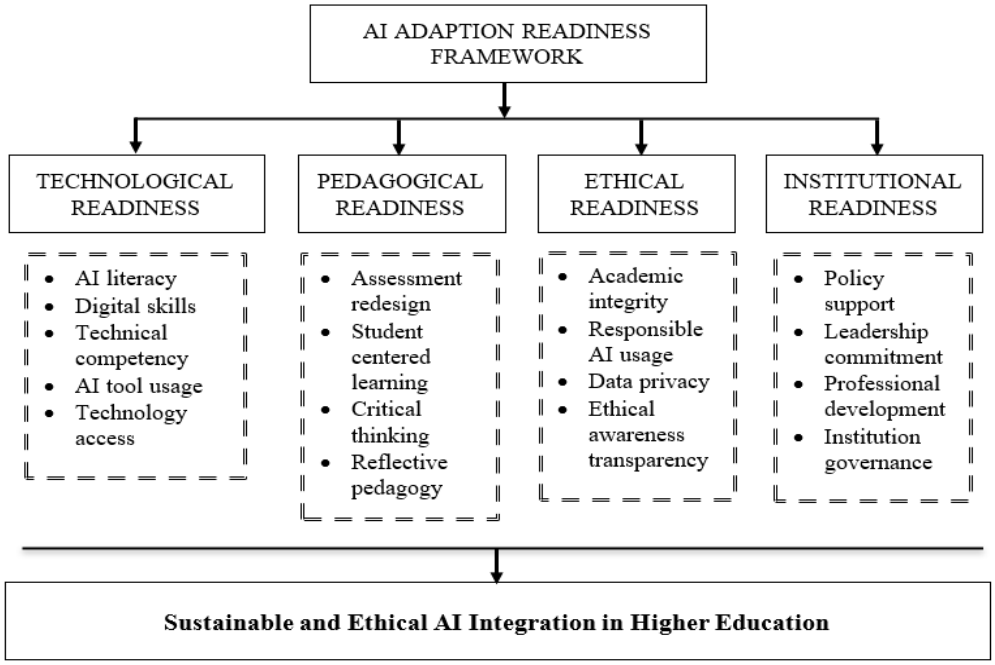
A critical comparison between global and Malaysian literature reveals both similarities and contextual differences regarding the challenges associated with AI integration in higher education. Globally, discussions surrounding AI integration primarily focus on optimizing pedagogical innovation, assessment redesign, and institutional transformation (Katsamakas et al., 2024; Krause et al., 2024). Many developed higher education systems have progressed beyond initial technological adoption toward strategic AI governance and curriculum redesign. In contrast, Malaysian higher education institutions continue to face foundational challenges related to readiness, infrastructure, policy development and lecturer competency. While global institutions increasingly debate ethical governance and advanced pedagogical innovation, Malaysian institutions remain concerned with basic adaptation and implementation issues.

Despite these contextual differences, several challenges appear universally significant. Academic integrity, pedagogical transformation, AI literacy and ethical concerns consistently emerge across both global and local studies. However, the Malaysian context demonstrates greater vulnerability regarding institutional support and professional readiness. The uneven distribution of technological resources, varying levels of digital competency and limited AI governance structures intensify implementation difficulties. Another notable difference involves student dependency on AI technologies. Krause et al. (2024) argue that excessive dependence on generative AI may weaken students' intellectual engagement and reduce meaningful cognitive participation in learning processes. Although this issue exists globally, it appears particularly concerning within Malaysian polytechnic and higher education environments where AI tools are increasingly utilized as substitutes rather than supplementary learning resources.

The comparative analysis also reveals that AI related challenges should not be interpreted merely as technological barriers. Instead, they represent indicators of broader structural transformation within higher education systems. The integration of AI fundamentally challenges traditional assumptions regarding teaching authority, knowledge production, classroom interaction and assessment authenticity. Consequently, successful AI adaptation requires multidimensional transformation involving pedagogy, ethics, governance, infrastructure and professional identity.

Proposed AI Adaptation Readiness Framework

Figure 1 AI Adaptation Readiness Framework for Malaysian Higher Education Lecturers



Based on the critical synthesis of global and Malaysian literature, this study proposes an "AI Adaptation Readiness Framework" for higher education lecturers.

The framework consists of four interconnected dimensions:

Technological Readiness

Technological readiness refers to lecturers' ability to utilize AI technologies effectively within teaching and learning environments. This dimension includes digital literacy, technical competency, AI tool familiarity, and access to technological infrastructure and support.

Pedagogical Readiness

Pedagogical readiness involves lecturers' capacity to redesign instructional approaches, learning activities, and assessment strategies in alignment with AI enhanced educational environments. This includes, authentic assessment design, student-centered learning, reflective pedagogy, critical thinking facilitation and AI supported instructional innovation.

Ethical Readiness

Ethical readiness refers to awareness and understanding of responsible AI usage, academic integrity, data privacy, transparency, and ethical governance. Lecturers must possess the ability to guide students toward ethical AI practices while ensuring educational accountability.

Institutional Readiness

Institutional readiness encompasses organizational support systems, policy development, infrastructure availability, leadership commitment, and continuous professional development opportunities. The framework suggests that sustainable AI integration depends on the balanced interaction of all four dimensions. Weakness within any dimension may negatively affect the effectiveness and ethical quality of AI implementation.

Implications for Malaysian Higher Education

The findings of this study provide several important implications for Malaysian higher education institutions. First, AI integration requires a shift from technology centered implementation toward human centered educational transformation. Institutions should recognize that successful AI adoption depends not only on technological infrastructure but also on pedagogical preparedness and ethical governance. Second, professional development initiatives should prioritize AI literacy among lecturers. Continuous training programs focusing on pedagogical integration, ethical awareness and assessment redesign are essential for strengthening lecturers' readiness. Third, higher education institutions should establish clear institutional policies regarding AI usage, academic integrity, and data privacy. Standardized governance frameworks can reduce uncertainty and support responsible implementation. Fourth, assessment systems within higher education require substantial redesign to accommodate AI enhanced learning environments. Greater emphasis should be placed on authentic, reflective, and applied learning approaches. Finally, policymakers should address disparities in technological infrastructure and institutional readiness to ensure equitable AI integration across Malaysian higher education institutions.

RECOMMENDATIONS

Based on the findings of this study, several recommendations are proposed to strengthen the integration of AI within Malaysian higher education institutions. First, higher education institutions should implement structured and continuous professional development programs to enhance lecturers' AI literacy, digital pedagogy competencies, ethical awareness and assessment redesign capabilities. Such initiatives are essential to ensure that lecturers are adequately prepared to integrate AI technologies effectively and responsibly into teaching and learning practices. Continuous training programs, workshops and certification initiatives can help lecturers remain updated with emerging AI developments and pedagogical innovations. In addition, institutions should establish comprehensive governance policies and clear guidelines regarding AI implementation in higher

education. These policies should address issues related to academic integrity, responsible AI usage, ethical considerations, data privacy and transparency in AI supported educational practices. Clear institutional frameworks are important to provide guidance for both lecturers and students while ensuring consistency and accountability in AI adoption.

Furthermore, assessment strategies within higher education should be redesigned to align with AI enhanced learning environments. Traditional assessment approaches that rely heavily on content reproduction should be complemented with more authentic forms of assessment emphasizing critical thinking, reflective learning, oral communication, creativity, collaboration, and applied problem solving. Such assessment approaches can help ensure meaningful learning while reducing overreliance on AI generated outputs. The study also recommends integrating AI ethics and digital literacy into academic curricula across disciplines. Students should be educated on responsible AI usage, ethical awareness, critical evaluation of AI generated information and the limitations of AI technologies. This is important to cultivate responsible, reflective and independent learners who are capable of utilizing AI as a supportive learning tool rather than a substitute for intellectual effort.

Additionally, higher education institutions should strengthen technological infrastructure and support systems to facilitate sustainable AI integration. Institutions must ensure equitable access to reliable digital platforms, AI tools, internet connectivity and technical support services. Adequate infrastructure and institutional support are crucial to minimize disparities in AI adoption and enhance the effectiveness of technology enhanced teaching and learning practices.

Collaborative research and innovation involving educators, researchers, policymakers and industry stakeholders should also be encouraged to explore context specific AI solutions suitable for Malaysian higher education environments. Such collaborations may contribute to the development of innovative pedagogical models, ethical frameworks and sustainable AI implementation strategies that address local educational needs and challenges.

Finally, continuous monitoring and evaluation of AI implementation should be conducted to assess its effectiveness, ethical implications and educational impact. Institutions should regularly collect feedback from lecturers and students to identify emerging issues, evaluate policy effectiveness and improve AI integration practices. Continuous evaluation is essential to ensure that AI implementation remains aligned with educational goals, pedagogical quality and human centered learning principles.

CONCLUSION

This study critically reviewed the issues and challenges faced by lecturers in adapting Artificial Intelligence technologies within higher education teaching and learning environments, with emphasis on global and Malaysian contexts. The findings indicate that while AI offers substantial opportunities to enhance instructional efficiency, personalized learning and pedagogical innovation, it simultaneously introduces complex challenges involving academic integrity, pedagogical transformation, AI literacy, ethical governance, and institutional readiness. Globally, higher education institutions increasingly focus on optimizing AI integration and redefining educational practices in response to technological advancement. However, within the Malaysian context, AI adaptation challenges are more pronounced due to limited institutional readiness, uneven infrastructure, insufficient professional training and evolving policy frameworks. This study argues that AI integration should not be interpreted merely as a technological issue but as a broader structural transformation affecting the fundamental nature of higher education. The emergence of generative AI has disrupted conventional assumptions regarding knowledge production, assessment validity and the professional role of lecturers. Therefore, successful AI implementation requires a holistic and context specific approach involving technological preparedness, pedagogical restructuring, ethical governance and institutional transformation. The proposed AI Adaptation Readiness Framework contributes to the growing discourse on AI in education by providing a multidimensional understanding of lecturers' adaptation challenges within Malaysian higher education. Ultimately, the future of AI in higher education depends on the ability of institutions and educators to balance technological innovation with educational integrity, human centered pedagogy and meaningful intellectual development.

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Authors' Contribution

Investigation, M.K., N.H. and K.F.; Writing – review & editing, M.K., N.H. and K.F.; Conceptualization, M.K., N.H. and K.F.; Writing – original draft, M.K., N.H. and K.F.; Visualization, M.K., N.H. and K.F.; Data curation, M.K., N.H. and K.F.; Validation, M.K., N.H. and K.F.; Resources, M.K., N.H. and K.F.; Methodology. M.K., N.H. and K.F. All authors have read and agreed to the published version of the manuscript.

REFERENCES

1. Akinwalere, S. N., & Ivanov, V. (2022). Artificial intelligence in higher education: Challenges and opportunities. ResearchGate Preprint. Retrieved from https://www.researchgate.net/publication/359080609
2. AlBlooshi, S. A. (2026). Artificial intelligence in higher education: Opportunities and challenges: A review. Frontiers in Education. Retrieved from https://doi.org/10.3389/feduc.2025.1683968
3. Batista, J., et al. (2024). Generative AI and higher education: Trends, challenges, and opportunities. Information, 15(11), 676. Retrieved from https://doi.org/10.3390/info15110676
4. Chu, H. C., Hwang, G. H., Tu, Y. F., & Yang, K. H. (2022). Roles and research trends of artificial intelligence in higher education: A systematic review of the top 50 most-cited articles. Australasian Journal of Educational Technology, 38(3), 22–42. Retrieved from https://doi.org/10.14742/ajet.7526
5. Katsamakas, E., et al. (2024). Artificial intelligence and the transformation of higher education institutions. arXiv. Retrieved from https://doi.org/10.48550/arXiv.2402.08143
6. Krause, S., et al. (2024). The evolution of learning: Assessing the transformative impact of generative AI on higher education. arXiv. Retrieved from https://doi.org/10.48550/arXiv.2404.10551
7. Mulaudzi, L. V., & Hamilton, J. (2025). Lecturers' perspectives on the role of artificial intelligence in personalized learning. Journal of Academic Ethics. Retrieved from https://doi.org/10.1007/s10805-025-09615-1
8. Muslimin, M. S., & Jamian, M. S. (2025). Artificial intelligence (AI) is changing how students learn in Malaysian polytechnics. Retrieved from https://ir.uitm.edu.my/id/eprint/131994
9. Pitchan, M. A., & Azmi, S. (2025). Pengalaman dan Cabaran Pensyarah Universiti Kebangsaan Malaysia Menggunakan Kecerdasan Buatan Sebagai Sokongan Pengajaran dan Pembelajaran. Jurnal Komunikasi: Malaysian Journal of Communication, 41(3), 313-329. Retrieved from https://doi.org/10.17576/JKMJC-2025-4103-17
10. Russell, S., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson.
11. Schmidt, D. A., et al. (2025). Integrating artificial intelligence in higher education: perceptions, challenges, and strategies for academic innovation. Journal Computers and Education Open, 9. Retrieved from https://doi.org/10.1016/j.caeo.2025.100274
12. Selvanathan, B., & Narayanan, S. (2024). ChatGPT in higher education Malaysia: An opportunity or threat to the education system? International Journal of Academic Research in Progressive Education and Development, 13(3), 965-979. Retrieved from http://dx.doi.org/10.6007/IJARPED/v13-i3/21455
13. UNESCO. (2023). Guidance for generative AI in education and research. UNESCO. Retrieved from https://doi.org/10.54675/EWZM9535
14. Weng, X., XIA, Q., Gu, M., Rajaram, K., & Chiu, T. K. (2024). Assessment and learning outcomes for generative AI in higher education: A scoping review on current research status and trends. Australasian Journal of Educational Technology, 40(6), 37–55. Retrieved from https://doi.org/10.14742/ajet.9540
15. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education. International Journal of Educational Technology in Higher Education, 16(39). Retrieved from https://doi.org/10.1186/s41239-019-0171-0