

### 3. Empowering Literacy with AI: Implications for Teaching, Ethics, and Policy

Damian Maher

ORCID: <https://orcid.org/0000-0002-3566-0805>

Don Carter

ORCID: <https://orcid.org/0000-0002-8974-5337>

#### **Abstract**

This chapter explores the transformative role of artificial intelligence (AI) in literacy education, examining its pedagogical benefits, ethical challenges, and implications for teacher professional development. As AI tools become increasingly embedded in classrooms, they offer promising avenues for enhancing literacy through personalised learning, adaptive feedback, and resource creation. However, these opportunities are accompanied by significant concerns, including algorithmic and cultural bias, misinformation, and equitable access. The chapter outlines the concept of AI literacy, proposing a framework that supports students' critical understanding and responsible use of AI technologies. It also highlights the ethical implications of AI use, particularly in relation to fairness and inclusivity in educational contexts. A key focus is on the need to equip teachers with the knowledge, tools, and confidence to effectively integrate AI into literacy instruction. Professional development, collaborative networks, and access to high-quality AI resources are identified as essential components for successful implementation. The chapter concludes by calling for a balanced and informed approach to AI in education—one that recognises both its potential and its limitations. By fostering AI literacy among educators and students, schools can ensure that AI serves as a powerful, ethical, and inclusive tool for advancing literacy in the 21st century.

#### 1. Introduction

Literacy is fundamental to the development of young people, serving as the cornerstone for academic achievement, personal growth, and future societal contributions. Literacy proficiency enables children to access and engage with educational content across all subjects, thereby enhancing their overall learning experience (World Literacy Foundation, 2023). Literacy fosters critical thinking and communication skills, empowering young people to articulate ideas effectively and navigate complex social contexts (Neuman & Celano, 2001). Moreover, early literacy development is linked to improved cognitive abilities and better health outcomes in adulthood (World Literacy Foundation, 2023). Given these multifaceted benefits, promoting literacy from a young age is imperative for individual and collective advancement.

Technological advancements have significantly influenced literacy practices, both supporting and transforming them within sociocultural contexts (Vygotsky & Cole, 1978). The integration of digital tools has expanded traditional notions of literacy to include multimodal forms, such as

visual, audio, and interactive media, aligning with the concept of multiliteracies that acknowledge diverse ways individuals engage with texts in technologically rich environments. This evolution has facilitated new forms of communication and expression, enabling users to participate in online communities and co-construct knowledge.

The advent of artificial intelligence (AI) further extends this transformation. AI-driven tools are already being used in classrooms to enhance literacy instruction, from speech-to-text applications and automated feedback systems to adaptive learning platforms that personalise content for students. These innovations provide new opportunities to improve literacy outcomes, particularly for students who struggle with traditional approaches. However, AI also introduces new challenges, including concerns about bias in AI-generated content, the ethical implications of automated decision-making in education, and the need for students and teachers to develop AI literacy skills.

Understanding AI's role in literacy education is more than a technical issue, it is also a pedagogical and ethical concern. AI is shaping how students read, write, and interact with information, making it essential for teachers to critically examine its implications. The purpose of this chapter is to explore how AI is reshaping literacy education, highlighting both its benefits and potential risks. The focus of the chapter will be on how AI literacy is a necessary component of modern education, ethical considerations such as bias and misinformation, and how AI can support teacher professional development. By addressing these themes, this chapter aims to provide insights into the evolving relationship between AI and literacy in 21st-century education.

In early childhood contexts, literacy instruction grounded in exploration, oral language, and storytelling can be enhanced by carefully selected AI tools. However, educators must ensure that these technologies do not displace the essential human interactions and play-based pedagogies that underpin learning at this developmental stage.

## 2. AI Literacy

AI permeates all aspects of our everyday lives, from Google, Alexa, Siri, to smart home appliances and smartphones. Add robot vacuum cleaners, virtual assistants and search systems and the definition of AI broadens to encompass performance of cognitive tasks, especially learning and problem-solving, perception, machine learning, natural language processing, knowledge representation, computer vision and neural networks among many others (Casal-Otero et al., 2023; Ng, et al., 2019). In addition, the use of AI is evident across different kinds of businesses, the arts, science and education. Increasingly over the past few decades, there has been increasing social and political interest in educating citizens about AI (Casal-Otero et al., 2023) with education authorities investigating how to integrate AI into school-based curriculum to equip students with suitable knowledge and skills to live in a “world with a significant presence of AI” (Casal-Otero, et al., 2023, p. 1).

Although defining AI can be problematic (Ng et al., 2024), it can be characterised as “that activity devoted to making machines intelligent...(where) intelligence is that quality that enables an entity to function appropriately and with foresight in its environment (Nilsson, 2009, p. 13). Furthermore, AI literacy is defined as a “set of skills that enable a solid understanding of AI through three priority axes” (Casal-Otero et al., 2023, p. 2) with the axes being: learning about AI, which focuses on understanding AI concepts and techniques and recognising which platforms use AI and which do not. The second axis centres on learning about how AI works in order to interact with it; while the third axis is learning for life with AI and focuses on understanding how AI can affect our lives and developing in order to develop the capacity to critically evaluate technology (p. 2). Research into developing the AI literacy capacities of children contends that early exposure to technology influences the way that they think about concepts like intelligence and what it means to be alive (Bernstein & Crowley, 2008). How children relate to AI is dependent on several factors including the propensity of children to rely on observable phenomena, their age and levels of maturity and their perceptions of intelligence inherent in technology (Long & Magerko, 2020).

In early childhood, AI literacy should be introduced through hands-on, sensory-rich experiences that align with young children’s natural curiosity and learning through play. Tools like Bee-Bots, programmable toys, or voice-activated story characters can foster emerging understandings of cause and effect, sequencing, and communication with smart systems. Teachers should frame these tools within purposeful learning tasks that prompt discussion, prediction, and reflection.

While the importance of early exposure to AI is important, research on the extent to which AI is taught in schools is limited (Casal-Otero et al., 2023). Although numerous AI curriculum projects are underway internationally, such as Exploring Computer Science, Microsoft TEALS, ReadyAI, AI4All, the Massachusetts Institute of Technology, and the Finnish Center for Artificial Intelligence (Touretzky, 2019, p. 89), examples of what a school-based AI curriculum might entail varies according to local and national contexts. One example from the Artificial Intelligence (AI) for K-12 initiative (AI4K12) in the United States centres on developing national guidelines for teaching AI in K-12 (Touretzky et al., 2019). This project aims to provide students a substantial knowledge of AI terminology and applications, with the guidelines providing four levels of engagement:

1. Awareness of AI in students’ daily lives and developing an understanding of the impact of AI throughout society.
2. Conceptual understanding of how AI works from a systems level perspective and at an algorithmic level.
3. The ethical and responsible design of automated decision-making systems using AI.
4. Skills for applying AI to real-world problems (Touretzky et al., 2023, p. 234).

This project argues that these four levels of engagement are essential in the preparation of K-12 students to pursue future AI careers that encompass both technical and non-technical career paths. Furthermore, the project seeks to nurture an “appreciation for some of the profound ideas that underlie our current understanding of human intelligence” (p. 234).

In their study of how AI literacy is being embedded in the school context, Casl-Otero et al. (2023) conclude that the development of AI literacy should take an “interdisciplinary and competency-based approach” (p. 13) integrated into the curriculum. This avoids the need to integrate new AI literacy subjects into the curriculum and instead, strengthen and extend the content and competencies of existing discipline subjects by integrating AI into them. This study argues that AI education can “break disciplinary boundaries” (p. 13) where a “global, practical and active approach” (p. 1) can facilitate project-based and contextualized work.

In early childhood settings, this interdisciplinary approach may involve using AI-powered tools in language-rich activities, such as voice-assisted question-and-answer games during story time or simple digital storytelling apps that adapt to children's choices. These experiences should be guided by teachers who support metacognitive talk (e.g., “What do you think will happen if we ask the robot something new?”) to build awareness of AI's responsive capabilities.

Importantly, the development of students' AI capacities facilitates their ability to learn how to identify and manage information that is presented as true but is actually false or misleading (Tay et al., 2021). In a world that is currently grappling with a “disinformation phenomenon” (Bontridder & Poulett, 2021, p. 1), with false information seeping through the domains of politics, climate change and public health proving (Tay et al., 2021), the provision of a sharply-focused education to ensure the “critical evaluation of information” (Bontridder & Poulett, 2021, p. 10) continues to be crucial. In addition, enabling the AI literacy capabilities of students is also important to ensure the maintenance of democratic principles including freedom of expression and information, as well as “media pluralism (and) media literacy” (p. 10).

Research into nurturing student AI literacy in schools is strengthening. School systems have published guides on how to integrate AI into curricula (Zimmerman, 2018); programs to actively engage young people in AI programming have been developed (Druga et al., 2019; Khan & Winters, 2017); and the development of a conceptual framework comprising five themes: *What is AI? What can AI do? How does AI work? How should AI be used? How do people perceive AI?* (Long & Magerko, 2020, p. 3). Furthermore, Ng et al., (2024) conducted a thematic analysis of 50 AI education studies from 2016 to 2022, seeking to evaluate teaching pedagogies and tools, specific content relevant to AI, and assessment methods in secondary schools. Their findings identified three main methods to developing student AI capacities: project/problem-based learning, collaborative learning, and experiential learning (p. 6213). The thematic analysis

identified that project/problem-based learning is applied widely in AI literacy development, providing “authentic settings” and “meaningful scientific and STEM contexts” (p. 6212). Collaborative learning requires students to communicate effectively and undertake different roles such as “project managers, software designers, hardware designers, and art designers” (p. 6212), while engaging students in experiential learning enabled immersion in machine learning using Code.org games, “intelligent agents, chatbot and Cognimates, syntax-based programs (e.g. Python) and block based programs (e.g. Scratch, Snap!)” (p. 6213). This study concludes that in addition to developing student AI literacy skills, attention to the concurrent development of communication, collaborative and critical thinking skills also need to be considered in policy development and pedagogical approaches.

Below is a vignette illustrating how AI might be embedded into a year 3 lesson to support students’ literacy development.

#### Vignette: Enhancing Literacy with AI in Year 3

Ms. Tan’s Year 3 class had been exploring narrative texts. This week, they were using an AI-powered storytelling app to help them draft and revise their own short stories. The focus was on building strong story structure—beginning, middle, and end—as well as developing character voice and precise vocabulary.

Each student began by drafting their story using paper-based planning templates. Then, with tablets in hand, they input their ideas into the AI tool. As they typed, the AI suggested synonyms to improve word choice and sentence starters to support cohesive writing. Liam changed the dog was sad to the dog whimpered softly, guided by a prompt that encouraged descriptive language.

Once drafts were complete, students used the app’s read-aloud function to hear their writing. This supported self-monitoring and oral fluency. Chloe noticed, “It doesn’t sound right when I say it out loud. I need to add more detail here.” Ms. Tan encouraged the class to pause and annotate any parts they thought could be stronger.

During partner sharing, students discussed vocabulary choices and gave feedback using a checklist focused on narrative elements: setting, character, problem, and resolution. The lesson ended with a class reflection: “How did the AI help you as a writer today?”

Through this activity, students developed their writing fluency, vocabulary awareness, and editing skills while also practising speaking and listening—key components of Year 3 literacy development.

#### 4. Ethics

The issue of ethics in relation to the use of AI in schools has attracted a great deal of attention from educators, administrators, and researchers (Hauer, 2022). The ethics of AI encompasses two dimensions. The first is concerned with roboethics, or the “ethics of AI” (Siau & Wang, 2020, p. 76) and the second, machine ethics, or “ethical AI” (p. 76). This is followed by discussion on bias.

Roboethics focuses on the “moral behaviours” of individuals as they “design, construct, use, and interact with AI agents” (Siau & Wang, 2020, p. 76) as well as the social ramifications related to the use of robots. Part of this dimension is consideration of potential human biases in the interpretation and use of data as in addition to issues of privacy and transparency. Also implicated are matters arising from the use of AI such as unemployment and unequal wealth distribution (p. 76). Just as human and animal rights require careful consideration of specific principles, roboethics requires society’s consideration of its moral obligation to increasingly intelligent and conscious machines. For example, what obligations do people have towards intelligent machines being deployed in dangerous battlefields or employing robots in dirty environments? (p. 76).

The second dimension of AI ethics is machine ethics. This dimension is associated with the “moral behaviours of Artificial Moral Agents (AMAs)” (Siau & Wang, 2020, p. 76), focusing on the “design of artificial moral agents” (p. 76). As machines become more intelligent, they should “behave morally and exhibit moral behaviours” (p. 76). This dimension was famously promoted by science fiction writer Isaac Asimov in the 1950s in his “Three Laws of Robotics” (Asimov, 1950). The first law is that “a robot may not injure a human being or, through inaction, allow a human being to come to harm”; the second, “a robot must obey orders given to it by human beings, except where such orders would conflict with the first law”; and the third, “a robot must protect its own existence as long as such protection does not conflict with the first or second law” (p. 10). These laws reflect the idea that AI technologies should be developed based on ethical principles and focused on “respect for fundamental rights...and ethical principles of beneficence, non-maleficence, human autonomy, justice and, explainability” (Hauer, 2022, p. 2).

These considerations are central to school education. For example, in research aimed at developing a school-based AI ethics education program to nurture the development of ethical consciousness and a positive attitude towards AI among 17 middle school students, Choi et al. (2024) developed an education program that focused on practical exercises related to bias. This program incorporated raising student awareness of issues such as transparency, accountability and reliability in AI, as well as developing skills and mindsets for future employment (p. 9). In addition, the research employed pre and post-test questionnaires to assess the impact and development of the program on the students’ ethical awareness of artificial intelligence. The

researchers found that following the participation in the program, students demonstrated a more positive view of the beneficial qualities of AI that can facilitate collaboration to solve complex problems (p. 13). Students also demonstrated a deeper understanding of the ethical issues related to the use of AI.

In early childhood settings, ethical AI use begins with the teachers's responsibility to choose developmentally appropriate tools that respect children's privacy, avoid commercial influence, and foster inclusive representations. Young children should not be exposed to AI that tracks extensive personal data or relies on persuasive design. Teachers and parents must be empowered to critically evaluate these technologies on children's behalf.

In addition, Adams et al., (2023) identified the following principles apparent in the literature on AI in school-based education: Transparency; Justice and Fairness; Non-maleficence; Responsibility; Privacy; Beneficence; Freedom and Autonomy (p. 4). The authors analysed selected documents of the four recent and globally relevant Artificial Intelligence in K-12 Education (AIEdK-12) ethics guideline statements using qualitative content analysis (QCA). The analysed documents were: the World Economic Forum's *Generation AI: Establishing global standards for children* (2019), the Institute for Ethical AI in Education's *The Ethical framework for AI in education* (2021), the United Nations Children's Fund *AI policy guidance: How the world responded* (2021), and UNICEF's *AI and education: Guidance for policy makers* (2021).

This study analysed these policy documents, identifying similarities, overlaps and omissions, ultimately recommending the deployment of four new ethical principles for AI in school education: pedagogical appropriateness, children's rights, AI literacy and teacher well-being (Adams et al., 2023, p. 4). While research into the deployment of AI in the classroom and associated ethical considerations, Adams et al., (2023) recommend more "pedagogically responsive, developmentally and context-sensitive ethical approaches to AI integration" (p, 9).

## 5. Bias

According to Murphy (2025), there are hundreds of different forms of bias. The integration of artificial intelligence (AI) tools in primary and secondary education introduces bias-related challenges that can affect students' literacy development. One of the major impacts related to cultural bias is that AI systems often struggle with languages and dialects that are less commonly used online or are underrepresented in training data. Students who speak in regional dialects or use non-standard language forms may find that feedback from AI indicates a misunderstanding resulting in inappropriate feedback. In addition to this, the style of interaction preferred in different cultures can vary significantly. Some cultures may prefer formal and respectful interactions (e.g., Japan), while others might value informality and friendliness (e.g., Australia).

AI interactions that are not suited to the cultural context can feel off-putting or disrespectful to students from particular backgrounds (Maher, forthcoming).

Related to cultural bias is algorithmic bias, where AI systems trained on non-representative data may perpetuate existing stereotypes and inequalities. For instance, AI-driven educational tools might favour language patterns prevalent in certain demographics, disadvantaging students from diverse linguistic backgrounds. This can lead to misinterpretations of students' abilities and reinforce existing disparities in literacy education (Chinta et al., 2024).

Another significant concern is the potential for AI systems to perpetuate existing biases present in their training data. For instance, AI-driven educational tools may inadvertently reinforce stereotypes or provide content that is not culturally inclusive, thereby disadvantaging certain student groups. A systematic literature review by Holmes et al. (2024) highlighted the ethical implications of AI in K-12 education, emphasising the need for careful consideration of bias and fairness in AI applications. For younger children, biased outputs may not be easily noticed or questioned by the learner. An AI reading app that consistently presents male characters as leaders or limits roles for certain cultural groups can shape early impressions and reinforce harmful stereotypes. Teachers and caregivers must remain vigilant in screening content and guiding children's interpretation through discussion and context.

Additionally, the effectiveness of AI literacy education is closely linked to teachers' perceptions and attitudes toward AI tools. A study by Yim (2024) explored teachers' acceptance of AI educational tools, revealing that educators' confidence and competence in using these technologies significantly influence their integration into the classroom. Teachers with limited AI literacy may fail to recognise biased outputs from AI tools, thereby affecting students' learning experiences.

The design of AI literacy curricula plays a crucial role in shaping students' understanding of AI and its societal impacts. Ng et al. (2022) examined primary students' development in AI literacy through digital story writing and found that well-structured curricula can enhance students' comprehension of AI concepts and ethical considerations. However, poorly designed curricula may overlook critical discussions about AI bias, leading to a superficial understanding of the technology.

## 6. Teacher Professional Development

Supporting teachers in using AI for literacy development requires a multifaceted approach that combines professional learning, access to adaptive tools, collaboration, and ethical guidance. By addressing these areas, educators can effectively harness AI to enhance student literacy outcomes, creating more inclusive and personalised learning environments. This integration not

only benefits students but also empowers teachers, allowing them to focus on the aspects of teaching that matter most.

Teachers can enhance student literacy development by using artificial intelligence (AI) in the classroom. However, to ensure effective implementation teachers require effective support systems, including professional learning opportunities, access to high-quality AI tools, and collaboration with peers and experts. These support systems assist teachers to integrate AI into literacy strategies in ways that are pedagogically sound and responsive to diverse student needs.

Professional development is central to supporting teachers in the use of AI for literacy instruction. Focused training can help educators understand AI's capabilities, limitations, and ethical considerations, ensuring that the technology is used responsibly. Studies have shown that when teachers are equipped with AI-related skills and knowledge, they are more likely to adopt innovative practices in their classrooms (Holmes et al., 2019). Workshops, online courses, and ongoing coaching can provide the necessary support, helping teachers to align AI tools with curriculum standards and learning objectives.

In early childhood education, professional development must address not only technical use of AI but also pedagogical concerns such as maintaining developmentally appropriate practice. Teachers need support in evaluating whether AI tools encourage rich language use, active engagement, and child-led exploration-key principles in early learning. Training should help teachers select tools that enhance oral language, emergent writing, and social interaction, rather than isolate children in passive screen experiences.

AI-powered tools offer considerable potential for personalised literacy instruction. Adaptive learning platforms, for example, analyse individual student's performance data to identify strengths and areas for improvement. These systems can then deliver tailored content that meets each student's unique needs, allowing for differentiated instruction at scale. Tools like these are especially valuable in classrooms where teachers face diverse student abilities and backgrounds. For teachers, using these tools necessitates ongoing professional development to understand their effective implementation. Training ensures that educators can interpret data insights provided by AI systems, integrate these into lesson planning, and maintain a balance between technology-driven and human-centered teaching strategies.

Research suggests that adaptive AI technologies improve student literacy skills by providing timely feedback and customised learning experiences (Luckin et al., 2016). This feedback provided by AI platforms supports students in developing their writing skills independently, allowing them to improve incrementally and at their own pace (Maher, forthcoming). Automated systems can analyse students' writing, reading fluency, and comprehension, providing detailed feedback that would otherwise be time-intensive for educators to undertake manually. For

instance, natural language processing (NLP) algorithms can evaluate grammar, vocabulary, and coherence in student writing, highlighting areas for improvement while offering suggestions for revision. Teachers can use the insights generated by these systems to guide instructional decisions, ensuring that every student progresses at an appropriate pace. Teachers can also use this feedback to focus on higher-order skills, such as critical thinking and creativity, rather than spending extensive time on routine assessments. This dual approach enhances instructional quality while saving valuable teaching time. AI systems can also be used to help guide the feedback teachers provide to students. Supporting AI feedback to students and using it to help provide feedback to students requires

A further way that AI can support teacher development is with lesson planning to create tailored, engaging, and standards-aligned lessons. It has been found that AI can produce plans similar to those produced by teachers. Karaman and Göksu (2024) for example evaluated the effectiveness of ChatGPT-generated lesson plans in elementary mathematics education. They found that “ChatGPT’s lesson plans were equally effective compared to teacher-prepared plans in improving students’ mathematics achievement” (Tan et al, 2024, p. 7). Using AI-driven platforms, teachers can access curated resources, such as worksheets, multimedia content, and interactive activities, tailored to specific learning objectives and student needs. AI can save time by automating repetitive tasks, such as formatting lesson plans, aligning them with educational standards, or generating assessment questions. By providing support to create lesson plans, AI assists teachers to focus more on fostering meaningful classroom interactions. There are a number of platforms designed specifically for teachers to assist them in constructing lesson plans. Some of these include Magic School, LessonUp and Khanmigo.

Collaboration among educators and experts can support the integration of AI in literacy education (Floris, 2023). Professional learning communities (PLCs) and teacher networks provide spaces for sharing best practices, discussing challenges, and exploring innovative uses of AI. These collaborative environments foster a culture of experimentation, enabling teachers to collectively refine their approaches to literacy instruction. Partnerships with AI developers and researchers can also be beneficial, ensuring that tools are designed with educators’ needs in mind and are aligned with evidence-based teaching practices.

In addition to training and collaboration, access to high-quality resources is important. Teachers should be provided with AI tools that are reliable, user-friendly, and adaptable to different teaching contexts. Governments, school systems, and technology companies play a key role in ensuring equitable access to these resources, particularly in under-resourced schools. Providing adequate infrastructure, such as devices and stable internet connections, is equally important to maximize the potential of AI-driven solutions. There are many sites teachers can visit for support. One of these include ‘AI for Education’ (n.d.). This site provides a comprehensive library of free resources, including downloadable guides, webinars, and a prompt library tailored

for educators. Another site is CRAFT (Classroom-Ready Resources About AI For Teaching). This site is developed by the Stanford Graduate School of Education (n.d) and offers free, co-designed AI literacy resources tailored for high school teachers.

Fostering a positive attitude toward AI among teachers is essential. Many educators may feel apprehensive about adopting new technologies. The lack of confidence has been noted by some researchers (e.g., Yim et al., 2024). By demonstrating the dimensions of AI in supporting student literacy outcomes, school leaders can help build trust and confidence. Success stories, pilot programs, and case studies, outlined in this chapter illustrate how AI has positively impacted teaching and learning, inspiring educators to embrace its potential. It is also important to critically evaluate the limitations of AI use in schools and the negative outcomes that its use may have on both students and teacher practices. As AI use becomes more entrenched in schools, ways that it can be used successfully will become apparent, through practical use and research. This information can be used to support a teacher's practice.

Supporting teachers in using AI for literacy development requires a multifaceted approach that combines professional learning, access to adaptive tools, collaboration, and ethical guidance. By addressing these areas, teachers can effectively harness AI to enhance student literacy outcomes, creating more inclusive and personalised learning environments. This integration not only benefits students but also empowers teachers, allowing them to focus on the aspects of teaching that matter most.

The use of AI outlined in this section such as lesson planning and differentiation can help teachers to support students' literacy practices and potentially save them time in the long run. However, understanding the different tools they can choose, and the limitations of different tools requires that teachers are provided with time and opportunities to evaluate these tools in practice. The rapid change in the affordances of different AI tools means that teachers may be required to invest significant amounts of time to ensure they are using the tools in the most effective ways.

Earlier in this chapter, the issue of bias was discussed. Addressing these bias issues requires comprehensive teacher training programs that enhance AI literacy and promote critical engagement with AI tools. Teachers must be equipped to identify and mitigate biases in AI applications to ensure equitable literacy development for all students. Furthermore, ongoing research and dialogue are essential to develop ethical guidelines and best practices for AI integration in education.

Below is a synthesis of the ideas presented in this section.

Professional development for teachers should be:

*Pedagogically Grounded*

Training should support developmentally appropriate teaching practices, especially in early and primary years. AI use must enhance—not replace—core literacy strategies like storytelling, phonemic awareness, and comprehension.

#### *Ethically Informed*

Teachers must be aware of issues like algorithmic bias, data privacy, and content inclusivity. Ethical training should include evaluating tools for fairness, transparency, and safety, particularly for young learners.

#### *Technologically Supported*

Teachers need hands-on experience with AI tools that support lesson planning, feedback, adaptive instruction, and language development. This includes understanding how to interpret AI-generated data to inform teaching.

#### *Collaborative and Ongoing*

Effective PD includes learning communities, peer sharing, and access to curated resources. Continued support ensures confidence and encourages reflective, research-informed use of AI tools.

#### *Sector-Specific*

For early childhood and primary educators, PD must address the unique needs of young learners—focusing on play-based, language-rich, and socially interactive uses of AI.

## 7. Conclusions

The history of literacy is marked by transformative shifts, from oral traditions to the invention of writing, the printing press, and digital technologies. Each advancement has reshaped how knowledge is created, shared, and accessed. The emergence of artificial intelligence represents another pivotal moment in this trajectory, offering new opportunities and challenges for literacy education.

AI has the potential to support literacy development through personalised learning, adaptive feedback, and resource creation. Its integration into classrooms can enhance student engagement, address diverse learning needs, and provide teachers with valuable insights. However, these benefits are accompanied by ethical concerns, particularly regarding bias, misinformation, and equitable access. The extent to which AI can truly enhance literacy depends on how educators, policymakers, and technology developers navigate these complexities.

While some educational systems are pushing for a ‘back to basics’ approach, emphasising traditional literacy skills, the reality is that AI is already reshaping the ways in which students engage with texts and information. Rather than resisting this change, schools must critically evaluate and integrate AI in ways that uphold educational integrity and inclusivity. A balanced approach, leveraging AI’s capabilities while addressing its limitations, will be key to fostering both digital and traditional literacy skills.

Ultimately, the responsible and informed use of AI in literacy education requires ongoing dialogue, research, and professional development. Equipping both students and teachers with AI literacy skills will be crucial in ensuring that AI serves as a tool for empowerment. As AI continues to evolve, so too must our understanding of literacy, ensuring that it remains a dynamic and inclusive foundation for learning in the 21st century.

## References

Adams, C., Pente, P., Lemermeier, G., & Rockwell, G. (2023). Ethical principles for artificial intelligence in K-12 education. *Computers and Education: Artificial Intelligence*, 4, 100131.

AI for Education. (n.d.). *AI resources*. <https://www.aiforeducation.io/ai-resources>

Asimov, I. (1950). Runaround. In *I Robot*. (The Isaac Asimov Collection Ed.). Doubleday.

Bernstein, D. & Crowley, K. (2008). Searching for Intelligent Life: An investigation of young children's beliefs about robot intelligence. *The Journal of the Learning Sciences*, 17(2), 225-247.

Bontridder, N., & Pouillet, Y. (2021). The role of artificial intelligence in disinformation. *Data & Policy*, 3, e32.

Casal-Otero, L., Catala, A., Fernández-Morante, C., Taboada, M., Cebreiro, B., & Barro, S. (2023). AI literacy in K-12: A systematic literature review. *International Journal of STEM Education*, 10(1), 29.

Chinta, S. V., Wang, Z., Yin, Z., Hoang, N., Gonzalez, M., Quy, T. L., & Zhang, W. (2024). FairAIED: Navigating fairness, bias, and ethics in educational AI applications. *arXiv preprint arXiv:2407.18745*.

Choi, J. I., Yang, E., & Goo, E. H. (2024). The effects of an ethics education program on artificial intelligence among middle school students: Analysis of perception and attitude changes. *Applied Sciences*, 14(4), 1588.

Druga, S., T. Vu, S., Likhith, E., & Qiu, T. (2019). Inclusive AI literacy for kids around the world. In *Proceedings of FabLearn 2019*, pp. 104-111.

Floris, F. D. (2023). Mutual engagement in virtual spaces: Unveiling the role of artificial intelligence in shaping teaching practices. *Modern Journal of Studies in English Language Teaching and Literature*, 5(2).

Hauer, T. (2022). Importance and limitations of AI ethics in contemporary society. *Humanities and Social Sciences Communications*, 9(1), 1-8.

- Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
- Holmes, W., & Tuomi, I. (2022). State of the art and practice in AI in education. *European Journal of Education*, 57(4), 542–570.
- Holmes, W., Porayska-Pomsta, K., & Holstein, K. (2024). The ethics of using AI in K-12 education: A systematic literature review. *Learning, Media and Technology*, 49(1), 1–17.
- Kahn, K., & Winters, N. (2017). Child-friendly programming interfaces to AI cloud services. In *Data Driven Approaches in Digital Education: 12th European Conference on Technology Enhanced Learning, EC-TEL 2017, Tallinn, Estonia, September 12–15, 2017, Proceedings 12* (pp. 566-570). Springer International Publishing.
- Karaman, M. R. (2024). Are lesson plans created by ChatGPT more effective? An experimental study. *International Journal of Technology in Education*, 7(1), 107–127.
- Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson.
- Maher, D. (forthcoming). Chatbots in schools: Opportunities and considerations. In S. Papadakis & G. Lampropoulos (Eds.), *Social robots and artificial intelligence in education: Integrating AI in K-12 and higher education*. Palgrave MacMillan.
- Maher, D. (forthcoming). Generative artificial intelligence and student literacy: A paradigm shift. In W. Slater (Ed.), *The Bloomsbury handbook of literacy*.
- Murphy, N. (2025, January 15). Types of bias. *CPD Online College*. <https://cpdonline.co.uk/knowledge-base/safeguarding/types-of-bias/>
- Ng, D. T. K., Su, J., Leung, J. K. L., & Chu, S. K. W. (2024). Artificial intelligence (AI) literacy education in secondary schools: a review. *Interactive Learning Environments*, 32(10), 6204–6224. <https://doi.org/10.1080/10494820.2023.2255228>
- Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2, 100041.
- Ng, D. T. K., Luo, W., Chan, H. M. Y., & Chu, S. K. W. (2022). An examination on primary students' development in AI literacy through digital story writing. *Computers and Education: Artificial Intelligence*, 3, 100054.
- Nilsson, N. J. (2009). *The quest for artificial intelligence*. Cambridge University Press.

Siau, K., & Wang, W. (2020). Artificial intelligence (AI) ethics: ethics of AI and ethical AI. *Journal of Database Management (JDM)*, 31(2), 74-87.

Stanford Graduate School of Education. (n.d.). *CRAFT (Classroom-Ready Resources About AI For Teaching)*. <https://craft.stanford.edu>

Tan, X., Cheng, G., & Ling, M. H. (2024). Artificial intelligence in teaching and teacher professional development: A systematic review. *Computers and Education: Artificial Intelligence*, 100355.

Touretzky, D., Gardner-McCune, C., Breazeal, C., Martin, F., & Seehorn, D. (2019). A year in K–12 AI education. *AI Magazine*, 40(4), 88–90.

Touretzky, D. S., Gardner-McCune, C., Martin, F., & Seehorn, D. (2019). Envisioning AI for K-12: What should every child know about AI? In *Proceedings of AAAI-19*. <https://doi.org/10.1609/aaai.v33i01.33019795>

Touretzky, D., Gardner-McCune, C., & Seehorn, D. (2023). Machine learning and the five big ideas in AI. *International Journal of Artificial Intelligence in Education*, 33(2), 233–266.

Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Harvard University Press.

Yim, I. H. Y., & Wegerif, R. (2024). Teachers' perceptions, attitudes, and acceptance of artificial intelligence (AI) educational learning tools: An exploratory study on AI literacy for young students. *Future in Educational Research*, 2(4), 318–345.

Yim, S. (2024). Teachers' perceptions, attitudes, and acceptance of artificial intelligence educational learning tools in early childhood settings. *Frontiers in Education*, 9, 65.

Zimmerman, M. (2018). *Teaching AI: Exploring New Frontiers for Learning*. International Society for Technology in Education.