

The Digital Divide in Lifelong Learning: Challenges, Technological Readiness and Policy Perspectives in Malaysia

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ABSTRACT

The rapid advancement of digital technology has transformed the landscape of lifelong learning by providing more open, flexible and geographically unrestricted learning opportunities. However, these benefits are not equally accessible due to the existence of the digital divide, which remains one of the major challenges in Malaysia. This article aims to discuss the challenges posed by the digital divide in the implementation of lifelong learning by examining the factors influencing access to and participation in the digital learning ecosystem. The discussion is based on secondary sources through an analysis of scholarly literature, reports published by international organizations and policy documents related to digital education and lifelong learning. It focuses on the concept and dimensions of the digital divide, disparities in access between urban and rural communities, economic, social and educational factors, technological readiness encompassing internet infrastructure, digital devices and digital literacy, as well as psychological and social challenges including digital stress, technology addiction, virtual learning fatigue, cybersecurity, digital ethics and academic integrity. Furthermore, the article explores the role of the Government, the Malaysian Digital Education Policy and the national digitalisation agenda in narrowing the digital divide. The findings indicate that the success of lifelong learning depends not only on the provision of technology and digital infrastructure but also on the development of digital literacy, policy enhancement, ethical values and strategic collaboration among the government, educational institutions, the private sector and the wider community. In conclusion, addressing the digital divide comprehensively is a fundamental prerequisite for ensuring that lifelong learning can be implemented sustainably, inclusively and effectively to support human capital development and enhance national competitiveness.

Keywords: Digital divide, lifelong learning, digital literacy, technological readiness, Malaysia

INTRODUCTION

The global educational landscape has undergone significant transformation as a result of the rapid advancement of digital technologies. The emergence of artificial intelligence (AI), big data, the Internet of Things (IoT), mobile technologies and high-speed internet connectivity has created unprecedented opportunities for individuals to acquire knowledge without the constraints of time, age, or geographical boundaries (European Commission, 2024). Within the context of lifelong learning, digital technology serves as a catalyst that enables individuals to continuously enhance their skills, knowledge and competencies throughout the different stages of life (UNESCO, 2023).

The rapid evolution of technology, changes in the labour market and the increasing need to adapt to a knowledge-based economy have brought lifelong learning to the forefront of educational and economic discourse. Formal education acquired during the early stages of life is no longer sufficient to meet the demands of a constantly evolving society. Instead, knowledge and skills must be continuously updated to remain relevant in an increasingly dynamic environment (OECD, 2023).

Despite the vast opportunities offered by digital technologies for flexible and self-directed learning, numerous challenges continue to hinder the effective implementation of lifelong learning. Factors such as unequal access to technology, inadequate digital infrastructure, limited digital literacy, psychological barriers and issues related to digital governance and policy can significantly reduce the effectiveness of digital learning initiatives (World Bank, 2023).

Furthermore, the rapid pace of technological advancement has generated new challenges for both educational institutions and individuals. While some members of society have successfully leveraged digital technologies to improve their knowledge and skills, others continue to be left behind due to limited access, inadequate resources, and insufficient digital competencies. This disparity reflects the phenomenon commonly referred to as the digital divide, which has become one of the most critical barriers to achieving an equitable lifelong learning society.

Accordingly, this article provides a comprehensive discussion of the issues, challenges and implications of the digital divide that influence the implementation of lifelong learning in the digital era. The discussion encompasses the dimensions of the digital divide, technological readiness, psychological and social challenges, as well as digital education policies designed to ensure that the benefits of technological advancement can be equitably enjoyed by all members of society.

The concept of the digital divide introduced by Dijk (2006) is adopted in this article as a framework for understanding inequalities in access to, use of and benefits derived from information and communication technologies among individuals and communities. This concept emphasises that the digital divide is not limited to physical access to technology; rather, it also encompasses factors such as digital skills, motivation and the ability to use technology effectively.

DIGITAL DIVIDE

Concept and Definition of the Digital Divide

The digital divide refers to inequalities in the access to, use of and ability to benefit from digital technologies among individuals, social groups, or geographical regions. Initially, the concept primarily described disparities in access to computers and the Internet. The term digital divide was first introduced in 1995 to distinguish between individuals who had access to digital technologies and those who did not (Noor Hadzvida et al., 2021). Since then, the concept has evolved beyond mere physical access to encompass information literacy, digital skills, patterns of technology use and the ability to leverage digital technologies for personal, educational and economic development (Dijk, 2020).

In addition to disparities in technological access, the digital divide now encompasses what is known as the outcome divide, which refers to differences in the benefits derived from the use of digital technologies. For example, two individuals may have equal access to the Internet, yet experience significantly different outcomes depending on their level of digital literacy, technological competence, information literacy and motivation for learning and self-development (Dijk, 2020; Mohd Khairulnizam et al., 2023; Dille & Buhl, 2025). Within the context of lifelong learning, this implies that while some individuals successfully enhance their professional competencies through digital learning, others utilise technology primarily for basic communication and entertainment purposes.

This situation has become increasingly complex with the emergence of generative artificial intelligence (AI) technologies such as Gemini, ChatGPT and Copilot, which have introduced a new form of digital inequality known as the AI divide. This divide arises because only certain segments of society possess the knowledge and competencies required to effectively utilise AI technologies to enhance creativity, productivity and learning, whereas others remain unfamiliar with or lack sufficient exposure to these technologies (Puri et al., 2026). This development illustrates that the digital divide has become increasingly multidimensional and requires a more comprehensive policy response within digital education.

Urban–Rural Digital Divide

One of the most visible manifestations of the digital divide is the disparity in digital access between urban and rural communities. Urban areas generally benefit from more advanced digital infrastructure, wider availability of modern digital devices, high-speed Internet connectivity and greater access to digital learning centres (World Bank, 2023). In contrast, rural communities often encounter significant challenges, including limited technological infrastructure, unstable Internet connections and relatively high service costs. According to Sharin and Suhaida (2021), inadequate digital infrastructure in rural areas continues to widen the digital divide. Consequently, these limitations disproportionately affect low-income communities, adults and older persons in accessing lifelong learning opportunities (UNESCO Institute for Lifelong Learning, 2022; United Nations, 2024).

The digital divide became particularly evident during the COVID-19 pandemic, when many students in rural areas experienced considerable difficulties participating in online learning due to inadequate access to digital devices and reliable Internet connectivity. Although conditions have improved following the pandemic, digital disparities remain and continue to require sustained attention from both telecommunications service providers and the Government.

The unequal development of digital infrastructure between urban and rural areas remains one of the primary barriers to strengthening lifelong learning in many developing countries, including Malaysia. Although Internet penetration has steadily increased over the years, some rural communities continue to experience inconsistent access to high-speed Internet services. These limitations restrict their ability to participate effectively in digital learning platforms that rely heavily on video streaming and online conferencing technologies (United Nations, 2024).

Furthermore, the rural digital divide extends beyond technological limitations to encompass broader issues of community development. Communities with relatively lower levels of educational attainment and economic development generally demonstrate lower rates of digital technology adoption. Therefore, efforts to reduce the digital divide should be integrated with broader strategies for local social and economic development to ensure that the benefits of digital transformation are distributed more equitably across society.

Economic Factors

Access to digital technologies is strongly influenced by an individual's socioeconomic status (World Bank, 2023). Individuals and families with higher incomes are generally able to afford smartphones, computers, tablets and high-quality Internet subscriptions. Conversely, low-income households frequently encounter financial constraints that limit their access to digital technologies. According to the OECD (2023), inequalities in digital education are closely associated with broader economic inequalities. Limited access to technology reduces opportunities for individuals to improve their digital competencies, participate in online learning, and obtain professional certifications.

Economic factors therefore influence not only ownership of digital devices and internet connectivity but also an individual's capacity to participate in professional development programmes, specialised training and digital certification courses. Many contemporary upskilling initiatives, including subscriptions to online learning platforms and professional certification examinations, require substantial financial investment. Consequently, disparities emerge in learning opportunities between high-income and low-income populations.

Closely related to this issue is the concept of digital poverty, which describes the inability of individuals to obtain adequate digital resources required for meaningful participation in the digital era. Individuals experiencing digital poverty often face considerable obstacles in accessing lifelong learning opportunities because of inadequate digital facilities and resources (Ina Murni, 2024).

Digital poverty extends beyond the lack of digital devices. It is also influenced by learning environments that meet acceptable educational standards, including adequate study space, sufficient learning time and appropriate family support (Syahrudin & Sitinurbayu, 2021). Such conditions may contribute to the

continued marginalisation of certain population groups from economic development as well as educational and employment opportunities increasingly offered through digital platforms (Schiller, 2025).

Social and Educational Factors

Besides economic considerations, social environments and educational backgrounds also significantly influence individuals' adoption and utilisation of digital technologies. Individuals with higher levels of education generally adapt more easily to digital technologies than those with lower educational attainment.

Among older adults, however, mastering digital technologies presents greater challenges due to limited exposure to digital environments and the increasing difficulty of acquiring new technological skills later in life. As a result, many older adults risk becoming increasingly excluded from a growing range of public services and lifelong learning opportunities that are now delivered predominantly through digital platforms.

TECHNOLOGICAL READINESS

Internet Infrastructure

The success of lifelong learning in the digital era depends largely on the availability of robust digital infrastructure. Online learning platforms cannot be utilised effectively without widespread and reliable Internet connectivity (World Bank, 2023). Recognising this need, the Malaysian Government has implemented various initiatives, including the National Digital Network Plan (Jalinan Digital Negara – JENDELA), to expand broadband access and improve nationwide Internet coverage (Ministry of Communications Malaysia, 2024).

Despite these encouraging developments, certain areas continue to experience inadequate Internet speeds and limited network coverage. Such infrastructural constraints impede access to digital learning and may reduce learners' motivation to participate in online educational activities. Learning approaches that fail to keep pace with technological advancements can lead to learner disengagement, boredom and diminished motivation to continue learning (Mohd Khairulnizam et al., 2023). Therefore, the development of digital infrastructure should be regarded as a strategic national investment to ensure the successful implementation of lifelong learning.

Digital Devices

Ownership of appropriate digital devices is a fundamental prerequisite for participation in online learning (European Commission, 2024). Accessing digital learning materials requires learners to possess suitable devices such as smartphones, tablets, or laptop computers that are functional and capable of supporting educational applications. Moreover, not all devices are equally suitable for learning activities involving specialised software, document editing, data analysis, or academic writing.

Malfunctioning or outdated digital devices represent another significant challenge in contemporary digital learning environments (Muhammad Ehsan & Satoria, 2025). Device failures or poor performance can interrupt learning activities, reduce concentration and negatively affect students' learning experiences. Consequently, the mere availability of digital devices is insufficient. Their functionality, technical specifications and suitability for educational purposes must also be considered to ensure effective participation in lifelong learning.

In addition, unequal ownership of digital devices among households contributes directly to educational inequality. Students from economically disadvantaged backgrounds often rely on shared devices or older equipment with limited capabilities, thereby restricting their ability to engage fully in digital learning activities. Addressing these disparities requires coordinated efforts from governments, educational institutions and the private sector to improve equitable access to appropriate learning technologies.

Digital Literacy

Digital literacy constitutes a fundamental dimension of technological readiness. It encompasses the ability to access, evaluate, create and utilise digital information responsibly, ethically and effectively through digital technologies (European Commission, 2024). In the era of artificial intelligence, digital literacy has become increasingly important, as individuals are expected not only to operate digital technologies but also to use AI applications ethically, evaluate the credibility of digital information and identify misinformation and disinformation (OECD, 2023). Insufficient digital literacy exposes individuals to cyber fraud, technological misuse, misinformation and poor decision-making.

Traditionally, digital literacy referred primarily to basic computer and Internet skills. However, the concept has evolved considerably to include multiple competencies, such as data literacy, information literacy, AI literacy and media literacy. These competencies enable individuals to understand the ethical implications of digital technology, critically evaluate the credibility of online content and distinguish reliable information from misleading or false sources (European Commission, 2024).

In today's information-rich environment, individuals are continuously exposed to an overwhelming volume of digital content that combines both factual information and misinformation. Without adequate digital literacy, individuals become increasingly vulnerable to digital manipulation, fake news and misleading information, which may result in poor judgement and uninformed decision-making. Therefore, strengthening digital literacy should become a central priority within lifelong learning policies to ensure that individuals are capable of navigating digital environments responsibly, critically and ethically (UNESCO, 2023).

PSYCHOLOGICAL AND SOCIAL CHALLENGES

Digital Stress

Contemporary society is increasingly exposed to the phenomenon of digital stress, a psychological condition that arises when individuals feel overwhelmed by the continuous use of digital technologies or struggle to adapt to the rapid pace of technological change. As digital technologies become deeply integrated into education, work and daily life, individuals are expected to remain constantly connected, responsive and capable of managing multiple digital platforms simultaneously.

Mental fatigue may result from continuous digital communication, constant notifications, information overload, and the expectation of being perpetually available online (World Health Organization, 2022). Digital stress is also associated with the need to continuously learn new applications, adapt to evolving technologies and navigate multiple online platforms for different educational and professional purposes (Palalas & Doran, 2024).

If left unmanaged, digital stress can lead to diminished learning motivation, emotional exhaustion, decreased concentration and lower academic performance. These adverse effects may ultimately undermine individuals' willingness to engage in lifelong learning activities. Consequently, promoting digital well-being has become increasingly important. Educational institutions should provide learners with appropriate support through digital wellness programmes, technology management training and psychological support services to help them cope with the demands of digital learning environments.

Technology Addiction

Technology addiction has emerged as one of the most concerning challenges within contemporary digital society. Time that could otherwise be devoted to learning activities is often consumed by excessive engagement with online gaming, social media, video streaming services and various forms of digital entertainment.

Previous studies have demonstrated that uncontrolled technology use can negatively affect academic achievement, reduce productivity and compromise mental well-being (UNESCO, 2023; World Health

Organization, 2022). Consequently, digital education should emphasise the development of self-regulation, time management and healthy digital lifestyles to ensure that technology serves as a tool for learning rather than becoming a source of dependency.

Technology addiction extends beyond excessive social media use to include compulsive smartphone usage, prolonged video streaming and online gaming addiction. Research suggests that excessive dependence on digital technologies can reduce the effectiveness of lifelong learning while disrupting the balance between personal life, education and professional responsibilities (Topluk & Genc, 2025).

The challenge is further intensified by social media algorithms specifically designed to maximise user engagement and prolong online activity. Such algorithms may reduce learners' capacity for deep learning, sustained attention and critical reflection by encouraging constant switching between digital content. Therefore, educational institutions should place greater emphasis on promoting ethical, balanced and responsible technology use across all levels of education.

Virtual Learning Fatigue

Following the COVID-19 pandemic, virtual learning fatigue has become an increasingly recognised issue in digital education. Extended periods of screen exposure may contribute to reduced concentration, headaches, eye strain, mental exhaustion and sleep disturbances (Dhawan, 2022).

In addition to physical fatigue, virtual learning environments often provide fewer opportunities for face-to-face interaction, potentially reducing learners' motivation and engagement. Limited interpersonal communication may cause learners to feel isolated, disconnected from their peers and instructors and less inclined to participate actively in collaborative learning activities.

Although online learning offers considerable flexibility and accessibility, excessive reliance on virtual instruction without adequate social interaction may diminish learners' sense of belonging and negatively affect their overall learning experience. Consequently, educational institutions should adopt blended learning approaches that combine the advantages of digital learning with meaningful interpersonal interaction to enhance both learning effectiveness and learner well-being.

Cybersecurity and Data Privacy

The increasing use of digital learning platforms has significantly heightened the risk of cybersecurity threats. These threats include data breaches, online fraud, identity theft, cyberattacks and the unauthorised use of personal information (United Nations, 2024; World Bank, 2023). Therefore, raising awareness of cybersecurity and personal data protection is essential for creating a safe and trustworthy lifelong learning environment.

According to Hamimda, Abdul Latiff and Arina Anis (2024), concerns regarding cybersecurity and data privacy have become increasingly significant with the rapid adoption of digital technologies and artificial intelligence. Digital learning platforms routinely collect sensitive information, including personal details, academic records, learning analytics and behavioural data. If these data are inadequately protected, they may become vulnerable to cyberattacks, unauthorised access or misuse by irresponsible parties (United Nations, 2024).

Cybersecurity risks are not solely external. Many users unknowingly expose themselves to security threats by oversharing personal information or neglecting basic cybersecurity practices. Consequently, cybersecurity education should become a core component of digital literacy programmes, equipping learners with the knowledge and skills required to protect their personal information, digital identities and online privacy (World Bank, 2023).

Digital Ethics and Academic Integrity

While digital technologies have significantly enhanced learning opportunities, they have also introduced important ethical challenges related to digital ethics and academic integrity. Technological competence should therefore be accompanied by a strong understanding of ethical responsibilities and moral principles governing the appropriate use of digital technologies.

Digital ethics refers to the values and principles that guide responsible behaviour in digital environments. It encompasses respectful online communication, protection of personal privacy, safeguarding personal data, compliance with digital laws and regulations and the responsible use of technology. Within the context of lifelong learning, digital ethics ensures that technology is employed primarily to support knowledge development and societal well-being rather than activities that may harm individuals or communities (European Commission, 2024).

One of the most pressing concerns is the increasing prevalence of digital plagiarism. The widespread availability of online resources has made it easier for individuals to copy or reproduce academic materials without appropriately acknowledging the original authors. Such practices undermine the authenticity of learning and compromise academic integrity. Therefore, education concerning ethical information use, proper academic citation, copyright awareness and intellectual property rights should be strengthened at all educational levels to foster responsible digital citizenship (Ministry of Education Malaysia, 2023). The emergence of artificial intelligence has further intensified debates surrounding academic integrity. Unregulated use of AI technologies may encourage excessive dependence on automated tools, thereby reducing opportunities for independent knowledge construction and critical thinking. Although AI has considerable potential to support learning, academic writing and research, educational institutions should establish clear policies and guidelines governing its appropriate use in academic work to maintain a balance between technological innovation and academic integrity.

Another significant challenge within digital environments is the rapid dissemination of misinformation and disinformation intended to mislead the public. Individuals with limited information literacy are particularly vulnerable to manipulated content and inaccurate information, potentially leading to poor decision-making, weakened critical thinking, and diminished learning outcomes (Zhao et al., 2024). Academic integrity should therefore be viewed not merely as compliance with institutional regulations but as a culture that is continuously cultivated throughout lifelong learning. Individuals should be encouraged to use technology responsibly, respect intellectual property rights and uphold intellectual honesty in all academic activities. Cultivating such values is essential for developing a digitally competent society grounded in ethical responsibility and moral integrity.

Overall, digital ethics and academic integrity constitute indispensable components of the lifelong learning ecosystem. Technological advancement alone cannot guarantee meaningful educational outcomes unless accompanied by strong ethical values, responsible digital practices and a sustained commitment to intellectual honesty. Consequently, the development of digital competencies should progress in tandem with the cultivation of responsibility, integrity and ethical awareness to ensure that digital technologies contribute positively to individual and societal development.

DIGITAL EDUCATION POLICIES

The Role of Government

The Government plays a pivotal role in expanding access to digital education and narrowing the digital divide through the formulation and implementation of appropriate policies and strategic initiatives. To support this objective, the Malaysian Government has introduced various programmes aimed at widening educational opportunities, strengthening digital literacy and enhancing the country's digital infrastructure (Ministry of Education Malaysia, 2023).

Beyond providing digital infrastructure, the Government is responsible for establishing a comprehensive learning ecosystem that supports lifelong skills development. Such initiatives include the provision of professional certification programmes, reskilling and upskilling initiatives and lifelong learning opportunities that are affordable and accessible to all segments of society (OECD, 2023). These programmes are essential in enabling individuals to continuously improve their competencies in response to evolving labour market demands.

Furthermore, the Government should adopt a more proactive approach in integrating emerging technologies into teaching and learning practices. Such efforts would equip learners with the digital competencies and technological skills required to meet the expectations of future industries and remain competitive in an increasingly digital economy (Shahidah, 2024).

Special attention should also be given to vulnerable groups, including rural communities, persons with disabilities and older adults. Inclusive national digitalisation policies are crucial to ensuring that these groups are not left behind during the country's ongoing digital transformation. Consequently, effective collaboration among government agencies, educational institutions, local communities and the private sector is essential for the successful implementation of inclusive digital education policies.

Malaysia's Digital Education Policy

As part of its national education transformation agenda, the Ministry of Education Malaysia introduced the Digital Education Policy (Dasar Pendidikan Digital) to guide the integration of digital technologies within the education system. The policy is founded upon six strategic pillars: strengthening digital infrastructure, developing high-quality digital educational content, enhancing teachers' digital competencies, promoting digital leadership, improving students' mastery of digital technologies and fostering strategic collaboration among multiple stakeholders.

These six pillars collectively address the major dimensions required to reduce the digital divide while ensuring the effective implementation of digital education across the country. Through this policy, Malaysia seeks to cultivate a culture of lifelong learning while simultaneously enhancing the digital readiness of educators, learners and educational institutions (Ministry of Education Malaysia, 2023).

The policy also recognises that successful digital transformation requires more than technological investment. It demands continuous professional development for educators, innovative pedagogical approaches and institutional readiness to respond to emerging technological trends. By integrating these elements, the Digital Education Policy aims to produce digitally competent citizens capable of contributing to the nation's socioeconomic development.

The National Digitalisation Agenda

In addition to educational reforms, Malaysia's broader national development strategies place digital transformation at the centre of economic growth and societal well-being. As the country prepares for the Fourth Industrial Revolution (Industry 4.0) and the era of artificial intelligence, digitalisation is regarded as a key driver of human capital development and national competitiveness (United Nations, 2024).

To ensure that the benefits of digital transformation are distributed equitably, digital inclusion must remain a national priority. No segment of society should be excluded from opportunities created by digital technologies because of geographical location, socioeconomic status, age, or educational background.

The national digitalisation agenda should therefore be viewed as a long-term human capital development strategy. With Industry 4.0 and AI rapidly reshaping employment across various sectors, digital competencies have become fundamental workplace requirements. Accordingly, Malaysia's education system must continuously evolve to align with changing industry needs and emerging technological developments (OECD, 2023).

Moreover, cultivating a lifelong learning culture requires the availability of open learning platforms, flexible training programmes and micro-credential courses that enable individuals to continuously upgrade their knowledge and skills throughout their lives. These initiatives are consistent with UNESCO's vision of learning as a continuous process that extends across all stages and contexts of human life (UNESCO, 2023).

Ultimately, the national digitalisation agenda should not merely focus on technological advancement but should also foster an inclusive digital society in which all citizens possess the competencies, opportunities and support necessary to participate meaningfully in the digital economy and lifelong learning ecosystem.

CONCLUSION

Developing a knowledgeable, skilled and competitive society through lifelong learning has become increasingly important in today's digital environment. Digital technologies have created unprecedented opportunities for individuals to acquire knowledge, enhance their competencies and adapt to the rapidly changing global landscape.

Nevertheless, numerous challenges must be addressed to ensure that the benefits of digital transformation are shared equitably across society. Issues such as the digital divide, unequal access to Internet connectivity and digital devices, inadequate digital literacy, psychological challenges, cybersecurity threats, weaknesses in digital governance, as well as concerns surrounding digital ethics and academic integrity continue to impede the successful implementation of lifelong learning.

Addressing these challenges requires integrated collaboration among governments, educational institutions, the private sector and society as a whole. Sustained investment in digital infrastructure, digital literacy programmes, technological competency development and the strengthening of digital education policies is essential to ensure that no individual is excluded from the nation's digital transformation.

In conclusion, lifelong learning in the digital era can only be successfully realised when equitable access to digital technologies is complemented by adequate skills, motivation, institutional support and enabling policies. When these challenges are addressed systematically and comprehensively, digital technologies possess enormous potential to become a powerful catalyst for human capital development, social inclusion, innovation and sustainable national development.

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