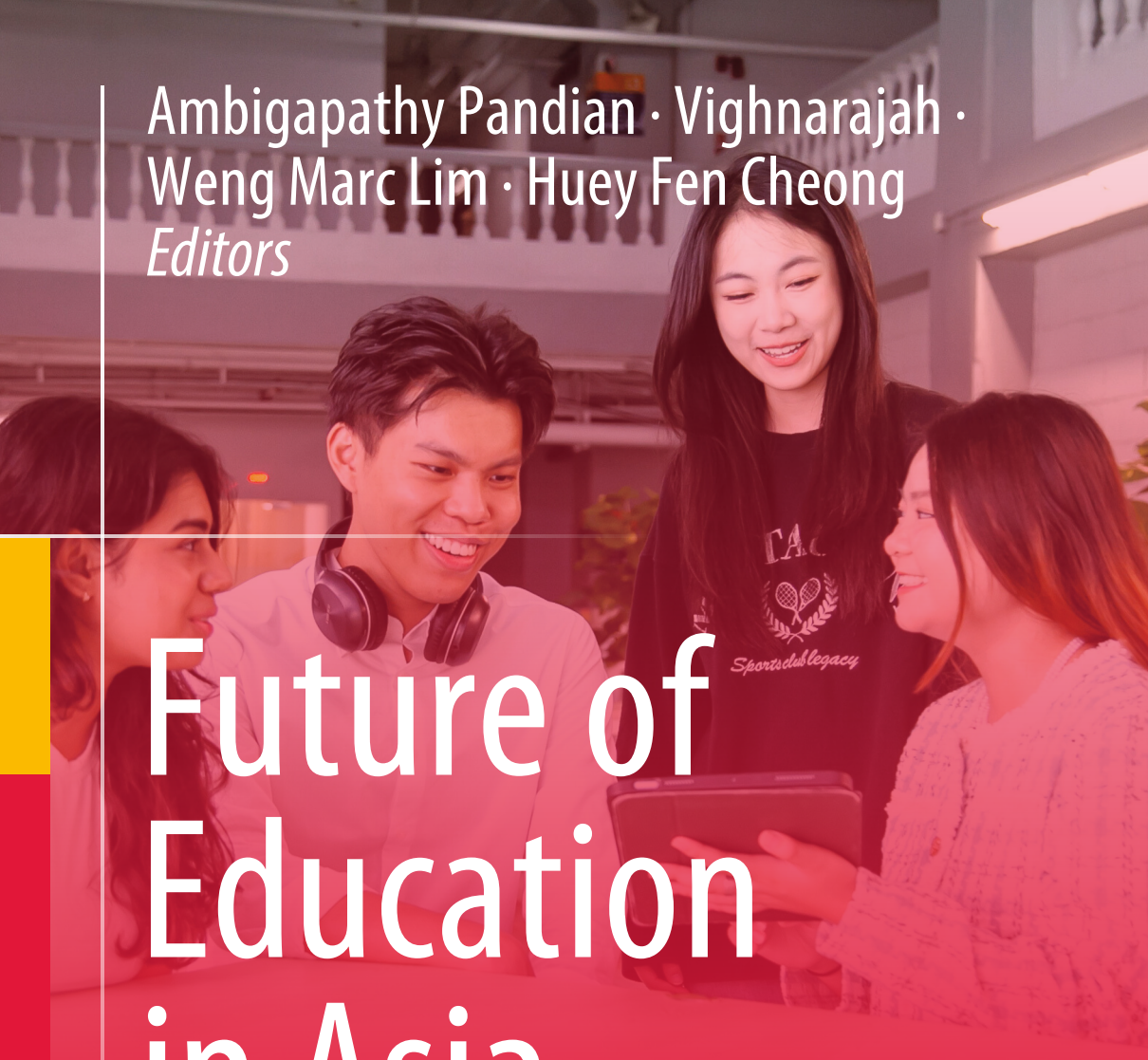
Ambigapathy Pandian · Vighnarajah · Weng Marc Lim · Huey Fen Cheong
Editors



Future of Education in Asia

Sustainability, Technology and Internationalisation

Springer

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Foreword

In an era marked by rapid technological advancements, global interconnectedness, and pressing environmental challenges, the future of education in Asia is undergoing a profound transformation. The education systems across the region must not only adapt to these shifts but also lead the way in fostering sustainable, inclusive, and future-ready learning environments. *Future of Education in Asia: Sustainability, Technology, and Internationalisation* is a timely exploration of these critical themes, offering insights and strategies for shaping the educational landscape of tomorrow.

This volume is thoughtfully structured into three thematic sections, each addressing a pivotal aspect that will influence the trajectory of education in Asia for years to come. The first section, *Fostering Sustainable Education*, emphasises the importance of creating educational systems that are both resilient, equitable and environmentally conscious. From the role of digital and hybrid mobility programmes in promoting global competence to inclusive practices across diverse classrooms, the chapters in this section examine how sustainability can be integrated into educational strategies to benefit all students.

The second section, *Technological Trends in Education*, explores the transformative role of emerging technologies in reshaping teaching and learning. As artificial intelligence (AI) and other digital innovations continue to evolve, these chapters offer valuable perspectives on how technology can enhance educational outcomes, improve accessibility, and equip students with the skills necessary to thrive in a rapidly changing world. The focus is on how educational institutions can leverage technological advances to meet the demands of the twenty-first century.

The third section, *Internationalisation of Education*, highlights the importance of cross-border collaboration and regional cooperation. This section addresses the current state of internationalisation in higher education, focusing on how Asia's educational systems can become more globally competitive while fostering stronger academic exchanges and international partnerships. Through an in-depth exploration of various internationalisation models, this section provides valuable insights into how the region can build a more integrated and dynamic educational ecosystem.

Throughout the chapters, the research is organised into thematic clusters that align with the current and future challenges facing education in Asia. These thematic clusters drawing on the works of Ferhnani (2019), such as *Past & Futures*, *Humanity at the Limen*, *Environmental Futures*, *Post-Normality & Complexity*, and *Technological Trends*, serve as the foundation for exploring the evolving nature of education and its intersection with sustainability, technology, and internationalisation. The thoughtful analyses in these chapters contribute to the ongoing conversation about how Asia can build educational systems that are both innovative and inclusive, addressing the needs of a rapidly changing world.

This collection serves as an essential resource for educators, policymakers, and stakeholders invested in advancing education across Asia. It provides a comprehensive framework for advancing education in the region, ensuring that future generations are equipped with the knowledge, skills, and values necessary to thrive in a globalised, technology-driven world. *Future of Education in Asia: Sustainability, Technology, and Internationalisation* is not just a reflection of the present but a roadmap for the future, guiding us towards a more inclusive, innovative, and sustainable future in education.

Professor Datuk Dr. Mohd Tajudin Md
Ninggal

Titles on the *Futures of Asia*

Future of Business in Asia: Exploring Pathways to Tomorrow's Business Landscape
Future of Cities in Asia: Future Direction of Urban Planning, Technology and Environmental Sustainability
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Contents

Chapter 7
Harnessing AI Innovations for Future-Ready Education in Malaysia Vis-à-Vis Thailand, Singapore and South Korea

Johari Abdullah, Kee Man Chuah, Erlinda Mikal, and Syahrul Nizam Junaini

Abstract This chapter explores the transformative role of Generative AI technologies in potentially redefining the educational landscape of Malaysia, with comparative insights drawn from Thailand, Singapore and South Korea. In the post-COVID-19 era marked by rapid technological change and evolving pedagogical needs, the chapter examines how these nations are integrating AI into their education systems. It critically analyses the impact of AI tools on educators, students and key stakeholders across these countries, highlighting differences in strategy, implementation and outcomes. Special focus is given to the integration of AI in teaching, learning and assessment practices, providing a regional perspective on innovation and inclusivity. The chapter also discusses opportunities and challenges faced by Malaysia and its neighbours in adopting AI in classrooms, offering strategic insights for effective and ethical integration. By comparing approaches and outcomes, this chapter provides a roadmap for educators and policymakers to collaboratively steer AI-driven educational reform in Malaysia and beyond. Ultimately, this chapter contributes to the broader discourse on future-ready education in Asia, positioning Malaysia at the forefront of educational innovation in the face of global technological advancements.

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7.1 Introduction

The emergence of Generative Artificial Intelligence (AI) technologies such as ChatGPT, Claude 3 and Google Gemini marks a new age in the field of education (Labadze & Grigolia, 2023), with the capacity to profoundly revolutionise teaching and learning methods, particularly in the Malaysian setting. This chapter investigates how these technologies are reshaping the educational landscape in Malaysia, while drawing comparative insights from Thailand, Singapore and South Korea. The urgency of this transformation has been amplified by the COVID-19 pandemic, which accelerated digital adoption and highlighted the need for more flexible, inclusive and future-focused educational practices. In Malaysia, the incorporation of Generative AI technologies presents a promising opportunity to strengthen teaching methods, effectively involve learners and boost educational results in all areas.

The educational sector faces distinct difficulties and opportunities in the era following the COVID-19 pandemic (Aboagye et al., 2020). The rapid transition to digital learning platforms and subsequent recognition of technology's potential in education have emphasised the necessity for a methodical and deliberate use of AI tools in teaching and learning procedures. This chapter seeks to examine the intricacies of teaching and learning in the current period, which is defined by swift technology advancements and shifting educational requirements.

While Malaysia sees promise in integrating Generative AI to enhance teaching methodologies and student engagement, its progress is uneven. In contrast, countries like Singapore have made significant strides through robust policy frameworks, and South Korea and Thailand are advancing with strategic investments in AI-powered learning environments. This chapter offers a critical examination of these comparative trajectories, addressing the challenges, innovations and outcomes of AI implementation in each context.

Focusing on AI's integration in instruction, engagement and assessment, the chapter seeks to understand how regional best practices can inform Malaysia's strategy towards future-ready education. By analysing these varied approaches, it aims to support educators, policymakers and institutions in developing balanced, inclusive and ethically guided AI adoption models across Asia.

7.2 Key Concepts and Issues

7.2.1 Understanding Artificial Intelligence

Artificial Intelligence (AI) aims to replicate human-like intelligence, enabling systems to understand language, recognise patterns, make decisions and solve complex problems. The field's genesis in the mid-twentieth century was marked by Alan Turing's seminal question about machine reasoning, leading to pivotal developments. Among these, IBM's Deep Blue chess victory over Garry Kasparov in 1997 and Google's AlphaGo defeating a professional Go player in 2016 stand out, showcasing AI's capacity for analysing complex patterns and strategic decision-making (Granter et al., 2017).

Early AI research concentrated on theoretical problem-solving and symbolic methods, resulting in significant programmes like the Logic Theorist and ELIZA. These initiatives proved that machines could undertake tasks previously believed to require human intelligence. However, the initial optimism was tempered by technological limitations, leading to periods known as 'AI winters,' characterised by diminished funding and interest (Toosi et al., 2021). The landscape shifted with advancements in computing power, data availability and machine learning (ML) techniques, transitioning AI from a focus on rule-based processing to data-driven learning.

Machine Learning, as a vital component of AI, revolutionised the field by enabling systems to learn from data, thus identifying patterns without direct programming (Rebala et al., 2019). This shift laid the groundwork for further advancements in AI, notably through deep learning. Deep learning employs intricate, multi-layered neural networks to discern complex patterns, significantly enhancing AI's capabilities in fields like image and speech recognition, natural language processing and autonomous driving (Liu et al., 2021; Sarker, 2021).

Building on these advancements, Generative AI emerged as a cutting-edge frontier, capable of producing novel content, ranging from text to images and music. This development extends AI's capabilities beyond mere pattern recognition, enabling the creation of original, innovative outputs (Cao et al., 2023). The evolution from AI's theoretical underpinnings to its practical applications across various sectors highlights its transformative impact and underscores the field's continuous growth and potential for future innovation.

7.2.2 The Evolution of AI in Education

The integration of AI into various levels of education has witnessed a shift from automated systems for drills and practice to intelligent systems capable of promoting personalised learning experiences. As aptly pointed out by Roll and Wylie (2016), the evolution transcends mere introduction of new technologies into the classroom.

The field of AI in education has also achieved significant breakthroughs in theoretical development, which has contributed to making learning experiences more engaging and personalised in line with the progress to Education 4.0 and beyond (Bonfield et al., 2020). It is, in fact, through this expansion in theoretical understanding that AI technologies can be developed or integrated to be more relevant for educational purposes.

In the early days of AI implementation in education around the 70s, the main interest of the researchers and educators was on improving computer-assisted instruction (CAI). The role of AI in CAI was limited to providing basic drill and practice exercises (Dede, 1986). Carbonell (1970) claimed that these programmes were effective for rote memorisation and practice but lacked the sophistication to adapt to the diverse needs of learners or to provide in-depth instructional support. This restricted usage mirrors the educational paradigm of that era, which was largely characterised by behaviourist learning principles (Schunk, 2012). Even though these early systems were simple, they showed that computers could provide tailored learning experiences, which paved the way for more advanced AI applications.

As technology advanced, the 1980s and 1990s saw the emergence of intelligent tutoring systems (ITS), which represented a significant leap forward (Nwana, 1990; VanLehn, 2011). Further, Kulik and Fletcher (2016) in their meta-analytic review showed that these systems could provide more customised feedback and adapt to individual learners' needs. ITS utilised primarily rule-based systems to model the domain knowledge and the learner's understanding. This makes it possible to tailor instructions and offer targeted guidance to learners (Nwana, 1990). The core idea of ITS lies in the quest to create a personal tutor capable of addressing the inherent challenges of traditional one-size-fits-all educational models (Ferster, 2022). These systems aim to replicate the effectiveness of one-on-one tutoring by offering a highly personalised and adaptive learning experience. However, during the 80s and 90s, ITS were limited to institutions or schools that had the necessary technological infrastructure and financial resources to support such advanced systems.

The advent of the internet and the proliferation of digital data in the late 1990s and early 2000s ushered in a new era for AI in education. The availability of vast amounts of educational data and the development of machine learning algorithms enabled the creation of more advanced and adaptive learning environments (Cheung et al., 2021; Park et al., 2023). These technologies could analyse learner data in real-time, which eventually provides insights into learning patterns and identifies knowledge gaps encountered by the learner. In the last decade, the rise of big data, natural language processing and advanced analytics has further revolutionised AI's role in education (Cui et al., 2023). AI-powered educational platforms now offer a wide range of functionalities, from automated grading systems and plagiarism detectors to chatbots that provide instant support and feedback to learners (Chuah & Kabilan, 2021; Gillani et al., 2023). Furthermore, AI is being used to develop immersive learning experiences through virtual and augmented reality, making learning more engaging and accessible.

Building upon these advancements, the birth of a new generation of AI tools known as Generative AI in recent years has caught the attention of many educational

Table 7.1 Prominent generative AI tools in the market

Category	Generative AI tools
Texts	ChatGPT, Claude3, Google Gemini, Microsoft Copilot, Jasper
Images	DALL-E (also integrated in ChatGPT and Copilot), MidJourney, StableDiffusion (Stability AI), Imagen 3, Adobe Firefly
Video	Synthesia, HeyGen, D-ID
Audio	ElevenLabs, PlayHT, Descript
Coding	AlphaCode, GitHub Copilot

researchers and educators (Stokel-Walker & Van Noorden, 2023). Generative AI tools can produce original content ranging from text to images and even simulations. The key to generative AI tools is that users can generate various forms of content just by providing textual instructions or commonly known as prompts. They offer unprecedented opportunities for personalised and interactive learning experiences, as learners can ideally embrace self-regulated learning by engaging with these tools. Table 7.1 summarises some of the prominent Generative AI tools according to its categories.

Despite these advancements in AI, its adoption in the Malaysian education system remains slower than expected. Although the Ministry of Science, Technology and Innovation Malaysia (MOSTI) launched the Malaysia National Artificial Intelligence Roadmap, 2021–2025 (MOSTI, 2021), the implementation of AI in education remains at the conceptual level with minimal outcomes. The focus on education was also geared towards using machine learning for learning analytics and the prediction of educational outcomes. There is an apparent need for a more consolidated effort to integrate relevant AI technologies and tools for teaching and learning. However, a renewed effort can be seen in recent developments within the Malaysian education system. While the adoption of AI in education has been slower than anticipated, there are several promising initiatives and strategies in place to accelerate its integration and improve outcomes.

7.3 Discussion of Implications

7.3.1 Comparative Review on AI Integration in Education: Malaysia, Thailand, Singapore and South Korea

Malaysia, like many nations in Asia, is actively exploring the integration of artificial intelligence (AI) in education to improve teaching and learning outcomes. The Malaysia National Artificial Intelligence Roadmap (2021–2025) outlines key strategies, including personalised learning, STEM education and administrative automation, yet its implementation faces challenges. Limited infrastructure, particularly in

rural areas and varying levels of teacher readiness have slowed AI adoption. Pilot projects such as 1BestariNet demonstrate the potential of AI integration, though these efforts have faced criticism for connectivity gaps and inconsistent implementation (MOSTI, 2021; Shanmugam et al., 2019).

In Thailand, the Digital Thailand and Thailand 4.0 policies prioritise AI to bridge educational inequities (Ajanapanya, 2024). Projects like the Smart Classroom Project aim to provide adaptive learning opportunities for rural students, leveraging partnerships with international tech companies to accelerate AI adoption. These programmes are aligned with Thailand's national goal of achieving educational equity through technology (Machmud et al., 2021).

Singapore, on the other hand, sets a regional benchmark with its Smart Nation 2.0 initiative, which fully integrates AI into education (Choudhury, 2024). Through tools such as predictive analytics, personalised learning systems and smart classrooms, Singapore emphasises scalability and equity. The EdTech Masterplan allocates substantial resources to ensure robust AI integration aligned with the national curriculum, making it an exemplary model of AI-driven education (EdTech Masterplan 2030, 2023).

The South Korean government has outlined three major policy directions for AI education, focusing on developing AI education content, advancing AI education policies and preparing for the new curriculum set to be implemented in 2025. These policies aim to integrate AI smoothly into classrooms and address emerging challenges (Lee & Jeong, 2023). AI curriculum design for K-12 education in Korea is still in its nascent stages, with efforts starting in 2020 to train teachers in AI education. The curriculum is designed by analysing AI education methods from advanced countries and adapting them to the Korean context (Park & Lim, 2023). The integration of AI into the Korean education system is progressing, with significant efforts in policy formulation, curriculum design and teacher training.

7.3.2 Impact of AI on Teaching and Learning

The impact of AI on teaching and learning is profoundly reshaping instructional methodologies across the globe, including in Malaysia. AI tools, such as adaptive learning software, AI-driven analytics and intelligent tutoring systems, are revolutionising traditional teaching methods (Gligorea et al., 2023). These technologies enable personalised learning experiences, allowing educators to tailor their instruction to meet the individual needs of each student (Pataranutaporn et al., 2021). For instance, adaptive learning platforms use AI algorithms to analyse a student's performance and learning style, adjusting the curriculum dynamically to suit their pace and understanding (Kabudi et al., 2021). In Malaysia, initiatives like the Malaysia Education Blueprint, 2013–2025 have emphasised the integration of such technologies into the curriculum, aiming to foster a more innovative and personalised learning environment (MOE, 2013).

The effect of AI technologies on student engagement and learning outcomes is significantly positive. AI-driven educational tools make learning more interactive and engaging, capturing the attention of students who might otherwise be disinterested in traditional teaching methods (Huang et al., 2023). These tools often incorporate gamification elements, interactive simulations and real-time feedback, making learning more appealing and relevant to students (Bachiri et al., 2023). This increased engagement often translates to improved learning outcomes, as students are more motivated and better equipped to understand complex concepts. In Malaysia, the use of AI in language learning apps has shown promising results in enhancing English proficiency among students, a key goal of the country's educational policy (Mohd Nasir et al., 2023). Such technologies also support educators in tracking student progress more accurately, enabling data-driven decisions to optimise teaching strategies and improve overall academic performance.

Case studies from Malaysian educational institutions highlight the transformative impact of AI on teaching and learning. For instance, in the study by Chew and Chua (2020), AI was utilised to enhance Chinese language learning by integrating the NAO robot into traditional classroom settings, which complemented human tutoring with interactive and engaging robot-led activities. This blend of human and robotic tutoring leveraged the robot's emotion recognition and body language capabilities to demonstrate Chinese words, making the learning process more interactive and memorable for students.

Also, the study by Rahim et al. (2022) addresses the transformative impact of AI in higher education by developing a model for adopting AI-based chatbots. This model, derived from a combination of Partial Least Squares Structural Equation Modelling (PLS-SEM) and Neural Network modelling, aims to enhance the understanding and effective integration of AI chatbots in educational environments. The research highlights the potential of AI to revolutionise educational practices, particularly through the use of advanced chatbot technologies that can facilitate more efficient, interactive and personalised learning experiences. These examples highlight the potential of AI to not only augment the role of educators but also to provide students with a more adaptive and immersive learning experience. As AI continues to evolve, its integration into the Malaysian education system promises to further enhance teaching methodologies and learning outcomes (Bachiri et al., 2023).

7.3.3 AI in Assessment and Evaluation

AI in educational assessment and evaluation presents opportunities to enhance efficiency and learning outcomes through personalised testing and automated grading. AI systems can tailor tests to individual students' needs, adjusting difficulty and question types based on past performance and learning preferences, ensuring engagement and knowledge retention (Chen et al., 2020; Minn, 2022). This personalised approach, supported by educational data mining, helps identify student challenges early, enabling targeted support (Romero & Ventura, 2020).

Automated grading through AI offers significant advantages, such as efficiency in grading essays and multiple-choice questions, reducing educator workload and providing timely feedback. Despite concerns about AI's current limitations in mimicking human judgement, advancements in deep learning are expected to address these challenges, improving grading consistency and bias reduction (Gardner et al., 2021; Hahn et al., 2021; Perrotta & Selwyn, 2020).

Furthermore, AI's analysis of assessment data can uncover trends and learning gaps, supporting data-driven decision-making in education. This approach helps identify at-risk learners and optimise resource allocation, although caution is advised due to potential biases in AI-driven insights (Sharma et al., 2019; Wang, 2021).

In summary, AI enhances educational assessments by offering personalised tests, automated grading and insightful data analysis. However, addressing challenges like bias and ensuring the irreplaceable role of human guidance is crucial for a responsible AI implementation in education.

7.3.4 Challenges and Opportunities

The integration of AI in education, while promising for enhancing learning experiences and administrative efficiency, encounters several significant challenges, including ethical concerns, resource allocation and the necessity for teacher training. Ethical issues, particularly regarding data privacy and security, necessitate stringent data protection measures to prevent breaches and misuse of student information (Stahl & Wright, 2018). Additionally, the substantial financial investment required for AI technologies' infrastructure poses a challenge, especially in economically disadvantaged regions, potentially exacerbating educational inequalities without strategic resource management (Schiff, 2021; Vrontis et al., 2022). Effective utilisation of AI tools in education also depends on teachers' proficiency with these technologies, highlighting the need for comprehensive training programmes to equip educators with the skills to integrate AI into teaching practices effectively (Celik et al., 2022; Jeon et al., 2020).

Despite these hurdles, AI presents opportunities for enhancing inclusivity and personalisation in Malaysian education. By accommodating the varied needs of students, including those with disabilities or from remote areas, AI can help overcome geographical and socioeconomic barriers. Tools offering real-time translation and subtitles expand access to non-native speakers and hearing-impaired students, while early identification of learning disabilities through AI enables tailored support (Hashim et al., 2022; Subashini & Krishnaveni, 2021).

7.3.5 Strategies for Effective AI Integration

Recent scholarly discourse presents a multifaceted view of the potential and challenges inherent in this technological evolution. A pivotal study underscores the importance of comprehending educators' perceptions and necessities vis-à-vis AI and other nascent educational technologies (Kizilcec, 2023). This foundational understanding is critical to ensure that implementing AI in classrooms aligns with pedagogical goals and teacher competencies.

Another intriguing aspect explored in the literature is the role of AI-driven tools, such as chatbots, in refining the educational process. While these technologies hold immense potential for enhancing student–teacher interactions and learning outcomes, they also bring forth significant ethical and practical considerations that necessitate careful deliberation (Adiguzel et al., 2023). Integrating AI in education is not merely a technical upgrade but also involves navigating complex moral landscapes.

Furthermore, the concept of 'smart classrooms', which amalgamate AI and advanced technological infrastructures, emerges as a revolutionary approach to education. Studies indicate these environments can substantially improve various facets of education, including classroom management, teaching methodologies and performance assessments (Dimitriadou & Lanitis, 2023). Smart classrooms represent a significant change, redefining the traditional educational space into a dynamic, responsive and interactive learning environment.

In addition, there is an increasing emphasis on the critical analysis of existing online AI educational resources. The current discourse advocates for these resources to be in alignment with effective pedagogical practices. There is a call for future AI curricula to adopt comprehensive designs that offer support, guidance and adaptability to cater to diverse learning needs and environments (Druga et al., 2022).

Lastly, the pioneering use of machine learning models, such as EDU-AI, in the educational sector represents a cutting-edge development. These models have shown potential in automating the design of classroom layouts, playing a vital role in the early stages of architectural projects (Karadag et al., 2023). This application of AI extends beyond the immediate realm of teaching and learning, illustrating its transformative impact on educational infrastructure.

7.3.6 Guidelines for Incorporating AI in Education

To effectively integrate AI into education while preserving its human elements, educators and policymakers must engage in collaborative efforts to enhance AI literacy through comprehensive training programmes. Olari and Romeike (2021) emphasise the importance of incorporating AI and data literacy into teacher education, preparing educators across all subjects for AI's expanding role. Such programmes should encompass technical, pedagogical, ethical and educational

aspects of AI to facilitate its integration into teaching strategies, ultimately enriching student learning.

Moreover, the development of ethical guidelines for AI use in education is crucial, necessitating collaboration among policymakers, technologists, educators and ethicists. These guidelines should address critical issues, including data protection, consent, bias, fairness and algorithm transparency, ensuring AI technologies respect students' and staff's rights and dignity.

Addressing educational disparities is imperative, with regulations aimed at ensuring equitable AI resource access across different regions and socioeconomic backgrounds (Gilbert, 2021; Olari & Romeike, 2021; Xiang, 2022). Investments in infrastructure, such as high-speed internet and digital devices, are essential, particularly for schools in underserved areas, to bridge the digital divide. AI applications should prioritise augmenting rather than replacing human interactions (Bryson & Theodorou, 2019; Horvatić & Lipic, 2021; Steels, 2023), supporting educators, personalising learning and fostering interactive, cooperative learning environments. The focus should be on enhancing human capabilities, including critical thinking, creativity and empathy. Continuous research and evaluation are necessary to monitor AI's impact on educational outcomes, fairness and student welfare. Policymakers should implement systems for ongoing assessment of AI applications in educational settings, incorporating feedback from educators, students and other stakeholders to refine AI tools and strategies.

These policy recommendations aim to guide educators and policymakers in integrating AI into education thoughtfully, ensuring that technological advancements complement and enhance human-centred educational practices.

7.4 Future Directions

The integration of Artificial Intelligence (AI) into education represents a significant shift towards personalised learning and advanced pedagogical methods. AI technologies, particularly Natural Language Processing (NLP), are instrumental in analysing student feedback to enhance educational practices and infrastructures. Highlighting the importance of NLP, studies such as Shaik et al. (2022) emphasise its role in refining educational feedback mechanisms, indicating a growing reliance on AI for pedagogical improvement.

Building on the utility of AI in analysing feedback, its application extends to enhancing student performance, notably in STEM fields. The incorporation of AI technologies in classrooms has been associated with increased student engagement and academic achievement, as discussed by García-Martínez et al. (2023). This positive correlation underscores AI's potential to revolutionise education by making learning more accessible and engaging. Furthermore, the interaction between human intelligence and AI is transitioning from merely automating tasks to augmenting human capabilities, supporting informed decision-making in educational settings. Ifenthaler and Schumacher (2023) discuss how AI's ability to process large datasets

in real-time can enhance educational strategies and outcomes. In the realm of online learning, AI-enabled tools like Smart Web-Based Interactive System Modelling (SWISM) are pioneering personalised education through predictive analytics, as described by Yang et al. (2023).

However, the deployment of AI, especially NLP in education, faces challenges, including the complexity of language and the need for advanced techniques for sentiment analysis and understanding domain-specific jargon (Shaik et al., 2022). The emergence of AI in education (AIEd) brings to light ethical considerations and the impact on stakeholders, necessitating ongoing research to address these issues effectively (Ojha et al., 2023).

The expanding research in AI for online learning, with significant contributions from global leaders such as China, India and the United States, focuses on enhancing online teaching and learning processes. This research, as Dogan et al. (2023) pointed out, includes developing adaptive learning systems and predicting student behaviours, indicating a broad interest in optimising online education through AI. The ethical dimensions of AI in education are paramount for fostering a trust-based learning environment. Yu and Lu (2021) advocate for ethical AI deployment, emphasising transparency, fairness and privacy. Furthermore, the post-pandemic potential of leveraging Extended Reality (XR) and AI in online higher education enhances learning accessibility and engagement, as suggested by Rangel-de Lázaro and Duart (2023).

In Malaysia, Thailand, Singapore and South Korea, AI's implementation in education has followed diverse trajectories shaped by national priorities, infrastructural readiness and policy ecosystems. While Malaysia is focusing on enhancing language education and supporting national STEM objectives, Thailand is leveraging AI to address rural–urban disparities through adaptive learning initiatives. Singapore, with its Smart Nation 2.0 framework, prioritises full-scale AI integration aligned with national curricula, and South Korea is actively developing AI-specific curricula and teacher training as part of its 2025 reform.

These regional developments emphasise the need for Malaysia to establish a robust ethical and operational framework that not only supports AI adoption domestically but also draws from successful practices in neighbouring countries. Comparative insights suggest that cross-border learning and collaboration can accelerate AI maturity in education systems.

Future research directions should include:

- Adapting AI tools to align with the diverse learning environments in Malaysia while benchmarking against regional leaders.
- Evaluating long-term impacts of AI on student learning outcomes and teacher effectiveness across Asian contexts.
- Developing inclusive, scalable AI policies grounded in ethical principles that resonate with Southeast and East Asian socio-cultural realities.

By navigating ethical, cultural and logistical challenges alongside Thailand, Singapore and South Korea, Malaysia can position itself as a regional leader in AI-driven educational innovation, shaping a collaborative and future-ready education ecosystem across Asia.

7.5 Conclusion

This chapter explores the transformative potential of AI and Generative AI in enhancing educational outcomes in Malaysia through personalised learning, while drawing comparative insights from Thailand, Singapore and South Korea. By tailoring instruction to individual needs, AI fosters greater student engagement, promotes educational equity and cultivates critical thinking and problem-solving skills essential for the modern workforce.

The comparative analysis highlights that while Malaysia is making strides, it can benefit from the strategic frameworks, infrastructure investments and policy innovations observed in its regional counterparts. Singapore's robust EdTech infrastructure, South Korea's structured AI curriculum development and Thailand's inclusive approaches to bridging digital divides offer valuable lessons for shaping a future-ready Malaysian education system.

However, the integration of AI in education across all four countries presents common challenges, including data privacy, algorithmic bias, infrastructural limitations and the need for comprehensive teacher training. Addressing these issues requires a collaborative and interdisciplinary approach involving educational institutions, AI specialists and policymakers across the region.

To harness AI's full potential, continuous research and cross-border knowledge exchange are essential to monitor its impact, adapt best practices and ensure inclusive and ethical implementation. Through these efforts, Malaysia, alongside its Asian peers, can build a resilient and innovative educational ecosystem that empowers learners and educators in an increasingly digital and interconnected global economy.

Highlights

- AI, especially NLP and Generative AI, is reshaping personalised learning and assessment practices across Asia, with Malaysia, Thailand, Singapore and South Korea at varying stages of implementation.
- Singapore's EdTech-driven Smart Nation policy and South Korea's curriculum reforms offer strategic models for AI integration that Malaysia can adapt and localise.
- Thailand's initiatives focus on bridging urban–rural education gaps through AI-enhanced learning environments, presenting key lessons in equity-driven implementation.

- Ethical considerations, including bias, privacy and teacher readiness, remain central to AI deployment across all four countries, underscoring the need for region-specific policy frameworks.
- Malaysia's strategic adoption of AI, informed by regional comparisons, positions it to accelerate innovation in STEM and language education while promoting educational equity.

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