DIGITAL DEXTERITY: EFFECT AND IMPLICATION THROUGH THE USE OF AI AMONG EDUCATORS IN MALAYSIA

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Abstract: *The rapid advancement of Artificial Intelligence (AI) in the education sector has intensified the urgency to strengthen digital competencies among educators. In this context, digital dexterity the ability to adapt, continuously learn, and innovate using digital technologies has emerged as a critical skill for navigating the demands of 21st-century education. This article explores the role of digital dexterity in the age of AI, with a specific focus on Malaysian educators, and examines both the effects and implications of AI integration in the teaching profession. The effects of AI implementation are multifaceted. Positively, AI enhances pedagogical practices through automation, intelligent tutoring systems, and data-informed decision-making. It supports real-time tracking of student progress, facilitates differentiated instruction, and improves the efficiency of classroom management and administrative tasks. However, the unintended effects include overreliance on algorithms, diminished educator autonomy, and widening digital gaps among educators with varying levels of technological proficiency. The implications of these effects are profound. On a professional level, educators must reconceptualize their roles not merely as content deliverers but as facilitators, data interpreters, and ethical decision-makers in technology-rich environments. Institutionally, there is a need for responsive policy frameworks and systematic capacity-building efforts to ensure that AI tools are used responsibly and equitably. This article, based on conceptual analysis and a review of current literature, outlines key strategies to develop AI-ready educators, including structured training programs, policy alignment, and the establishment of a robust digital competency framework. The findings and recommendations aim to inform*

educational leaders, teacher training institutions, and policymakers in creating a responsive, inclusive, and future-proof educational ecosystem.

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Introduction

In recent years, digital transformation has emerged as a powerful force reshaping the landscape of education globally, including in Malaysia. This transformation is driven by the widespread adoption of intelligent technologies and digital tools such as adaptive learning platforms, digital learning management systems, and AI-powered applications like ChatGPT, Google Bard, Canva AI, and others. These technologies are not only accelerating the digitisation of teaching and learning processes but are also redefining the roles of educators, pedagogical approaches, and the way knowledge is delivered and acquired in the modern classroom.

In the Malaysian context, educators are now increasingly expected to demonstrate not only technological literacy but also *digital dexterity* a more comprehensive and strategic set of capabilities. Digital dexterity goes beyond basic technical skills; it encompasses a growth-oriented mindset, adaptability to continuous change, the ability to critically evaluate and apply digital tools, and the confidence to innovate within digital environments. It represents a shift from simply using digital tools to leveraging them effectively to enhance the quality of education.

The integration of AI in education has significantly impacted the traditional role of teachers. Teaching is becoming more data-informed, automated, and personalised. For example, AI-based learning platforms can adapt content delivery to students' individual performance levels in real-time, transforming the teacher's role from being a sole knowledge provider to a learning facilitator, progress monitor, and ethical decision-maker in technology-mediated environments. This transformation presents new challenges that require educators to acquire advanced digital skills while also understanding the pedagogical, ethical, and professional implications associated with the use of such technologies.

Considering this, the present article aims to explore how AI is influencing educators' roles and to examine the broader effects and implications of its integration into teaching and learning processes in Malaysia. Furthermore, the article seeks to identify strategic approaches that can be adopted to support educators in this evolving digital landscape, including policy recommendations, professional development initiatives, and the development of comprehensive digital competency frameworks. It is hoped that these insights will contribute to the creation of a more resilient, inclusive, and future-ready education system aligned with the demands of the Fourth Industrial Revolution and beyond.

Understanding Digital Dexterity in Education

Digital dexterity is increasingly recognised as a core competency in the 21st-century educational ecosystem. It refers to an individual's ability to accept, adapt to, and utilise digital technologies in a flexible, innovative, and contextually appropriate manner. Unlike digital literacy, which focuses primarily on basic technological use, digital dexterity encompasses broader capabilities such as strategic thinking, cognitive flexibility, a lifelong learning mindset, and the courage to explore new approaches in teaching and learning. For educators, digital

dexterity is not merely about operating software or devices; it involves an understanding of how, when, and why to use specific technologies to achieve meaningful learning outcomes.

First, digital dexterity is evident in an educator's ability to quickly master new digital platforms. In an era where educational technology is rapidly evolving such as learning management systems (LMS), collaborative tools, visual aids, and online assessment platforms educators must be prepared to adapt swiftly. Those with digital dexterity can evaluate the pedagogical value of a digital tool and integrate it effectively into their daily instructional practices.

Second, educators with digital dexterity are capable of strategically utilising intelligent technologies, such as Artificial Intelligence (AI), to support teaching. This includes the use of intelligent tutoring systems, learning analytics, and automated feedback mechanisms to personalise the learning experience. Educators are no longer mere transmitters of knowledge, but rather facilitators and progress monitors who harness data and technology to enhance instructional effectiveness.

Third, digital dexterity enables educators to transition smoothly between various teaching modes whether face-to-face, online, or hybrid. This is particularly important in the post-pandemic era, where teaching modalities are constantly shifting in response to needs and circumstances. Flexible educators can adapt their teaching materials, manage virtual classrooms, and maintain student engagement regardless of the mode of delivery.

Fourth, educators with digital dexterity play a key role in promoting digital citizenship among students. This includes fostering ethical use of technology, online safety, information literacy, and awareness of digital footprints. Educators are responsible for shaping students' values and attitudes so they can become responsible and ethical users of technology.

Fifth, digital dexterity also encompasses collaborative and reflective practice. Modern educators are encouraged to share best practices, co-develop teaching materials, and participate in professional learning communities online. Platforms such as Google Workspace, Padlet, and Trello support collaboration and innovation among education professionals.

Finally, truly digitally dexterous educators consistently seek to empower themselves through continuous learning and innovation. They actively engage in courses, attend workshops, and experiment with new teaching strategies to ensure they remain aligned with current developments. In an ever-changing educational environment, digital dexterity is a vital advantage that ensures educators remain relevant, effective, and prepared to face future challenges. However, digital dexterity is not a static skill set, but a dynamic capacity that must be nurtured and continuously developed. In an age of rapid technological advancement and increasing integration of AI, educators who possess digital dexterity play a crucial role in shaping a generation of learners who are technologically literate, creative, and future-ready.

The Role of AI in Enhancing Educator Performance

Artificial Intelligence (AI) is rapidly transforming the education sector by providing innovative tools that enhance the efficiency, effectiveness, and adaptability of teaching practices. For educators, the integration of AI does not only support classroom instruction but also alleviates administrative burdens, enriches student engagement, and informs pedagogical decisions. As educational institutions strive to improve teaching quality and learning outcomes, AI serves as

both a facilitator and an accelerator of educator performance (Ministry of Education, 2023; Tan, 2021).

First, one of the key contributions of AI is the automation of routine administrative tasks. AI-powered systems can manage scheduling, marking assessments, tracking attendance, and even generating lesson plans. By reducing time spent on these repetitive tasks, educators can redirect their energy towards more impactful instructional activities, such as student mentoring, curriculum design, and classroom innovation.

Secondly, personalized learning environments are now more attainable through AI. Intelligent tutoring systems and adaptive learning platforms can analyse student data in real time and modify instructional content based on individual learning pace, style, and performance. This allows teachers to deliver differentiated instruction that meets the diverse needs of learners, thus improving engagement and academic outcomes.

Thirdly, AI also plays a significant role in professional development. By analysing educators' interests, teaching styles, and performance data, AI systems can recommend relevant learning resources, courses, or communities of practice. This targeted approach enables teachers to pursue continuous professional growth efficiently, without being overwhelmed by the vast amount of content available online.

In addition, AI-based data analytics allows educators to better understand patterns in student learning. By providing insights into class performance, behavioural trends, and achievement gaps, AI equips teachers with the information needed to make data-informed decisions. This supports timely intervention, more accurate assessment of learning needs, and enhanced student outcomes.

In the Malaysian context, several applications of AI in educational institutions illustrate these functions:

- AI-powered assessment tools have been introduced in Teacher Training Institutes (Institut Pendidikan Guru Malaysia, IPGM) to support formative and summative evaluations. These tools allow for automated marking, analysis of student progress, and feedback generation.
- Canva AI has been adopted in pedagogical training sessions to support creative and efficient digital content creation. It enables educators to develop visually engaging instructional materials with ease, improving the quality of teaching resources.
- Learning analytics platforms such as DELIMa and MyGuru integrate AI algorithms to monitor learner interaction, detect disengagement, and recommend interventions in real-time. These virtual learning environments provide both lecturers and administrators with actionable data to improve teaching strategies and student support services.

Overall, AI serves as a powerful enabler for educators by streamlining processes, enriching instructional design, and enhancing reflective teaching. When strategically implemented, AI can contribute significantly to improving the professional performance of educators while maintaining a learner-centred focus.

Effects of AI on Educator Practices

Positive effects

The use of Artificial Intelligence (AI) in education has increasingly shown significant positive effects on teaching and learning practices among educators. Four key aspects have been identified as contributors to the enhanced effectiveness of educational practices through AI integration.

Firstly, AI has contributed to increased efficiency and time savings for educators. Various AI applications, such as automated grading systems, administrative bots, and scheduling assistants, have enabled teachers to reduce the time spent on routine and repetitive tasks. This indirectly allows educators to focus more on teaching, engaging with students, and their own professional development. The time saved also opens opportunities for planning more creative and strategic instructional activities.

Secondly, the use of AI-based analytics platforms has enhanced educators' capacity for data-informed decision-making. AI provides real-time access to information related to student performance, learning gaps, and relevant behavioural patterns. This information allows teachers to plan more targeted, evidence-based, and outcome-oriented teaching strategies, as well as implement interventions tailored to students' specific needs.

Thirdly, AI supports increased student engagement through personalized learning experiences. Adaptive learning platforms and intelligent tutoring systems enable learning content to be dynamically adjusted based on students' proficiency levels, interests, and individual needs. This approach can enhance motivation, active engagement, and support for students throughout their learning journey.

Fourthly, AI empowers educators to design innovative and interactive instructional content. With the help of tools such as ChatGPT, Canva, and AI-based video editors, teachers can create engaging teaching materials including multimedia content, quizzes, simulations, and impactful visuals. These materials not only enrich students' learning experiences but also promote the adoption of more responsive and future-ready digital pedagogy.

Therefore, the positive impact of AI on educator practices demonstrates that the integration of this technology not only enhances the effectiveness of teaching but also contributes to professional development and pedagogical transformation that is more inclusive and effective

Negative implications:

Negative Implications of AI Integration in Educator Practices

While the integration of Artificial Intelligence (AI) in education offers numerous benefits, it also brings about several challenges that must be addressed to ensure ethical, equitable, and sustainable implementation. Among the most pressing negative implications are digital fatigue, ethical concerns, skill disparities, and the pressure for constant upskilling among educators.

Digital fatigue and overreliance on technology have become increasingly common among educators who must constantly engage with multiple digital platforms and tools. The extensive use of AI-powered systems for lesson planning, assessment, and communication can lead to cognitive overload, screen exhaustion, and decreased job satisfaction. Moreover, when teaching

becomes overly dependent on AI systems, there is a risk that human elements such as emotional connection, intuition, and contextual judgment may be diminished, ultimately affecting the quality of the teaching and learning experience.

Ethical concerns also arise in relation to AI use in educational settings. One key issue is plagiarism, particularly when students use AI tools such as language models or content generators without proper attribution. Educators may struggle to detect AI-generated assignments, leading to integrity challenges.

In addition, bias in AI algorithms poses another serious concern. Many AI systems are trained on datasets that may reflect cultural, gender, or racial biases. When these systems are used to assess student performance or guide learning recommendations, they may unintentionally reinforce inequalities and marginalize certain groups of learners.

Another critical implication is the skill gap among educators, particularly those who are older or less familiar with emerging technologies. These educators may find it difficult to adapt to AI-based systems, leading to a sense of inadequacy or exclusion from innovative teaching practices. Without targeted professional development, these individuals' risk being left behind in the digital transformation of education, exacerbating generational and technological divides within institutions.

Finally, the increased pressure for continuous upskilling places a burden on educators who must regularly update their digital competencies to remain effective in an AI-enhanced environment. While lifelong learning is essential in a fast-evolving educational landscape, the expectation to keep pace with rapid technological changes can cause stress, burnout, and resistance to innovation. Institutions that fail to provide adequate support, training, and time allocation for skill development may inadvertently undermine educator morale and well-being.

While AI offers transformative potential in education, it also introduces significant challenges that must be proactively managed. Addressing digital fatigue, ethical dilemmas, technological disparities, and upskilling demands is essential to ensure that the integration of AI empowers all educators rather than widening gaps or creating new vulnerabilities.

Implications for Educational Leadership and Policy

The integration of AI necessitates:
The integration of Artificial Intelligence (AI) into educational settings presents not only technological challenges but also significant leadership and policy implications. To harness the transformative potential of AI while addressing its complexities, educational leaders and policy makers must focus on four core areas: professional development, infrastructure support, ethical governance, and leadership capacity building.

Professional Development Programs Focused on AI Literacy
Educators need to be equipped with the knowledge, skills, and mindset to understand and apply AI tools in pedagogically sound and ethically responsible ways. This requires ongoing, structured professional development programs that go beyond technical training to include AI ethics, data literacy, and classroom application.
According to UNESCO (2022), "teacher capacity building is essential to ensure meaningful use of AI in education" and should be aligned with digital transformation strategies. In the

Malaysian context, the Malaysia Digital Education Policy (2021–2025) also emphasizes the importance of continuous professional development in emerging technologies, including AI.

Institutional Support for Infrastructure and Digital Resources

The effective integration of AI is contingent upon access to adequate digital infrastructure. This includes reliable internet connectivity, access to AI-based learning platforms, and availability of hardware such as laptops, servers, and cloud storage. Educational institutions must also ensure maintenance support and cybersecurity measures.

A report by the Malaysian Communications and Multimedia Commission (MCMC, 2023) found that disparities in digital infrastructure persist between urban and rural schools, with only 67% of rural schools having sufficient internet bandwidth to support AI tools. This digital divide can hinder equitable access to AI-enabled learning.

Policy Guidelines on Ethical AI Usage in Classrooms

With AI systems increasingly making decisions that affect learning, such as content recommendation, performance prediction, and automated feedback, there is a pressing need for clear policy frameworks to govern their ethical use. These guidelines should address data privacy, algorithmic transparency, accountability, and student well-being. UNESCO's *Recommendation on the Ethics of Artificial Intelligence* (2021) proposes a rights-based framework that national education systems can adapt to guide responsible AI deployment. The absence of such guidelines may lead to unintended consequences such as algorithmic bias, surveillance concerns, or misuse of generative AI by students.

Leadership Readiness to Lead Digital Transformation

Educational leaders play a critical role in championing the digital transformation process. They must possess not only administrative and strategic competencies but also digital fluency to make informed decisions regarding AI implementation. Leadership training programs should therefore include AI literacy, change management, and innovation leadership.

A national study by Lee and Salleh (2023) found that only 38% of school leaders in Malaysia felt adequately prepared to lead AI-related initiatives, highlighting a leadership readiness gap. Strengthening leadership capacity is key to fostering an adaptive and future-oriented educational culture.

Summary Table: Key Leadership & Policy Implications

Area	Key Focus	Source
Professional Development	Structured AI literacy training for educators	UNESCO (2022); Digital Education Policy (2021–2025)
Infrastructure Support	Ensure equitable access to devices and connectivity	MCMC (2023)
Ethical Guidelines	National policy for responsible classroom AI usage	UNESCO (2021)
Leadership Capacity	Executive programs for digital transformation leadership	Lee & Salleh (2023)

Challenges in Malaysian Context

Although Malaysia has made significant progress in integrating educational technology, the implementation of Artificial Intelligence (AI) within the national education system still faces several critical challenges that warrant serious attention from educational leaders and policy makers.

First, the digital divide between urban and rural areas remains a major barrier to equitable access to education. Urban schools are generally better equipped with technological infrastructure compared to rural schools, which often struggle with slow internet connectivity, a lack of digital devices, and limited technical support. According to the Malaysian Communications and Multimedia Commission (MCMC, 2023), only 67% of rural schools have access to high-speed internet, making the use of cloud-based AI platforms such as adaptive learning systems nearly impossible in certain areas.

Second, there is inconsistency in the level of digital readiness among educational institutions. While some teacher training institutes and selected secondary schools have embarked on significant digital transformation efforts, others remain at a foundational stage in their use of technology. A study by the Ministry of Education Malaysia (Moe, 2022) found that only 42% of institutions reported optimal use of digital tools in teaching and learning (T&L), indicating disparities in implementation in terms of resources, leadership, and professional support.

Third, language and cultural adaptation of AI tools present an additional challenge. Most AI software and platforms developed internationally use English as the primary language, which can hinder access for students and teachers with limited English proficiency. Moreover, AI-generated content that lacks sensitivity to local cultural contexts may reduce pedagogical effectiveness and negatively impact students' learning identity. As noted by Zawacki-Richter et al. (2022), the effectiveness of AI in education depends on local adaptation to ensure contextual relevance, fairness, and user acceptance.

In addition, there remains an urgent need to systematically integrate AI into the national curriculum and teacher education programs. Existing curricula do not fully address the pedagogical, assessment, and classroom management implications of AI integration. Although initiatives such as the *Malaysia Digital Education Policy (2021–2025)* have outlined the importance of strengthening technology literacy in teacher training, implementation is still in the early stages and not yet widespread.

Therefore, these challenges demand a comprehensive strategic approach that includes policy restructuring, investment in digital infrastructure, ongoing professional development, and collaboration with local AI industries to develop relevant and affordable content tailored to the Malaysian educational context.
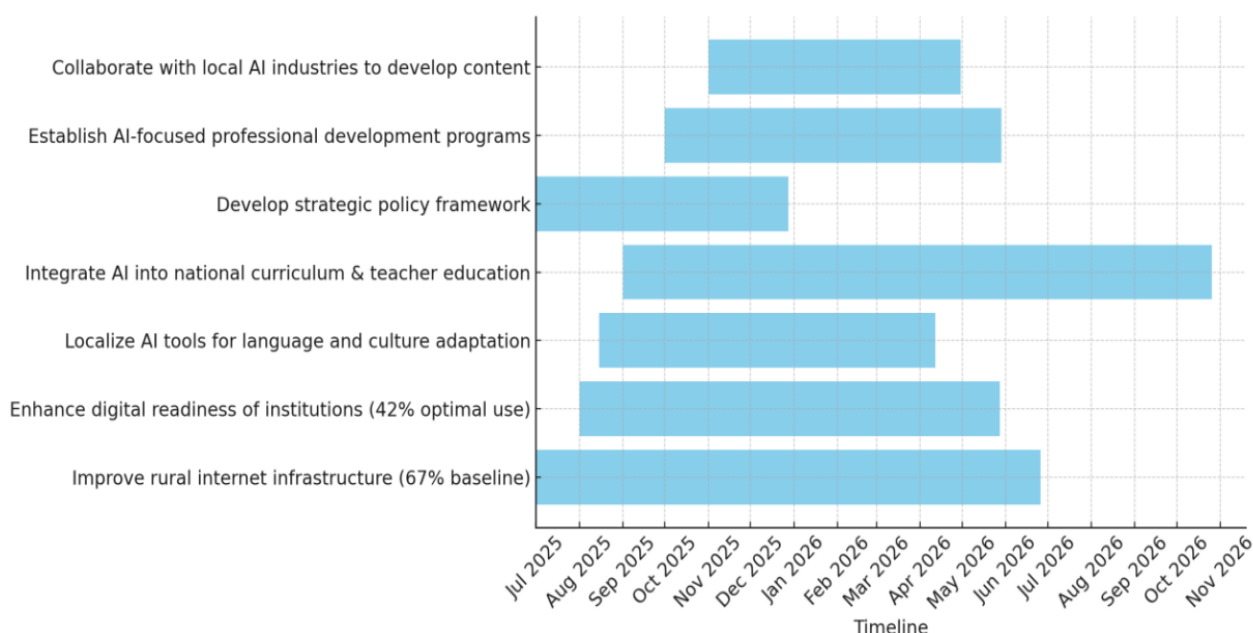
Figure 1: Addressing AI Integration Challenges in Malaysian Education
Sources: UNESCO (2022); Digital Education Policy (2021–2025)

Recommendations

Considering the opportunities and challenges presented by the integration of Artificial Intelligence (AI) in Malaysian education, several strategic recommendations are proposed to strengthen the digital readiness and professional capacity of educators. These recommendations focus on systemic transformation, ethical foundations, peer collaboration, and formal recognition of digital skills.

Develop a National Digital Dexterity Framework for Educators

To ensure consistent development and assessment of digital capabilities across all education levels, Malaysia should establish a National Digital Dexterity Framework tailored for educators. This framework should articulate clear indicators of digital dexterity including digital, media, information, technology, and human literacy as competencies necessary for 21st-century teaching.

The framework can be modelled after existing international references such as the European Commission's DigCompEdu Framework (Vuorikari et al., 2022) or Australia's Digital Dexterity Framework for Libraries (Council of Australian University Librarians, 2021) but adapted to reflect Malaysia's cultural and educational context. It should serve as a guideline for teacher training institutions, school leaders, and policy makers to align curriculum, professional development, and performance evaluation systems with national digital transformation goals.

Promote AI Ethics Training in Professional Development Modules

As AI becomes more deeply embedded in teaching, learning, and assessment processes, educators must be well-versed in AI ethics including algorithmic bias, data privacy, student rights, and responsible use. Therefore, ethics training should be made a core component of continuous professional development (CPD). The UNESCO (2021) Recommendation on the Ethics of Artificial Intelligence provides a comprehensive framework for integrating human rights-based, transparent, and accountable AI use in education. Malaysian CPD modules should include case studies, ethical dilemma simulations, and reflective discussions to help educators develop critical understanding of both the power and pitfalls of AI tools in classroom practice.

Encourage Collaborative Communities of Practice Around AI Use

To bridge knowledge gaps and foster innovation, the Ministry of Education and teacher training institutions should encourage the formation of collaborative Communities of Practice (CoP). These can be school-based or cross-institutional groups where educators regularly exchange experiences, resources, and strategies related to AI integration. Communities of Practice have been shown to improve confidence, creativity, and collective problem-solving among educators adopting new technologies (Wenger, McDermott, & Snyder, 2002). In the Malaysian context, these CoPs could be supported through online platforms (e.g., DELIMa), regional training centres, or digital innovation hubs in Institutes of Teacher Education (ITE).

Implement Micro credentialing Systems for Digital Competency

Recognizing educators' efforts and progress in digital skills development is vital to motivate continuous learning. The Ministry should implement a national micro credentialing system that allows educators to earn verified digital badges or certificates for completing AI-related training, workshops, or practical classroom implementations. Micro credentials offer flexible, modular, and stack-able pathways for teachers to up skill at their own pace, and have been widely adopted in countries such as Australia, Singapore, and the UK. These digital credentials should be aligned with the national digital dexterity framework and integrated into teacher performance appraisals and career advancement pathways.

Conclusion

Digital dexterity is no longer a supplementary or optional skill in the 21st-century educational landscape it has become a core professional competency for educators, particularly in the era of Artificial Intelligence (AI). As AI technologies increasingly influence how information is accessed, processed, and delivered, the ability of educators to adapt, innovate, and lead with digital confidence is critical to the success of educational transformation. Malaysia's education system stands at a strategic inflection point. While there are clear efforts being made such as the *Malaysia Digital Education Policy (2021–2025)* and various state-level initiatives the full potential of AI can only be realized when digital dexterity is institutionalized across every level of the teaching workforce. This involves more than mere exposure to digital tools; it requires a systemic shift in mindset, pedagogical approach, and professional identity. To move forward effectively, strategic policies must be crafted that prioritize ethical AI integration, equitable digital infrastructure, and measurable standards of digital competence. These policies must be supported by targeted professional development programs that build both the technical skills, and the critical literacies educators need to use AI meaningfully and responsibly.

Moreover, the role of visionary educational leadership cannot be overstated. Leaders at all levels school heads, IPG directors, curriculum developers, and policy makers must not only embrace AI, but also drive a culture of digital innovation and reflective practice. When educators are empowered with the necessary digital competencies and supported by a clear national framework, AI can become a transformational force not one that replaces teachers, but one that enhances their capacity to deliver inclusive, personalized, and impactful learning experiences. It can help bridge learning gaps, support differentiated instruction, and foster 21st-century skills such as creativity, collaboration, and critical thinking among students.

In summary, the intersection of AI and education represents a powerful opportunity for Malaysia. With sustained commitment, cross-sector collaboration, and a focus on developing digitally dexterous educators, the national education system can lead not only in adopting technology but in shaping a more equitable, human-cantered, and future-ready learning ecosystem

References

Council of Australian University Librarians. (2021). *Digital dexterity framework*. https://www.caul.edu.au/programs-projects/digital-dexterity

Deloitte. (2020). *Digital dexterity: The missing link in digital transformation*. Deloitte Insights.

Kementerian Pendidikan Malaysia. (2022). *Laporan pencapaian transformasi digital pendidikan*. KPM.

Lee, N., & Salleh, M. (2023). Leadership preparedness for AI integration in Malaysian schools. *Journal of Educational Technology and Leadership*, *8*(1), 45–62.

Malaysian Communications and Multimedia Commission. (2023). *Digital infrastructure in schools report*. MCMC.

Ministry of Education Malaysia. (2021). *Malaysia digital education policy 2021–2025*. MOE.

Ministry of Education. (2023). *Digital Education Policy*.

https://www.moe.gov.my/dasarmenu/dasar-pendidikan-digital

Mohd Noor, A., & Lim, C. (2023). Teachers' readiness for AI tools in Malaysian classrooms. *Malaysian Journal of Education Technology*, *18*(2), 44–58.

OECD. (2022). *Artificial intelligence in education: Challenges and opportunities*. OECD Publishing.

OECD. (2023). *Teaching in the digital age: AI, skills and equity*. OECD Publishing. https://doi.org/10.1787/17f694a5-en

Tan, C. (2021). The impact of COVID-19 on student motivation, community of inquiry and learning performance. *Asian Education and Development Studies*, *10*(2), 308–321. https://doi.org/10.1108/AEDS-05-2020-0084

UNESCO. (2021). *Recommendation on the ethics of artificial intelligence*. UNESCO Publishing. https://unesdoc.unesco.org/ark:/48223/pf0000381115

UNESCO. (2022). *AI and the futures of learning: Toward equity and inclusion*. UNESCO Publishing.

Vuorikari, R., Punie, Y., Carretero, S., & Van den Brande, G. (2022). *DigCompEdu: European framework for the digital competence of educators*. Publications Office of the European Union.

Wenger, E., McDermott, R., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge*. Harvard Business Press.

Zainuddin, N., & Roslan, S. (2022). Educators and digital fluency: Case study in teacher training institutes. *Asian Education Review*, *10*(1), 12–23.

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2022). Systematic review of research on AI applications in higher education. *International Journal of Educational Technology in Higher Education*, *19*, 1–27. https://doi.org/10.1186/s41239-019-0171-0