Vol.9 No.1 (2026)

Journal of Applied Learning & Teaching

ISSN: 2591-801X

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Content Available at: **https://jalt.open-publishing.org/index.php/jalt/index**

AI literacy in an uncertain world

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Keywords

AI literacy;
Artificial Intelligence;
generative AI;
higher education.

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Article Info

Received 29 May 2025
Received in revised form 6 Nov 2025
Accepted 10 November 2025
Available online 22 January 2026

DOI: https://doi.org/10.53761/jalt.2026.9.1.1

Abstract

As Artificial Intelligence (AI) continues to reshape industries, education, and daily life, the ability to critically engage with AI has become essential. In an increasingly unpredictable and AI-saturated world, AI literacy has emerged as a cornerstone for effective learning, ethical reasoning, and professional adaptability. This paper conceptually examines the necessity of AI literacy in education through a theoretical and narrative approach, drawing on contemporary literature and reflective analysis. The paper urges educators and institutions to embed AI literacy across curricula through interdisciplinary design and ethical awareness. Recommendations for future research include empirical testing of AI literacy frameworks, development of reliable assessment tools, and cross-cultural analyses of AI literacy education. Ultimately, the paper underscores the enduring role of human wisdom and critical reflection in ensuring that AI serves as a catalyst for learning and professional growth rather than a replacement for human judgment.

Introduction

In the ever-evolving landscape of education, technology has consistently played a pivotal role in shaping teaching methodologies and learning experiences. Among these innovations, Artificial Intelligence (AI) stands out as a transformative force that is redefining how knowledge is created, accessed, and personalised. Broadly speaking, AI refers to the ability of machines to perform tasks that typically require human intelligence such as reasoning, learning, perception, and problem-solving (Marr, 2020). Its applications now permeate everyday life, from virtual assistants and recommendation systems to autonomous vehicles and medical diagnostics. In education, AI-driven systems are being used to provide adaptive learning, automate assessment, and generate data-driven insights that support teachers in identifying students' learning needs (Luckin et al., 2016; Shah, 2023; Southworth et al., 2023; Khan, 2024).

As AI becomes an integral part of educational practice, the question is no longer whether to use it but how to do so effectively and ethically. This calls for more than functional use of AI tools; it requires AI literacy, the ability to think critically about, evaluate, and apply these technologies responsibly (Long & Magerko, 2020; Pinski & Benlian, 2024; Yang et al., 2025).

The role of AI in learning also invites reflection on how human cognition and educational objectives evolve in response to intelligent technologies. Here, Bloom's Taxonomy (Bloom, 1984) offers a valuable lens. Originally designed to classify educational goals into hierarchical levels of thinking, from remembering and understanding to creating, Bloom's framework remains a cornerstone in curriculum design and assessment. When re-examined in the age of AI, the taxonomy provides a structured way to align AI tools with specific cognitive outcomes. For instance, AI can assist lower-order processes such as remembering and understanding through summarisation and retrieval tools, while also supporting higher-order thinking by enabling analysis, evaluation, and creation through interactive simulations or generative models.

Recent scholarship has begun to merge these two domains, proposing frameworks that extend Bloom's taxonomy into the AI era. For example, Mohammad Hmoud and Shaqour (2024) conceptualise how AI can support each cognitive level from factual recall aided by intelligent tutoring systems to creative synthesis facilitated by generative AI. Similarly, Lubbe, Marais, and Kruger (2025) discuss how AI, Bloom's Taxonomy, and critical thinking interrelate in assessment pedagogy. Jain and Samuel (2025) argue that generative AI introduces co-creation as a new cognitive layer within Bloom's hierarchy, while Clark (2025) provides practical guidance for educators seeking to adapt Bloom's model to AI-driven classrooms. These frameworks collectively suggest that effective AI integration depends on aligning technological capabilities with pedagogical intent.

Understanding AI literacy is crucial for educators and institutions seeking to integrate AI meaningfully into teaching and learning. By mapping AI tools to cognitive objectives, educators can design experiences that empower students to think critically, act ethically, and use technology as a catalyst for intellectual growth. Against this backdrop, the present paper explores the capabilities and limitations of AI, the necessity of developing AI literacy, and the implications of AI for teaching and learning.

What is AI literacy?

AI literacy is a multifaceted and evolving concept that encompasses technical, cognitive, ethical, and sociocultural dimensions. Its multidimensional nature reflects the diverse ways individuals engage with AI from understanding its underlying mechanisms to applying it responsibly and critically in daily life and professional settings. As such, AI literacy cannot be reduced to mere technological know-how; it integrates understanding, use, evaluation, and ethical reflection (Long & Magerko, 2020; Yang et al., 2025).

While AI literacy shares some characteristics with digital literacy, the two are distinct in scope and depth. Digital literacy focuses primarily on the ability to access, evaluate, and create digital content using information and communication technologies (Ng, 2012; UNESCO, 2018). It equips individuals to operate effectively in online environments, emphasising functional and communicative competence. AI literacy, on the other hand, extends beyond digital fluency to include understanding how intelligent systems work, how they make decisions, and ho-

-w they can perpetuate bias or ethical concerns. In other words, digital literacy helps individuals use digital tools effectively, whereas AI literacy enables them to understand and critically reason with intelligent technologies (Long & Magerko, 2020; Zhou & Schofield, 2024).

This distinction highlights AI literacy as an evolutionary progression of digital literacy, reflecting the growing autonomy and complexity of modern technologies. While both literacies share a commitment to critical thinking, ethical responsibility, and lifelong learning, AI literacy adds a crucial layer of cognitive and ethical discernment, empowering individuals not only to use technology, but to question, evaluate, and co-create responsibly with it (Gilster, 1997; Ng, 2012; Long & Magerko, 2020).

Beyond digital literacy, AI literacy can also be differentiated from related constructs such as AI competence, AI proficiency, and AI familiarity that refine our understanding of how humans engage with intelligent technologies. Specifically:

- AI familiarity refers to basic awareness of AI and its everyday presence, for instance, recognising that recommender systems or chatbots are powered by AI. It reflects surface-level exposure rather than skill.

- AI proficiency implies the ability to use AI tools effectively to achieve specific tasks, often within defined contexts such as writing, data analysis, or customer support.

- AI competence goes further, denoting applied and contextual mastery; the capability to select, adapt, and integrate AI solutions while understanding their implications. It combines procedural skill with decision-making.

AI literacy encompasses all the above and extends them by incorporating critical awareness, ethical reasoning, and sociocultural understanding. An AI-literate person not only knows how to use AI, but also understands why and when to use it, questions its biases and limitations, and reflects on its impact on society.

In this regard, it is useful to conceptualise AI literacy using Long and Magerko's (2020) foundational framework, which remains one of the most cited and comprehensive models. They define AI literacy as a set of competencies enabling individuals to evaluate AI systems critically, interact with them meaningfully, and use them as tools in varied settings. This framework highlights three central domains:

- Conceptual understanding: grasping how AI works (e.g., algorithms, data, learning).

- Practical application: being able to interact with and use AI tools productively.

- Critical and ethical reflection: recognising AI's limitations, biases, and societal consequences.

This tripartite model has since been expanded by researchers such as Kong et al. (2021), who identify cognitive, affective, and sociocultural dimensions, and Zhou and Schofield (2024), who propose four domains: Know and understand AI, Use and apply AI, Evaluate and create with AI, and AI ethics. These extensions align closely with the present paper's focus on integrating cognitive, ethical, and educational perspectives.

A number of instruments and benchmarks have been developed to assess AI literacy, reflecting growing global attention to this field. For example, Hornberger, Bewersdorff and Nerdel (2023) created the AI Literacy Test to measure university students' conceptual and applied understanding of AI. Du et al. (2024) developed a teacher-oriented assessment to evaluate educators' AI literacy, encompassing both cognitive and affective dimensions. In the corporate domain, the AI Readiness Index (OECD, 2023) gauges nations' and institutions' preparedness for AI adoption. While these instruments differ in focus, they collectively underscore that AI literacy involves not only knowledge of AI systems but also the ability to engage critically and ethically with a broad range of AI tools.

The interpretation and emphasis of AI literacy vary across educational levels and cultural contexts. In higher education, AI literacy is increasingly recognised as an essential digital-age competency, comparable to information or media literacy (Snow, 2025). At the same time, some scholars, such as Corbin et al. (2025), charac-

-terise the assessment of generative AI use as a "wicked problem" due to its complexity and evolving ethical implications. In school settings, generative AI has been described both as a valuable tool that supports inquiry-based learning and creative exploration (Hollands & Breazeal, 2024) and as a potential source of educational fraud, where students might complete qualifications with limited genuine understanding (Corbin et al., 2025). Cross-cultural studies reveal nuanced differences in how AI literacy is conceptualised and applied. For example, research across Asian contexts such as China, Singapore, and South Korea highlights an emphasis on collective responsibility and ethical harmony in AI use, whereas Western frameworks often prioritise innovation and individual critical inquiry (Barnes et al., 2024; Lim et al., 2025; Ma et al., 2024). These distinctions highlight that AI literacy is both universal and contextual anchored in global principles of understanding, application, and ethics, yet shaped by local values and educational priorities.

The need to equip students with AI literacy is increasingly urgent, driven by key stakeholders, including employers, students, and government bodies, who recognise its importance for workforce readiness and the development of AI-literate citizens in an AI-driven economy (see Rudolph et al., 2025). The World Economic Forum (2024) projects that 50% of employees will require reskilling by 2025, with a particular focus on AI capabilities. While having a foundational understanding of how AI systems work is certainly beneficial, achieving AI literacy does not require deep technical expertise. In line with the definition of AI literacy referenced earlier, being AI literate includes the ability to critically understand and engage with AI tools, recognise their capabilities and limitations, and make informed decisions about which tools to use in various contexts.

The next two sections will explore what AI is currently capable of and its limitations. Understanding both the capabilities and limitations of AI is essential to foster an appreciation of AI literacy.

What can AI do?

Through algorithms that detect patterns in data, AI can now emulate many cognitive and sensory functions once considered uniquely human. Its growing influence spans multiple domains, transforming how people work, learn, and communicate.

In education, AI systems analyse learning patterns to deliver personalised support. Platforms such as Carnegie Learning's MATHia, Squirrel AI, and Knewton adapt lessons to student performance, helping close knowledge gaps and enhance comprehension (Luckin et al., 2016). Tools like Duolingo and Socratic use natural language processing and image recognition to aid self-directed learning (Godwin-Jones, 2020), while Grammarly and large language models such as ChatGPT, Claude, and Gemini support academic writing and idea generation (Hagiu & Wright, 2025). AI-driven grading systems such as Gradescope streamline assessment and free educators to focus on formative feedback (Hansel et al., 2024).

AI's cognitive capabilities extend to text and data processing. Systems like Facebook's DeepText can analyse multilingual text at scale (Abdulkader et al., 2016), and Google's Mariner autonomously executes online tasks from booking travel to synthesising research, demonstrating advanced procedural automation (Morris et al., 2025). In journalism, Natural Language Generation (NLG) enables media outlets such as The New York Times and Bloomberg to automate news production (Chace, 2020).

AI also performs perceptual tasks that simulate human senses. Visual recognition systems support facial identification and surveillance applications, from KFC China's "smile-to-pay" technology (Reuters, 2017) and Beijing's subway ticketing (Dai, 2019) to law enforcement image matching (Brunette, 2025). Auditory and speech technologies, including Baidu's Deep Voice (Cole, 2018), replicate human tone and accent with minimal data. In healthcare, AI can analyse chemical compounds in breath to detect illness (Soltoggio, 2018).

Beyond perception, AI demonstrates physical and operational capability. Robotics and machine learning allow intelligent systems to move, manipulate objects, and interact in physical environments. Google Glass Enterprise Edition 2, for example, provides hands-free access to information in inspection and quality-control contexts (Garcia, 2019). In agriculture, John Deere and Blue River Technology employ computer vision and machine learning to monitor crop health and optimise yield (Hassan, 2024).

AI is also reshaping creative and affective domains. Generative AI systems such as Deep Dream Generator produce new artistic forms, while the AI-generated painting Portrait of Edmond de Belamy sold for US$432,500, signalling a new frontier in creative production (Cohn, 2018). IBM's Watson collaborates with McCormick & Company to generate innovative flavour combinations (Newcomb, 2019). In affective computing, AI now recognises and responds to emotional cues, detecting deception in insurance claims (Narimal, 2025), assessing student engagement (Holcombe & Wozniak, 2024), and supporting mental health interventions (Olawade et al., 2024).

Across industries, AI is transforming workflows and decision-making. In healthcare, wearable technologies such as the Apple Watch conduct ECGs, while AI-assisted eye screenings in Singapore help detect diabetic symptoms (Tan, 2025). Smart contact lenses monitor glucose levels (Elsherif et al., 2022). In finance and business, AI analyses vast datasets to identify trends and improve efficiency (Minson, 2024). These capabilities highlight AI's expanding role in enhancing productivity and insight across sectors.

While these advancements demonstrate AI's impressive functional breadth - from perception and cognition to creativity and empathy - they also underscore its dependence on human oversight. AI can simulate intelligence but lacks consciousness, contextual understanding, and ethical reasoning. The subsequent section examines these limitations more closely, considering why human discernment remains essential in an AI-driven world.

The limits of AI

The notion that AI can surpass human capability applies mainly to environments governed by fixed rules and predictable outcomes, such as chess or Go. In contrast, AI performs poorly in complex, dynamic contexts like education, law, or social interaction, settings where ambiguity, emotion, and moral judgment are central. As Gigerenzer (2022) explains, AI thrives on large, stable datasets but struggles when the future diverges from past patterns, making it unreliable in real-world situations marked by uncertainty.

Frank Knight's (1921) distinction between risk and uncertainty helps clarify this limitation. Under conditions of calculable risk, algorithms excel; under uncertainty where probabilities are unknown, human intuition, empathy, and contextual awareness remain irreplaceable. In education, for example, AI can analyse student data, but it cannot interpret personal circumstances, motivation, or the moral nuances that guide teachers' judgments.

Human and machine learning diverge at a deeper cognitive level. While AI processes data statistically, human cognition integrates consciousness, emotion, and ethical reflection (Kahneman, 2011; Minda, 2021). AI systems optimise for accuracy and efficiency, not meaning or morality. As Harari (2024) observes, algorithmic platforms amplify engagement rather than truth, a tendency that fuels misinformation and polarisation. These tendencies reflect the data on which AI is trained; datasets often infused with societal bias, making human oversight indispensable for interpreting AI outputs responsibly (UNESCO, 2023).

Scholars broadly agree that current AI systems lack inferential reasoning and moral discernment. Dehaene (2020) argues that while machines recognise patterns and simulate reasoning, they cannot engage in abstract thought or reflective learning. McKendrick and Thurai (2022), Gärdenfors (2023), and Likierman (2024) likewise contend that AI cannot exercise judgment in the ethical sense; it can only approximate decision-making within defined parameters. These insights underscore that AI functions best as a supportive instrument rather than an autonomous decision-maker.

The ethical pitfalls of uncritical AI use illustrate these limits vividly. Microsoft's chatbot Tay quickly adopted offensive language after exposure to biased data (Rudolph et al., 2023). Gender bias in AI-generated search results further demonstrates how algorithms reproduce stereotypes (UNESCO, 2023). In constitutional law, AI lacks the interpretive reasoning required to navigate moral and political complexity (Coan & Surden, 2024). In accounting, Minson (2024) proposes a "trust but verify" approach, arguing that AI insights must be contextualised by human expertise.

Philosophically, these examples affirm Aristotle's (2004) claim that knowledge serves the good only when guided

by wisdom. Data and logic alone cannot replace the moral and experiential dimensions of human reasoning. As Dehaene (2020) and Rudolph et al. (2024) suggest, progress in AI should not aim to eliminate human agency but to enhance it through critical oversight, ethical literacy, and discernment.

In sum, the limits of AI lie not only in what machines cannot do but in what they fail to understand, context, meaning, and morality. These boundaries highlight the enduring necessity of human judgment and the importance of cultivating AI literacy that equips individuals to navigate technological uncertainty wisely and ethically.

Rethinking ethics education in the age of AI

It is well known that in profit-driven organisations, employees face pressure to prioritise financial outcomes, sometimes at the expense of ethics. For instance, in for-profit hospitals, healthcare professionals may feel compelled to limit the time spent with each patient to increase revenue. Beyond daily business practices, ethics plays a critical role in corporate decisions such as mergers and acquisitions, which are often motivated by financial incentives (in mergers and acquisitions, overlooking cultural and human factors in favour of economic goals can lead to employee dissatisfaction and integration failures, highlighting the need for ethical leadership that values all stakeholders).

Traditionally, this is where *ethics education* in higher education institutions plays a critical role. Ethical reasoning, whether in law, business, healthcare, or the arts, revolves around the ability to think critically about the impacts of decisions and their alignment with fundamental values such as fairness, justice, and respect for human dignity. Two major ethical frameworks are utilitarianism and deontological ethics. Utilitarianism evaluates actions based on their outcomes, aiming to maximise overall happiness. The principle behind it is that the best course of action produces the greatest good for the greatest number (Bentham, 1789/1981; Mills, 1863/2014). This framework has influenced policies across various sectors, from economics to healthcare, by focusing on collective well-being (Mulgan, 1998; Singer, 2004; Congleton, 2022). Determining what constitutes the "greatest happiness" can be complex, as it depends on subjective factors and situational context. In contrast, deontological ethics, as articulated by Immanuel Kant (1788/2012), emphasises moral duties and principles over outcomes. Kant's categorical imperative insists that individuals act according to rules that could be universally applied, treating people as ends in themselves rather than as means to an end. His framework provides clear guidance for making ethical decisions, ensuring that human dignity and individual rights are prioritised.

In an AI-driven world, traditional ethics education is no longer sufficient. While conventional ethics focuses on human decision-making, interpersonal conduct, and moral philosophy, it often assumes that decisions are made by agents capable of empathy, accountability, and contextual judgment. However, AI systems function very differently. They operate at immense speed and scale, making automated decisions that influence millions of people across domains such as healthcare, education, law enforcement, finance, and social media. These systems are not conscious moral agents; they process data based on patterns and algorithms, often without transparency or accountability. As a result, the ethical issues they raise, such as algorithmic bias, data privacy violations, surveillance, and the amplification of misinformation, require new frameworks of understanding that go beyond traditional moral theory. Ethical questions now extend to how data is collected and labelled, how AI models are trained, who has access to them, and how their impacts are measured and mitigated (Crawford, 2021; Pietropaoli, 2022). To prepare students and professionals for these realities, ethics education should evolve to include AI ethics, such as data governance, algorithmic accountability, and the social implications of automation. Only then can we ensure that future professionals are prepared to responsibly engage with AI-driven decision-making in their respective fields. [There is a substantial and growing body of literature on AI ethics. For readers seeking thoughtful and in-depth discussions, several key texts offer valuable insights. Notable among these are Atlas of AI: Power, Politics, and the Planetary Costs of Artificial Intelligence by Kate Crawford (2021), Nexus by Yuval Noah Harari (2024), AI Ethics by Mark Cockelbergh (2020) and Human Compatible: Artificial Intelligence and the Problem of Control by Stuart Russell (2019)].

AI literacy in higher education

Building on the previous sections, which have outlined what AI is, its capabilities, and its inherent limitations, I turn next to examine the value of AI literacy within educational contexts.

Research has shown that higher levels of AI literacy are positively associated with enhanced academic performance. Students with greater AI literacy are more adept at utilising AI tools for tasks such as language support, personal development, and exam preparation, leading to increased learning efficiency and subject comprehension (Asio, 2024; Moosa et al., 2024). AI literacy enables students to leverage AI-powered platforms that tailor educational experiences to individual needs, allowing for personalised feedback, improved study techniques, and better time management. These factors contribute to higher grades, reduced study-related stress and enhanced emotional well-being, leading to higher energy levels, increased motivation, and greater overall happiness among students (Shahzad et al., 2024; Moosa et al., 2024; Klimova & Pikhart, 2025). Students with higher AI literacy also report increased motivation and engagement with their studies, as AI tools can make learning more interactive and accessible (Mansoor et al., 2024). Over 80% of students surveyed believe that using AI enhances their academic performance, citing benefits such as improved comprehension and efficiency (Vieviu & Petrea, 2025). As AI shapes industries, influences decision-making, and transforms societal interactions, its integration into university curricula has become a pressing priority.

Indeed, universities are increasingly accepting the use of AI tools, recognising both their permanence in society and the likelihood that students will use them independently. AI assist in generating ideas and prompts that enhance learning. However, this acceptance is grounded in the need to cultivate AI literacy such as the ability to critically assess, question, and make informed use of AI-generated content. Zhou Xue and Lilian Schofield (2024) present an AI literacy framework that can be useful to guide and support educators in effectively incorporating AI into their teaching practices. This framework consists of four key dimensions that collectively foster a well-rounded understanding of AI. The first dimension, “Know and understand AI”, aims to introduce learners to fundamental AI concepts, ensuring they grasp the basic functions and applications of AI in various learning contexts. The second dimension, “Use and apply AI”, emphasises the practical application of AI for problem-solving, enabling students to leverage AI tools to enhance their analytical and decision-making abilities. The third dimension, “Evaluate and create with AI”, focuses on the critical assessment of AI-generated content, encouraging higher-order thinking skills such as analysis, synthesis, and innovation. Finally, the fourth dimension, “AI Ethics”, underscores the importance of understanding the ethical and moral implications of AI, equipping learners with the awareness needed to navigate issues related to bias, privacy, and responsible AI usage. This structured framework serves as a valuable resource for programme directors and module developers, providing a roadmap for integrating AI literacy into curricula.

Recognising this, an increasing number of universities worldwide have begun to integrate AI-focused programmes and interdisciplinary initiatives into their curricula. These efforts reflect a growing consensus that AI literacy represents not merely a specialised domain of study but a core competency for lifelong learning and citizenship in an increasingly digital world. Notable examples include:

- University of Florida (UF), USA: UF’s “AI Across the Curriculum” initiative aims to infuse AI education across all its colleges, equipping students with AI skills, societal awareness, and ethical considerations (Southward et al., 2023).

- Nanjing University, China: Nanjing University has launched a compulsory AI core course to enhance AI literacy, offering interdisciplinary courses that integrate AI with various disciplines (EduTech Talks, 2024).

- Arizona State University (ASU), USA: ASU offers a course on “AI Literacy in Design and the Arts”, focusing on the ethical and practical implications of AI in creative fields (Faller & Sussman, n.d.).

- The Education University of Hong Kong (EdUHK), Hong Kong: EdUHK’s AI Literacy Programme helps students understand AI’s ethical use and its societal impact (The Education University of Hong Kong, n.d.).

- Singapore University of Technology and Design (SUTD), in partnership with Certis, offers a digital literacy pro-

-gramme aimed at enhancing AI mastery among security professionals (Techno Global Staff, 2024).

The increasing integration of AI in education has brought renewed attention to variations in learners' levels of AI literacy. While AI-literate learners, those capable of critically and ethically engaging with intelligent tools, tend to exhibit higher levels of autonomy, adaptability, and digital discernment in technology-mediated environments (Long & Magerko, 2020; Kong et al., 2021; Mansoor et al., 2024; Du et al., 2024; Asio, 2024), this does not diminish the enduring strengths of traditional learners. Learners who rely more on instructor-led guidance and structured approaches often demonstrate valuable attributes such as discipline, persistence, and reflective depth, which continue to play a vital role in meaningful learning and cognitive development (Hollands & Breazeal, 2024). Consequently, rather than framing AI literacy as a dichotomy, it is useful to conceptualise it as an evolving continuum. Pedagogical strategies could aim to bridge the gap by supporting traditional learners in developing confidence and competence in AI-mediated contexts, while also encouraging AI-literate learners to refine their critical, ethical, and reflective engagement with intelligent systems.

It is equally important to recognise that even before the advent of AI-driven learning environments, educators have long promoted exploration, dynamic learning, creative problem-solving, and reflective judgment as central tenets of effective pedagogy. These foundational principles remain at the heart of quality education and continue to shape how learners construct understanding in diverse contexts. The integration of AI does not replace these established practices but rather amplifies the need to sustain and adapt them within digitally mediated classrooms. In this sense, the pursuit of AI literacy should be viewed not as a departure from traditional pedagogical values, but as a natural extension of them grounded in curiosity, critical thinking, and ethical reasoning that empower all learners to navigate and contribute meaningfully to an AI-enhanced educational landscape.

AI literacy has gone beyond students. At Stanford University, the Stanford Teaching Commons' "Understanding AI Literacy" guide offers educators a comprehensive framework to navigate the integration of generative AI in educational settings. This framework is structured around four key domains:

- Functional Literacy: Focuses on understanding how AI operates, including knowledge of AI tools, basic prompting skills, and awareness of AI developments. Educators are encouraged to familiarise themselves with AI technologies, their capabilities, and limitations.

- Ethical Literacy: Addresses the moral considerations of AI usage, such as issues of bias, privacy, and academic integrity. It emphasises the importance of forming personal ethical positions and promoting responsible AI practices within educational contexts.

- Rhetorical Literacy: Involves the effective use of language in collaboration with AI, understanding the nuances of AI-generated content, and developing skills to critique and refine such content to meet specific educational goals.

- Pedagogical Literacy: Centers on integrating AI to enhance teaching and learning practices. This includes exploring AI-powered educational tools, attending professional development related to AI, and adapting teaching strategies to incorporate AI in a manner that supports evidence-based practices.

NUS has also taken significant steps to equip its administrative staff with essential data literacy and AI skills, reinforcing its commitment to lifelong learning. Through two key initiatives - the Data Literacy Programme (DLP) and the Artificial Intelligence Competency Course (AICC) - NUS aims to enhance employees' technical capabilities and enable them to apply data-driven decision-making in their roles.

- Data Literacy Programme (DLP): Launched in mid-2020, the DLP provides staff with foundational knowledge in data analytics, empowering them to extract meaningful insights and improve business performance. The programme follows a blended learning approach, combining eLearning modules with 15 hours of hands-on workshops and a group project.

- Artificial Intelligence Competency Course (AICC): Introduced in early 2021, the AICC builds on this foundation

by training staff in AI applications, including machine learning and deep learning. Designed across basic, intermediate, and advanced levels, the course features weekly three-hour discussions and culminates in a group project where participants propose AI-driven solutions for real-world challenges. Notable projects include automating the verification of postgraduate admission documents and leveraging AI to enhance alumni engagement.

The 24 Vice Chancellors of the Russell Group universities have pledged their commitment to ensuring the ethical and responsible use of generative AI technologies such as ChatGPT (see Daws, 2023). Their joint statement outlines key principles, including AI literacy support for students and staff, faculty training to guide students in the appropriate and effective use of generative AI, and the ethical integration of AI in teaching and assessment. It calls for universities to maintain rigorous academic integrity while embracing AI's role in education. Incorporating AI literacy into university education is no longer optional; it is essential.

While AI offers valuable tools for personalised and efficient learning, educators should be mindful that its overuse can lead to several negative effects. Students may experience technostress and digital fatigue, especially when constantly engaging with digital platforms or struggling to keep pace with evolving technologies. Excessive reliance on AI can also reduce face-to-face interactions, weakening interpersonal skills and emotional intelligence, and increasing feelings of isolation. Concerns over data privacy in AI-driven environments may further contribute to student anxiety and mistrust (Crawford et al., 2024; Klimova & Pikhart, 2025).

Growing concerns have also emerged about AI's impact on students' cognitive development and critical thinking. A 2025 study by Microsoft and Carnegie Mellon University found that overreliance on AI assistants can erode critical thinking, as students tend to accept AI-generated information without adequate scrutiny, leading to a decline in independent problem-solving skills (Lee et al., 2025). Evidence also suggests that students lack confidence in their own writing abilities and increasingly turn to generative AI tools like ChatGPT to complete even simple assignments (Lee et al., 2025; Messner, 2025; Gerlich, 2025). Such dependency reflects a deficit in self-efficacy and critical engagement rather than genuine learning. Dergaa et al. (2024) introduced the concept of AI-induced cognitive atrophy (AICICA), describing how frequent chatbot use can undermine core cognitive skills, including memory, creativity, and analytical thinking. Zhai et al. (2024) highlights the issue of overreliance on AI, which occurs when users accept AI-generated recommendations without question, leading to errors in task performance in the context of decision-making. This typically arises when individuals struggle to assess the reliability of AI or how much trust to place in its suggestions.

In 2022, the University of Wollongong in Australia developed SmartTest, a chatbot integrated into a law class. The AI was designed to support teaching by answering students' questions and helping them better understand legal concepts. However, despite its potential, the chatbot consistently produced incorrect or misleading responses. These inaccuracies not only confused students but also raised concerns about the reliability of such tools in complex, high-stakes subjects like law (Alimardani & Jane, 2025).

Wolfgang Messner (2025) raises concerns that the growing use of generative AI in education may foster mediocrity and conformity. Students are now producing essays rapidly with the help of AI, often making only superficial edits without engaging in deeper analysis. Likewise, some educators are turning to similar tools for providing feedback, further reinforcing this trend. Messner warns that such reliance on AI risks narrowing the range of perspectives during brainstorming sessions, an essential process for creative breakthroughs. Another concern is that generative AI systems tend to reflect the values and worldviews of affluent, English-speaking nations, potentially marginalising diverse voices and limiting global inclusivity in education. These examples serve as a cautionary tale about over-reliance on AI in classrooms and underscores the need for rigorous vetting, human oversight, and continued development of AI literacy among both educators and learners.

It is worth noting that high-performing students tend to use AI tools strategically, as supplementary aids rather than primary sources, preserving critical thinking and academic integrity (Mansoor et al., 2024). This cautious approach is especially important given recent admissions by OpenAI CEO Sam Altman in April 2025, acknowledging that ChatGPT can sometimes be sycophantic - agreeing too readily with users and reinforcing flawed assumptions rather than challenging them.

Current AI detectors such as Turnitin and GPTZero are unable to reliably identify instances where students have used AI tools in their work. Cases of producing false positives, wrongly accusing students of cheating, have surfaced (Davalos & Yin, 2024), which explains why some educators have remained hesitant in integrating AI into education due mainly to fears of academic dishonesty, including ghost-writing and plagiarism, as well as privacy risks, ethical challenges, and gaps in their knowledge of technology-enhanced pedagogy (Bewersdorff & Nerdel, 2023; Celik, 2023; Hornberger, Bewersdorff & Nerdel, 2023; Nah et al., 2023; Rasul et al., 2023). Clearly, we do not want to see our students outsourcing their writing and thinking to machines.

That said, the goal should not be to position humans against AI, but rather to think in terms of merging human capabilities with intelligent systems. Just as calculators were once disruptive yet ultimately became essential tools integrated into everyday learning and problem-solving, AI is poised to become a natural part of how we think, work, and live.

I would argue that the future of education lies in finding a balanced approach where AI augments human judgment, creativity, and social interaction, not replaces them. Educators play a crucial role in guiding students to develop the discernment to use AI thoughtfully, ensuring that it supports, not supplants, human learning and development. This balance will help students benefit from AI's advantages while maintaining essential life skills and mental resilience.

The following strategies offer practical guidance for achieving this balance:

- Comprehensive professional development is crucial. Teachers need continuous, targeted training that helps them integrate AI tools within their existing pedagogical frameworks. This empowers them to use technology with confidence and clarity, ensuring that instructional decisions remain firmly in their hands. Professional development should emphasise both the technical and ethical dimensions of AI use.

- Schools should adopt blended teaching approaches that combine in-person instruction with AI-driven tools. For example, hands-on projects and group discussions can be paired with adaptive learning platforms or virtual simulations. This hybrid model promotes personalisation and engagement while preserving the social and communicative benefits of classroom interaction.

- Coursework assignments may be designed to integrate both AI tools and human-centred inquiry. One effective model is to require students to critically analyse AI-generated outputs, for example, by using tools like ChatGPT, Claude and Gemini to produce initial responses or content drafts, which students then evaluate for accuracy, bias, depth, and ethical implications. This encourages active learning and cultivates critical thinking rather than passive reliance on AI. Assignments can also incorporate micro studies focusing on specific companies that have adopted AI in their operations, allowing students to contextualise AI's real-world applications and consequences within a defined business environment. Incorporating interviews with industry professionals or employees within the selected company adds a qualitative dimension that AI cannot replicate, providing insight into human perspectives, workplace dynamics, and ethical concerns. This approach reinforces the value of interpersonal communication, reflective judgment, and contextual understanding. By blending AI-generated content with empirical investigation and human interaction, students learn not only how to leverage AI effectively, but also how to challenge, refine, and complement it with human insight, fostering a well-rounded, responsible engagement with emerging technologies.

- It is essential to establish clear guidelines and ethical standards for AI use in education. These should address key concerns such as data privacy, academic integrity, and appropriate levels of AI involvement. Transparent policies help build trust among students, educators, and parents, and promote equitable access to technology.

- It is also important to foster a supportive, student-centered environment where students are encouraged to use AI tools for exploration, collaboration, and self-assessment. At the same time, traditional skills like critical thinking, creativity, and interpersonal communication must remain central. By cultivating a safe space for experimentation, educators can help students become confident, responsible users of technology.

- Embedding AI literacy across curricula requires more than the inclusion of technology-focused modules; it demands an interdisciplinary design that bridges technical competence, ethical reasoning, and domain-specific knowledge. Integrating AI literacy into diverse fields, such as business, healthcare, the arts, and the humanities, enables students to contextualise intelligent technologies within real-world and moral frameworks. Interdisciplinary collaboration between educators, technologists, and ethicists ensures that AI education is not siloed but woven throughout the academic experience. This approach cultivates both cognitive depth and ethical discernment, equipping students to evaluate AI's implications for human values, equity, and societal impact. Ethical awareness, as emphasised by Bloom's higher-order thinking levels and by frameworks such as Zhou and Schofield's (2024), should therefore underpin all AI-related curricular initiatives. By uniting disciplinary perspectives through a shared ethical and reflective foundation, universities can prepare graduates who are not only technologically proficient but also responsible, critically aware contributors to an AI-mediated world.

- While AI in education is designed to enhance students' problem-solving skills and promote psychological empowerment, its impact depends greatly on how educators guide and frame its use. AI technologies can support adaptive learning and foster metacognitive awareness; however, unmoderated or excessive reliance on such tools may inadvertently diminish students' confidence in their own reasoning and task performance, even in relatively simple activities. Educators therefore play a crucial mediating role in ensuring that AI functions as a complement to, rather than a replacement for, human cognition. Through intentional pedagogical design, such as encouraging students to justify AI-generated responses, reflect on their learning processes, and critically evaluate technological input, teachers can help learners retain agency and confidence while still benefiting from AI's affordances. In this way, AI integration becomes not merely a technological enhancement but a guided learning partnership, in which educators balance automation with human judgment to cultivate both competence and self-efficacy within AI-mediated learning environments.

- Continuous evaluation and adaptation is another essential strategy. Schools should regularly assess the effectiveness of AI tools and be ready to adjust their implementation based on outcomes and feedback. Staying attuned to evolving best practices allows educators to refine their approaches and remain responsive to student needs.

- It is vital to preserve human agency and empathy in the learning process. Teachers play a crucial role in offering moral guidance, emotional support, and nuanced understanding, qualities that AI cannot replicate. AI can take on routine tasks such as grading or providing instant feedback. By using AI to free up time and reduce workload, educators can focus more deeply on these human elements, reinforcing the foundational relationships that underpin effective teaching.

Conclusion

As AI's role in society grows, educators must lead the charge in preparing students and staff to use AI technologies ethically and effectively. Amidst the technological advancements, we underscore the indispensable need to retain the human touch in education. Educators emerge as crucial guides, navigating students through the complexities of knowledge acquisition, utilising AI as a potent tool to foster critical thinking and creativity. The harmonious integration of AI and human educators is posited as the key to unlocking the full potential of this transformative partnership.

Future research should move beyond conceptual analysis to empirical validation of AI literacy frameworks and their outcomes across educational contexts. Studies could examine how AI literacy influences learning performance, ethical reasoning, and long-term employability across disciplines and cultures. Developing reliable and adaptable assessment instruments, for example, those that combine quantitative evaluation with reflective self-assessment, will be essential for tracking learners' progress and institutional readiness. Further exploration is needed into interdisciplinary pedagogies that integrate AI literacy with ethics, creativity, and critical inquiry, as well as into models of professional development that empower educators to embed AI literacy sustainably within their curricula. Comparative research across national and cultural settings would also deepen understanding of

how contextual values shape AI education. Such investigations will advance both theory and praxis, guiding the creation of AI-literate societies capable of navigating technological change with wisdom, integrity, and innovation.

The Bloom (1984) 2-Sigma problem, the redefinition of learning measurement, and the ethical considerations surrounding AI data underscore the multi-faceted nature of this transformative journey. As we navigate this intricate path, it becomes imperative to prioritise the development of AI systems endowed with a robust moral compass and a commitment to fostering human intelligence. The future of education lies in a symbiotic collaboration between AI and human educators, ensuring that technology serves as a catalyst for learning and innovation without eclipsing the irreplaceable human touch that defines the essence of education.

Acknowledgement

The author wishes to express sincere gratitude to the Editor-in-Chief and the two anonymous reviewers for their thoughtful and constructive feedback on earlier versions of this paper. Any remaining errors or oversights are entirely the author's own.

References

Abdulkader, A., Lakshmiratan, A., & Zhang, J. (June 1, 2016). I*ntroducing DeepText: Facebook's text understanding engine.* https://engineering.fb.com/2016/06/01/core-infra/introducing-deeptext-facebook-s-text-understanding-engine/

Alimardani, A., & Jane, E. A. (June 1, 2025). Researchers created chatbot to teach law class in uni, but AI kept messing up. *The Straits Times.*

Aristotle. (2004). *The Nicomachean Ethics.* The Penguin Books.

Asio, J. M. R. (May 31, 2024). *Artificial Intelligence (AI) literacy and academic performance of tertiary level students: A preliminary analysis.* https://ssrn.com/abstract=4925027

Barnes, A. J., Zhang, Y., & Valenzuela, A. (2024). AI and culture: Culturally dependent responses to AI systems. *Current Opinion in Psychology*, Aug, *58*:101838.

Bentham, J. (1789/1981). *An introduction to the principles of morals and legislation*. Garland.

Bewersdorff, A., & Nerdel, C. (2023). What do university students know about Artificial Intelligence? Development and validation of an AI literacy test Marie Hornberger. *Computers and Education: Artificial Intelligence*, *5*, 100165.

Bloom, B. (1984). The 2 Sigma problem: The search for methods of group instruction as effective as one-to-one tutoring. *Educational Researcher*, *13*(6), 4-16.

Brunette, A. (February 28, 2025). *Policing in the AI era: Balancing security, privacy & the public trust*. https://www.thomsonreuters.com/en-us/posts/government/policing-ai-security/

Celik, I. (2023). Towards Intelligent-TPACK: An empirical study on teachers' professional knowledge to ethically integrate artificial intelligence (AI)-based tools into education. *Computers in Human Behavior*, *138*, 107468.

Chace, C. (August 24, 2020). *The impact of AI on journalism*. https://www.forbes.com/sites/calumchace/2020/08/24/the-impact-of-ai-on-journalism/

Clark, L. A. (2025). *Reframing Bloom's for the age of AI: A white paper for future-ready educators*. Anthology Inc. https://backstage.anthology.com/sites/default/files/2025-9/ReframingBloomsForTheAgeOfAI_WhitePaper_v1.pdf

Coan, A., & Surden, H. (December 16, 2024). AI and constitutional interpretation: The law of conservation of judgement. *Lawfare.* https://www.lawfaremedia.org/article/ai-and-constitutional-interpretation--the-law-of-conservation-of-judgment

Cockelbergh, M. (2020). *AI ethics.* MIT Press.

Cohn, G. (October 25, 2018). *AI art at Christie's sells for $432,500*. The New York Times.

Cole, S. (March 7, 2018). *'Deep Voice' software can clone anyone's voice with just 3.7 seconds of audio*. https://www.vice.com/en/article/baidu-deep-voice-software-can-clone-anyones-voice-with-just-37-seconds-of-audio/

Congleton, R. D. (2022). *Solving social dilemmas: Ethics, politics, and prosperity*. Oxford University Press.

Corbin, T., Bearman, M., Boud, D., & Dawson, P. (2025). The wicked problem of AI and assessment. *Assessment & Evaluation in Higher Education*, 1–17. https://doi.org/10.1080/02602938.2025.2553340

Crawford, J., Allen, K. A., Pani, B., & Cowling, M. (2024). *When artificial intelligence substitutes humans in higher education: The cost of loneliness, student success, and retention. Studies in Higher Education*, *49*(5), 883–897. https://doi.org/10.1080/03075079.2024.2326956

Crawford, K. (2021). *The atlas of AI: Power, politics, and the planetary costs of artificial intelligence*. Yale University Press.

Dai, S. (December 4, 2019). *China's subways embrace facial recognition payment systems despite rising privacy concerns*. https://www.scmp.com/tech/apps-social/article/3040398/chinas-subways-embrace-facial-recognition-payment-systems-despite

Davalos, J., & Yin, L. (October 18, 2024). AI detectors falsely accuse students of cheating – with big consequences. *Businessweek*. https://www.bloomberg.com/news/features/2024-10-18/do-ai-detectors-work-students-face-false-cheating-accusations

Daws, R. (July 4, 2023). *Universities want to ensure staff and students are 'AI-literate'*. https://www.artificialintelligence-news.com/news/universities-ensure-staff-and-students-ai-literate/

Dehaene, S. (2020). *How we learn: Why brains learn better than any machines…for now*. Viking.

Dergaa, I., Ben Saad, H., Glenn, J. M., Amamou, B., Ben Aissa, M., Guelmami, N., Fekih-Romdhane, F., & Chamari, K. (2024). From tools to threats: A reflection on the impact of artificial-intelligence chatbots on cognitive health. *Frontiers in Psychology*. *15*, 1259845.

Du, H., Sun, Y., Jiang, H., Atiquil Islam, A. Y. M., & Gu, X. (2024). Exploring the effects of AI literacy in teacher learning: An empirical study. *Humanities and Social Sciences Communications*, *11*, 559. https://doi.org/10.1057/s41599-024-03101-6

EduTech Talks. (March 21, 2024). *Nanjing University to introduce innovative AI literacy curriculum.* https://edutechtalks.com/nanjing-university-to-introduce-innovative-ai-literacy-curriculum/

Elsherif, M., Moreddu, R., Alam, F., Salih, A. E., Ahmed, I., & Butt, H. (2022). Wearable smart contact lenses for continual glucose monitoring: A review. *Frontiers in Medicine*, *4*(9), 858784.

Faller, M. B., & Sussman, D. (n.d.). *Creativity and AI: AI literacy course prepares ASU students to set cultural norms for new technology*. https://disrupt.asu.edu/article/creativity-and-ai/

Garcia, A. (May 20, 2019). *Google Glass lives on in the workplace*. https://edition.cnn.com/2019/05/20/tech/google-

glass-enterprise-edition-2

Gärdenfors, P. (June 5, 2023). Why AI lacks judgement. *Psychology Today.* https://www.psychologytoday.com/sg/blog/what-is-a-human/202306/why-ai-lacks-judgment

Gerlich, M. (2025). AI tools in society: Impacts on cognitive offloading and the future of critical thinking. *Societies,15*, 6. https://doi.org/10.3390/soc15010006

Gigerenzer, G. (2022). *How to stay smart in a smart world: Why human intelligence still beats algorithm.* The MIT Press.

Gilster, P. (1997). *Digital literacy*. Wiley.

Godwin-Jones, R. (2020). Language learning and technology: The state of the art. *Language Learning & Technology*, 24(3), 1–19.

Hagiu, A., & Wright, J. (2025). Artificial intelligence and competition policy. *International Journal of Industrial Organization*, 103134. https://doi.org/10.1016/j.ijindorg.2025.103134.

Hansel, C. A., Ottenbreit-Leftwich, A., Quick, J. D., Greene, A. H., & Ricci, M. (2024). Gradescope in large lecture classrooms: A case study at Indiana University. *Journal of Teaching and Learning with Technology, 13*, 33-48.

Harari, Y. N. (2024). *Nexus: A brief history of information networks from the Stone Age to AI*. Fern Press.

Hassan, T. (October 7, 2024). *Revolutionising farming with AI.* https://agrinextcon.com/farming-with-aisustainable-agriculture-solutions/

Holcombe, A., & Wozniak, S. (July 1, 2024). *Using AI to fuel engagement and active learning.* https://www.ascd.org/el/articles/using-ai-to-fuel-engagement-and-active-learning

Hollands, F., & Breazeal, C. (2024). Establishing AI literacy before adopting AI. *The Science Teacher*, March/April 2024, 35-42.

Hornberger, M., Bewersdorff, A., & Nerdel, C. (2023). What do university students know about Artificial Intelligence? Development and validation of an AI literacy test. Computers and Education: Artificial Intelligence, 5, 100165.

Jain, J., & Samuel, M. (2025). *Bloom meets Gen AI: Reconceptualising Bloom's Taxonomy in the era of co-piloted learning.* Preprints, 2025010271. https://www.preprints.org/manuscript/202501.0271/v1

Kahneman, D. (2011). *Thinking, fast and slow*. Allen Lane.

Kant, I. (1788/2012). *Groundwork of the metaphysics of morals*. Cambridge University Press.

Khan, S. (2024). *Brave new words: How AI will revolutionize education (and why that's a good thing).* Allen Lane.

Klimova, B., & Pikhart, M. (2025). Exploring the effects of artificial intelligence on student and academic well-being in higher education: A mini-review. *Frontiers in Psychology, 16* (3 February 2025). https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2025.1498132/full

Knight, F. (1921). *Rick, uncertainty and profit.* Houghton Mifflin Company.

Kong, S. C., Cheung, W. M. Y., & Zhang, G. (2021). Evaluation of an artificial intelligence literacy course for university students with diverse study backgrounds. *Computers and Education: Artificial Intelligence, 2*, 100026.

Lee, H. P., Sarkar, A., Tankelevitch, L., Drosos, I., Rintel, S., Banks, R., & Wilson, N. (2025). The impact of generative AI on critical thinking: Self-reported reductions in cognitive effort and confidence effects from a survey of knowledge workers. In *CHI Conference on Human Factors in Computing Systems (CHI '25)*, April 26–May 01, 2025, Yokohama, Japan. ACM, New York, NY, USA. https://doi.org/10. 1145/3706598.3713778

Likierman, A. (December 4, 2024). Good news for humans: AI doesn't do judgment. *Airport Technology*.

Lim, D. C., Mat, H., & Yusooff, F, (2025). Centring the human: Critical AI literacy, student engagement, and institutional implications for open universities in developing Asia. *Asian Association of Open Universities Journal*, vol ahead of print. https://doi.org/10.1108/AAOUJ-04-2025-0041

Long, D., & Magerko, B. (2020). What is AI Literacy? Competencies and design considerations. *CHI '20: Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1 – 16 https://doi.org/10.1145/3313831.337672

Lubbe, A., Marais, E., & Kruger, D. (2025). Cultivating independent thinkers: The triad of artificial intelligence, Bloom's taxonomy and critical thinking in assessment pedagogy. *Education and Information Technologies, 30*, 17589–17622. https://www.airport-technology.com/sponsored/good-news-for-humans-ai-doesnt-do-judgement/ *15*, 6. https://doi.org/10.3390/soc15010006

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education.* Pearson.

Ma, Y., Akram, H., & Chen, S. (2024). Artificial intelligence in higher education: A cross-cultural examination of students' behavioural intentions and attitudes. *International Review of Research in Open and Distributed Learning, 25*(3), 84–103. https://www.airport-technology.com/sponsored/good-news-for-humans-ai-doesnt-do-judgement/ 15, 6. https://doi.org/10.3390/soc15010006

Mansoor, H. M. H., Bawazir, A., Alsabri, M. A., Alharbi, A., & Okela, A.H. (2024). Artificial Intelligence literacy among university students: A comparative transnational survey. *Frontiers in Communication, 9,* 1478476.

Marr, B. (2020). The intelligence revolution: *Transforming your business with AI.* KaganPage.

Messner, W. (June 4, 2025). *Why AI may encourage a drift towards mediocrity.* The Straits Times.

McKendrick, J., & Thurai, A. (September 15, 2022). AI isn't ready to make unsupervised decisions. *Harvard Business Review*. https://hbr.org/2022/09/ai-isnt-ready-to-make-unsupervised-decisions

Mills, J. S. (1863/2014). *Utilitarianism*. Cambridge University Press.

Minda, J. P. (2021). *How to think: Understanding the way we decide, remember and make sense of the world.* Robinson.

Minson, A. (September 11, 2024). Beyond the numbers: Why AI can't replace human judgment in accounting. *Trullion.* https://trullion.com/blog/beyond-the-numbers-why-ai-cant-replace-human-judgment-in-accounting/

Mohammad H., & Shaqour, A. (2024). AIEd Bloom's Taxonomy: A proposed model for enhancing educational AI. *Journal of Artificial Intelligence in Education Research, 5*(2), 45–63. https://staff.najah.edu/media/published_research/2024/05/07/watermarked_aied-bloom-s-taxonomy_apr-26-2024-18-49-35_1.pdf

Moosa, D., Bozkurt, V., Reesha, A., & Shina, A. (2024). The effects of Artificial Intelligence (AI) literacy and use on students' perceptions of academic performance in the Maldives. *Journal of Knowledge Economy and Management, 19*(2), 163-174.

Morris, S., Heikkila, M., & Criddle, C. (May 27, 2025). *Can Google still dominate search in the age of AI chatbots?* The Straits Times.

Mulgan, T. (1998). *Understanding Utilitarianism*. Westview Press.

Nah, F. N., Zheng, R., Cai, J., Siau, K., & Chen, L. (2023). Generative AI and ChatGPT: Applications, challenges, and AI-human collaboration. *Journal of Information Technology Case and Application Research, 25*(3), 277-304.

Narimal, M. (April 14, 2025). *How AI can detect fraud and speed claims*. https://www.insurancethoughtleadership.com/ai-machine-learning/how-ai-can-detect-fraud-and-speed-claims

Newcomb, A. (February 4, 2019). *IBM and McCormick are using Artificial Intelligence to create new spice blends*. https://fortune.com/2019/02/04/ibm-watson-mccormick-spice-artificial-intelligence/

Ng, W. (2012). Can we teach digital natives digital literacy? *Computers & Education, 59*(3), 1065–1078. https://doi.org/10.1016/j.compedu.2012.04.016

OECD. (2023). *AI Readiness Index 2023: Benchmarking national capabilities.* OECD Publishing.

Olawade, D. B., Wada, O. Z., Odetayo, A., David-Olawade, A.C., Asaolu, F., & Eberhardt, J. (2024). Enhancing mental health with Artificial Intelligence: Current trends and future prospects. *Journal of Medicine, Surgery, and Public Health, 3*, 100099.

Pietropaoli, I. (2022). Artificial Intelligence and data governance. *Singapore Academy of Law Journal, 34,* 795-833.

Pinski, M., & Benlian, A. (2024). AI literacy for users: A comprehensive review and future research directions of learning methods, components, and effects. *Computers in Human Behavior: Artificial Humans, 2*(1), 100062.

Rasul, T., Nair, S., Kalendra, D., Robin, M., de Oliveira Santini, F., Ladeira, W. J., Sun, M., Day, I., Rather, R. A., & Heathcote, L. (2023). The role of ChatGPT in higher education: Benefits, challenges, and future research directions. Journal of Applied Learning and Teaching, 6*(1), 41-56. https://doi.org/10.37074/jalt.2023.6.1.29*

Reuters. (September 1, 2017). *You can now smile to pay for your KFC meal in China.* https://nypost.com/2017/09/01/you-can-now-smile-to-pay-for-your-kfc-meal-in-china/

Rudolph, J., Ismail, F., & Popenici, S. (2024). Higher education's generative artificial intelligence paradox: The meaning of chatbot mania. *Journal of University Teaching and Learning Practice, 21*(6), 14-48. https://doi.org/10.53761/54fs5e77

Rudolph, J., Ismail, F., Tan, S., & Seah, P. (2025). Don't believe the hype: AI myth and the need for a critical approach in higher education. *Journal of Applied Learning and Teaching, 8*(1), 6-26. https://doi.org/10.37074/jalt.2025.8.1.1

Rudolph, J., Tan, S., & Tan, S. (2023). War of the chatbots: Bard, Bing Chat, ChatGPT, Ernie and beyond. The new AI gold rush and its impact on higher education. *Journal of Applied Learning and Teaching, 6*(1), 364-389. https://doi.org/10.37074/jalt.2023.6.1.23

Russell, S. (2019). *Human compatible: Artificial Intelligence and the problem of control.* Viking.

Shah, P. (2023). *AI and the future of education: Teaching in the age of Artificial Intelligence.* Jossey-Bass.

Shahzad, M. F., Xu, S., Lim, W. M., Yang, X., & Khan, Q. R. (2024). Artificial intelligence and social media on academic performance and mental well-being: Student perceptions of positive impact in the age of smart learning. *Heliyon, 10*(8), e29523.

Singer, P. (Ed.) (2004). *Ethics*. Oxford University Press.

Snow, J. (2025). *Are you AI literate? Schools and jobs are insisting on it – and how it's EU law*. https://www.fastcompany.com/91276048/ai-literacy-schools-and-workforce

Soltoggio, A. (June 13, 2018). *AI is acquiring a sense of smell that can detect illnesses in human breath*. https://www.independent.co.uk/news/science/ai-artificial-intelligence-smell-detect-illness-science-technology-a8394706.html

Southworth, J., Migliaccio, K., Glover, J., Glover, J., Reed, D., McCarty, C., Brendemuhl, J., & Thomas, A. (2023). Developing a model for AI Across the curriculum: Transforming the higher education landscape via innovation in AI literacy. *Computers and Education: Artificial Intelligence, 4*, 100127.

Tan, D. W. (April 6, 2025). *'Cracking the wall' between AI and medicine.* The Straits Times.

Techno Global Staff. (October 14, 2024). *Certis partners SUTD to launch AI literacy program in Singapore*. https://technode.global/2024/10/14/certis-partners-sutd-to-launch-ai-literacy-program-in-singapore/

The Education University of Hong Kong. (n.d.). *AI literacy programmes for EduHK students*. https://www.aidcec.eduhk.hk/for-students/ai-edu/ai-literacy-programme-for-eduhk-students/

UNESCO. (2018). *Digital competence framework for educators (DigCompEdu)*. https://joint-research-centre.ec.europa.eu/digcompedu_en#:~:text=The%20focus%20is%20not%20on,New%20Skills%20for%20New%20Jobs.

UNESCO. (April 21, 2023). *Artificial Intelligence: Examples of ethical dilemmas*. https://www.unesco.org/en/artificial-intelligence/recommendation-ethics/cases

World Economic Forum. (2024). *Reskilling revolution: Preparing 1 billion people for tomorrow's economy*. https://www.weforum.org/impact/reskillingrevolution-reaching-600-million-people-by-2030.

Vieviu, A. M., & Petrea, G. (2025). The impact of Artificial Intelligence (AI) on students' academic development. *Education Science, 15*(3), 343.

Yang, Y., Zhang, Y., Sun, D., He, W., & Wei, Y. (2025). Navigating the landscape of AI literacy education: Insights from a decade of research (2014–2024). *Humanities and Social Sciences Communication, 12*, 374. https://doi.org/10.1057/s41599-025-04583-8.

Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. *Smart Learning Environment, 11*, 28. https://doi.org/10.1186/s40561-024-00316-7

Zhou, X., & Schofield, L. (2024). Developing a conceptual framework for Artificial Intelligence (AI) literacy in higher education. *Journal of Learning Development in Higher Education, 31*, 1-14.