International Journal of Teaching and Learning (INJOTEL) e-ISSN: 3025-8308
Vol. 3 No. 11 (2026), pages: 76~87

INTEGRATING EDUCATIONAL AI INTO PRIMARY EDUCATION: A LITERATURE REVIEW ON DIGITAL LITERACY TRANSFORMATION AND CRITICAL THINKING SKILLS

Novianty Djafri
Jurusan Manajemen Pendidikan Fakultas Ilmu Pendidikan Universitas Negeri Gorontalo
noviantydjafri@ung.ac.id

Syamsu Qajar Baru
Jurusan Matematika FMIPA UNG
sqb.tuta@gmail.com

Kartin Usman
Jurusan Matematika FMIPA UNG
kartin.usman@ung.ac.id

Abstract

This study aims to examine the integration of educational artificial intelligence in primary education and its role in transforming digital literacy and strengthening pupils' critical thinking skills. The rapid development of AI-based learning tools has changed the way pupils access information, interact with digital resources, and construct knowledge. Therefore, digital literacy in primary education cannot be understood solely as the ability to use digital devices; it must also encompass AI literacy, data awareness, ethical responsibility, and the ability to evaluate AI-generated information critically. This study uses a library research method with a qualitative descriptive approach. Data were collected from journal articles, books, conference proceedings, and institutional reports published within the last three years, especially those discussing educational AI, AI literacy, digital literacy, primary education, and critical thinking. The findings show that educational AI can support adaptive learning, personalized feedback, interactive learning experiences, and problem-solving activities. However, AI integration may also create risks such as technological dependence, algorithmic bias, data privacy issues, and the weakening of independent reasoning if not supported by proper pedagogy. This study concludes that educational AI can strengthen pupils' digital literacy and critical thinking only when implemented through human-centered, ethical, and reflective learning strategies. Teachers play a central role in guiding pupils to question, verify, compare, and reflect on AI-generated outputs. Therefore, AI integration in primary education should be directed toward developing digitally literate, critically minded, and ethically responsible learners.
Keywords: educational AI, digital literacy, AI literacy, primary education, critical thinking skills.

Introduction

The rapid development of artificial intelligence in education has accelerated the transformation of how pupils access information, understand learning materials, interact with digital resources, and construct new knowledge. In primary education, the integration of educational artificial intelligence is no longer limited to digital tools; it has

become part of a broader learning ecosystem that enables personalization, automated feedback, learning analytics, and support for higher-order thinking. UNESCO emphasizes that digital transformation and AI in education should be directed toward strengthening human agency, ethical awareness, and critical thinking, rather than merely improving technological efficiency (UNESCO, 2023). Therefore, primary education is a crucial stage for establishing the foundation of digital literacy so that pupils are not only able to use technology but also to understand, evaluate, and apply it responsibly.

In recent years, the use of AI in school-based learning has increased significantly, including at the primary level. AI is increasingly applied through adaptive learning platforms, educational chatbots, recommendation systems, automated assessment tools, writing assistants, and interactive learning media. These technologies have the potential to support more personalized learning experiences, increase pupil engagement, and help teachers respond to diverse learning needs. However, the growing use of AI among young learners also raises fundamental concerns regarding pupils' digital readiness, their ability to evaluate information, ethical awareness, data privacy, and the risk of overdependence on automated systems. This phenomenon indicates that integrating AI into primary education must be accompanied by robust development of digital literacy and critical thinking.

In the context of digital literacy, AI integration has created a significant conceptual shift. Digital literacy is no longer limited to the ability to operate devices, search for information, or use learning applications. It now includes algorithmic awareness, data literacy, understanding of AI-generated content, digital safety, ethical use of technology, and the ability to evaluate machine-generated outputs critically. Recent studies suggest that AI literacy intersects with digital literacy, data literacy, computational thinking, and ethical reasoning, underscoring the need for a more interdisciplinary approach to digital competence in schools (Yim, 2024). This shows that digital literacy in primary education needs to be transformed to address the growing presence of AI-based learning environments.

The main research problem addressed in this study is the lack of clarity regarding how educational AI can be effectively integrated to strengthen both digital literacy and critical thinking skills among primary school pupils. On the one hand, AI can support pupils by providing information, immediate feedback, adaptive learning pathways, and interactive exploration of concepts. On the other hand, AI may weaken independent reasoning if pupils accept automated answers without verification, reflection, or critical evaluation. This issue is particularly important in primary education because young learners are still developing their cognitive, social, and ethical understanding of digital technologies. Without appropriate pedagogical guidance, AI may encourage passive learning rather than reflective and analytical thinking.

The research gap lies in the limited number of literature reviews that specifically connect three central dimensions: educational AI integration, digital literacy transformation, and the development of critical thinking skills in primary education. Many previous studies on

AI in education have focused more on higher education, technological effectiveness, academic achievement, or teacher support. Meanwhile, studies on AI literacy in schools have begun to emerge. Still, they often focus on definitions, competency frameworks, and instructional strategies rather than on how AI reshapes digital literacy and critical thinking among primary school pupils. As a result, there remains a need for a more integrated literature review that explains the relationship between AI-based learning, digital competence, and critical reasoning in the context of early education.

Another important gap concerns pedagogical and ethical dimensions. Existing studies often highlight the benefits of AI for personalized learning, teacher efficiency, and student motivation. Still, fewer studies examine how teachers can design learning activities that encourage pupils to question, compare, evaluate, and reflect on AI-generated outputs. Critical thinking in digital learning environments is not merely the ability to answer questions correctly; it also involves recognizing information bias, assessing source credibility, distinguishing facts from opinions, understanding technological limitations, and making responsible decisions. Therefore, AI integration in primary education should not only introduce pupils to AI as a learning tool but also guide them in developing critical AI literacy.

The novelty or incremental contribution of this literature review lies in its attempt to develop a more integrative conceptual understanding of the role of educational AI in transforming digital literacy and strengthening critical thinking skills among primary school pupils. This study does not view AI merely as an instructional technology, but as a pedagogical medium that influences how pupils search for, process, evaluate, and use information. Accordingly, this review offers a perspective that AI integration in primary education should be analyzed through the interconnection between digital competence, ethical awareness, metacognitive ability, and critical thinking practices. This integrated approach contributes to current discussions on AI literacy as a multidimensional competence involving technical knowledge, social understanding, ethical sensitivity, and reflective thinking.

The urgency of this study is reinforced by the fact that primary education is the foundational stage for shaping pupils' learning habits, digital behavior, and thinking skills. If AI is integrated without a clear pedagogical and ethical framework, pupils may become passive users who depend on automated responses. Conversely, when AI is used critically, ethically, and reflectively, it can become a powerful tool for enhancing digital literacy, creativity, problem-solving, and critical thinking from an early age. Therefore, this literature review is important for providing a conceptual foundation for teachers, schools, curriculum developers, and policymakers in designing AI integration strategies that support digital literacy transformation and the development of critical thinking in primary education.

Literature Review

1. Educational AI in Primary Education

Educational artificial intelligence has increasingly become a major component of digital transformation in education. In primary education, AI is commonly used through adaptive learning platforms, intelligent tutoring systems, automated feedback tools, learning analytics, educational chatbots, and AI-assisted content generation. These technologies are designed to support more personalized, interactive, and responsive learning experiences for young learners. Recent literature suggests that AI has the potential to assist pupils in understanding concepts, practicing skills, receiving immediate feedback, and engaging with learning materials at their individual pace. Yim's systematic review on AI literacy education in primary schools found that studies in this field commonly discuss theoretical frameworks, pedagogical strategies, learning tools, assessment methods, educational outcomes, and implementation challenges.

However, the integration of AI in primary education should not be understood merely as technological adoption. It also requires pedagogical readiness, ethical awareness, teacher competence, and age-appropriate instructional design. Primary school pupils are still developing basic cognitive, emotional, and social abilities; therefore, the use of AI must be carefully guided by teachers. Without proper guidance, AI tools may encourage pupils to become passive users who depend on automated answers rather than actively constructing knowledge. This issue indicates that AI integration in primary education must be linked to broader educational goals, particularly digital literacy and critical thinking.

2. Digital Literacy Transformation in the AI Era

Digital literacy has undergone a significant transformation in the era of artificial intelligence. Traditionally, digital literacy referred to the ability to access, use, evaluate, and communicate information through digital technologies. However, AI-based learning environments require a broader understanding of digital literacy. Pupils are now expected not only to operate digital devices but also to understand how digital systems work, how data is used, how algorithms influence information, and how AI-generated content should be evaluated critically.

In this context, AI literacy becomes an important extension of digital literacy. Yim argues that AI literacy intersects with digital literacy, data literacy, computational thinking, and ethical reasoning, making it a multidimensional competence for contemporary education. This means that primary education needs to move beyond basic technology skills and introduce pupils to more reflective forms of digital engagement. Pupils should be taught to ask whether AI-generated information is accurate, biased, incomplete, or ethically problematic. Therefore, digital literacy transformation in primary education should include technical competence, information evaluation, ethical responsibility, data awareness, and reflective use of AI.

3. AI Literacy as a Foundation for Digital Competence

AI literacy refers to the ability to understand, use, evaluate, and critically reflect on artificial intelligence technologies. In primary education, AI literacy does not necessarily mean teaching children complex programming or advanced machine learning concepts. Instead, it involves introducing basic ideas about how AI works, what AI can and cannot do, how AI systems use data, and why human judgment remains important. The goal is to help pupils become informed, critical, and responsible users of AI-based technologies.

Recent studies emphasize that AI literacy education in primary schools should be tailored to children's developmental stages. Learning activities should be concrete, interactive, visual, and connected to pupils' everyday experiences. For example, pupils can learn about AI through games, storytelling, simple classification activities, image recognition examples, or discussions about recommendation systems. Such approaches help children understand AI not as a mysterious technology but as a system created by humans with strengths, limitations, and social consequences. This perspective is important because pupils increasingly encounter AI in search engines, learning platforms, games, social media, and digital applications.

4. Educational AI and Critical Thinking Skills

Critical thinking is one of the most important competencies in AI-supported learning environments. It refers to the ability to analyze information, evaluate evidence, identify assumptions, compare perspectives, make reasoned judgments, and solve problems logically. In the context of AI integration, critical thinking becomes essential, as pupils must learn to evaluate the outputs generated by digital systems. AI can provide fast answers, but those answers are not always accurate, neutral, or contextually appropriate.

Educational AI can support critical thinking when it is used as a tool for inquiry, comparison, questioning, and reflection. For example, pupils can be asked to compare AI-generated answers with textbook explanations, evaluate the reliability of the information, identify missing details, or revise AI outputs using their own reasoning. Such learning activities encourage pupils to become active thinkers rather than passive recipients of machine-generated content. However, when AI is used only to provide instant answers, it may weaken pupils' reasoning processes and reduce opportunities for deep learning. Recent concerns from educators also highlight that overreliance on AI may reduce pupils' independent thinking, creativity, writing skills, and problem-solving abilities when schools lack clear policies and pedagogical guidance.

5. Critical AI Literacy in Primary Education

Critical AI literacy expands the concept of AI literacy by emphasizing social, ethical, cultural, and political dimensions of AI. It not only asks whether pupils can use AI tools, but also whether they can question how AI systems affect human decisions, knowledge, identity, fairness, privacy, and power. Veldhuis' scoping review explains that critical AI literacy enables children to question, critique, and transform the social and ethical implications of AI in everyday life.

For primary school pupils, critical AI literacy can be introduced through simple but meaningful questions: Who created this AI tool? Where does the information come from?

Can AI make mistakes? Can AI be unfair? Should we trust every answer from AI? What should humans still decide by themselves? These questions help pupils understand that AI is not neutral or perfect. Data, design choices, and human values shape it. Therefore, critical AI literacy is closely related to critical thinking because both require pupils to evaluate information, identify limitations, and make responsible judgments.

6. The Role of Teachers in AI-Based Digital Literacy

Teachers play a central role in integrating AI into primary education. Although AI can provide personalized learning support, teachers remain responsible for designing meaningful learning experiences, guiding pupils' reflection, and ensuring ethical use of technology. AI should not replace teachers' pedagogical judgment; rather, it should support teachers in creating more adaptive and engaging learning environments.

Teacher competence is especially important because many primary school teachers may not yet have sufficient knowledge of AI, digital ethics, data privacy, or AI-based pedagogy. If teachers lack AI literacy, they may use AI only as a technical tool without connecting it to critical thinking or digital literacy outcomes. Therefore, teacher professional development should include not only how to operate AI tools, but also how to design AI-supported learning activities, assess AI-generated outputs, prevent misuse, and cultivate pupils' critical awareness. UNESCO also emphasizes that human-centered values, inclusion, equity, transparency, and ethical responsibility must guide AI in education.

7. Challenges of AI Integration in Primary Education

Despite its potential, AI integration in primary education faces several challenges. The first challenge is unequal access to digital infrastructure. Not all schools have stable internet access, sufficient devices, or digital platforms that support AI-based learning. This digital divide may create unequal learning opportunities among pupils. The second challenge is data privacy and child protection. Because AI systems often collect and process user data, schools must ensure that pupils' personal information is protected.

The third challenge is algorithmic bias. AI systems may produce biased or inaccurate responses because they are trained on large datasets that may contain social, cultural, or linguistic biases. The fourth challenge is the risk of cognitive dependency. If pupils rely too heavily on AI to answer questions, write texts, or solve problems, they may lose opportunities to practice independent reasoning. The fifth challenge is the absence of clear school policies. Many schools are still uncertain about how AI should be used, which rules should apply, and how teachers should supervise pupils' AI use. These challenges show that AI integration requires not only technological readiness but also ethical, pedagogical, institutional, and policy readiness.

8. Synthesis of Previous Studies and Conceptual Position

Based on the reviewed literature, educational AI has the potential to transform digital literacy and strengthen critical thinking skills in primary education. Still, this potential depends on how AI is integrated pedagogically. AI can support personalized learning, interactive engagement, and immediate feedback. However, its educational value becomes stronger when pupils are encouraged to question, verify, evaluate, and reflect

on AI-generated information. Therefore, AI should be positioned as a cognitive and pedagogical partner, not as a replacement for human reasoning.

The literature also shows that digital literacy in the AI era must include AI literacy and critical AI literacy. Pupils need to understand how AI works, how AI uses data, why AI can make mistakes, and how humans should use AI responsibly. At the same time, critical thinking skills are needed to prevent passive dependence on AI. Thus, the integration of educational AI in primary education should be built on three interconnected dimensions: digital literacy transformation, AI literacy development, and the cultivation of critical thinking.

Method

This study used a library research method with a qualitative descriptive approach. Library research was selected because this article aims to examine, compare, and synthesize previous scholarly work on the integration of educational artificial intelligence, digital literacy transformation, and critical thinking skills in primary education. The data sources included journal articles, systematic literature reviews, books, conference proceedings, and institutional reports published within the last 3 years. The main literature was obtained from reputable academic databases, including Scopus, ScienceDirect, SpringerLink, Taylor & Francis, Emerald, ERIC, and Google Scholar. The selection focused on studies of educational AI, AI literacy, digital literacy, critical thinking, primary education, and technology-based pedagogy.

The data analysis process consisted of several stages: identifying relevant keywords, selecting literature according to inclusion and exclusion criteria, classifying the findings thematically, and synthesizing the results into conceptual arguments. The keywords used included *educational artificial intelligence*, *AI literacy*, *digital literacy transformation*, *primary education*, *critical thinking skills*, and *AI-based learning*. The inclusion criteria covered publications from 2023 to 2026, studies on primary or basic education, and articles discussing the relationship between AI, digital literacy, and pupils' thinking skills. Meanwhile, studies that focused solely on technical AI development, with no educational relevance, were excluded. The selected literature was then analyzed using thematic analysis to identify major patterns, research gaps, pedagogical implications, and conceptual contributions related to AI integration in primary education.

Results and Discussion

1. Educational AI transforms primary education from digital tool use to adaptive learning

The literature shows that integrating educational AI into primary education has shifted digital learning from simple technology use to more adaptive, personalized, and interactive learning environments. AI-based platforms can support pupils through automated feedback, learning recommendations, adaptive exercises, educational chatbots, intelligent tutoring systems, and interactive applications. A systematic literature review of 54 Scopus-indexed articles published between 2020 and 2024 found that AI in

primary education is primarily applied through machine learning, deep learning, natural language processing, and adaptive platforms, with reported benefits including personalization, engagement, inclusive learning support, teacher efficiency, and the development of digital literacy.

This finding indicates that educational AI has the potential to strengthen learning experiences at the primary level by providing more responsive learning support. However, the effectiveness of AI does not depend only on technological availability. It also depends on teachers' readiness, school infrastructure, curriculum design, and ethical safeguards. Therefore, AI integration should not be viewed merely as a technological innovation, but as a pedagogical transformation that changes how pupils interact with knowledge, learning resources, and digital systems.

2. Digital literacy in the AI era becomes broader and more complex

The literature review suggests that digital literacy in the AI era has expanded beyond the ability to operate devices or access online information. Pupils are now expected to understand how AI systems work, how data is used, how algorithms influence information, and why AI-generated content must be evaluated critically. Yim's 2024 review explains that AI literacy lies at the intersection of digital literacy, data literacy, computational thinking, and AI ethics, underscoring that digital literacy must now encompass technical, cognitive, and ethical dimensions.

This finding is important because primary school pupils increasingly encounter AI-based systems in learning platforms, search engines, games, social media, and digital applications. If digital literacy remains limited to operational skills, pupils may become passive users of technology. Therefore, digital literacy transformation in primary education must include the ability to question AI outputs, recognize misinformation, understand data bias, protect privacy, and use digital tools responsibly. In this sense, AI literacy becomes an essential extension of digital literacy.

3. AI literacy supports critical thinking when taught through active and reflective pedagogy

The reviewed studies indicate that AI literacy can support pupils' critical thinking when it is taught through active, inquiry-based, and reflective learning. Yim's 2025 review reports that primary school pupils can develop computational thinking, problem-solving, creativity, and critical ability through activities such as Scratch-based AI learning, machine learning training, debugging, model testing, design-based pedagogy, and unplugged AI activities. The review also found that pupils' understanding of AI can be developed through artifacts, interviews, performance-based tasks, and reflection.

This means that AI should not only be used to provide quick answers or automated solutions. Instead, it should be used as a learning object and thinking partner. For example, pupils may be asked to compare AI-generated answers with textbook explanations, identify errors in AI outputs, discuss whether an AI response is fair or biased, and explain why a machine may make mistakes. These activities can train pupils to analyze, evaluate,

and justify their reasoning. Thus, AI can strengthen critical thinking when it is embedded in a pedagogy that requires pupils to question, verify, and reflect.

4. Critical thinking is needed to prevent passive dependence on AI

Although AI has strong educational potential, the literature also highlights the risk of overdependence. If pupils rely too heavily on AI-generated responses, they may lose opportunities to develop independent reasoning, creativity, writing ability, and problem-solving skills. Recent educational concerns have shown that teachers worry students may lose critical thinking skills due to increasing reliance on AI, especially when schools lack clear guidance and policies for responsible AI use.

This issue is highly relevant to primary education because young pupils are still developing foundational cognitive and metacognitive skills. At this stage, they need opportunities to ask questions, make mistakes, test ideas, and explain their reasoning. If AI is used only as an answer machine, it may reduce the learning process to information consumption. Therefore, critical thinking must become the core of AI-supported learning. Pupils should be guided to treat AI-generated information as something to be examined, not simply accepted.

5. Ethical and responsible AI use is a central component of digital literacy transformation

The literature also shows that ethical awareness is a key dimension of AI literacy and digital literacy transformation. UNESCO's AI Competency Framework for Students emphasizes that learners should become responsible users and co-creators of AI, with competencies in human-centered thinking, the ethics of AI, AI techniques and applications, and AI system design. The framework also stresses critical judgment, citizenship responsibility, foundational AI knowledge, and inclusive AI design.

This finding suggests that digital literacy in primary education should include ethical questions such as: Can AI be wrong? Can AI be unfair? Who is responsible for AI-generated information? What data are used by AI systems? How should pupils protect their privacy? These questions help pupils understand that AI is not neutral, perfect, or independent from human values. Therefore, ethical AI education is necessary to develop pupils who are not only digitally skilled but also responsible and reflective.

6. Teachers play a decisive role in linking AI, digital literacy, and critical thinking

The results of the literature review indicate that teachers are central actors in successful AI integration. Although AI can provide adaptive learning support, teachers remain responsible for designing learning activities, guiding pupils' reflection, evaluating AI use, and protecting pupils from inappropriate or unethical technology use. UNESCO's AI Competency Framework for Teachers identifies five dimensions of teacher competence: human-centered mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning.

This shows that teacher readiness is not only about technical ability to use AI tools. Teachers also need pedagogical and ethical competence to help pupils use AI meaningfully. In primary education, teachers must simplify complex AI concepts into age-

appropriate learning experiences. They must also create classroom discussions that encourage pupils to evaluate AI outputs, identify bias, compare sources, and explain their reasoning. Without teacher guidance, AI integration may become superficial and may fail to develop digital literacy and critical thinking.

7. The main challenges are infrastructure, curriculum readiness, teacher competence, and data privacy

The reviewed literature identifies several challenges in integrating AI into primary education. These include limited infrastructure, unequal access to digital devices and the internet, insufficient teacher readiness, financial constraints, a lack of a systematic AI literacy curriculum, and concerns about children's data privacy. Revenaya et al.'s 2025 systematic literature review concludes that successful AI implementation in primary education depends on ecosystem readiness, equitable access, and ethical safeguards.

These challenges show that AI integration cannot be separated from broader educational inequality. Schools with better infrastructure and teacher training may benefit more from AI, while under-resourced schools may be left behind. In addition, because primary school pupils are children, data privacy and digital safety must receive special attention. AI-based platforms should not be introduced without clear rules regarding data protection, responsible use, teacher supervision, and age-appropriate content.

8. Synthesis: AI can strengthen critical thinking only when integrated through human-centered pedagogy

Overall, the results suggest that educational AI can contribute to the transformation of digital literacy and the development of critical thinking in primary education, but only when integrated through a human-centered, ethical, and reflective pedagogy. AI can personalize learning, increase engagement, provide feedback, and introduce pupils to computational thinking. However, these benefits will not automatically lead to critical thinking unless teachers design activities that require pupils to analyze, evaluate, question, and reflect on AI-generated information.

Therefore, the relationship between educational AI, digital literacy, and critical thinking should be understood as an interconnected learning ecosystem. AI provides new learning opportunities; digital literacy equips pupils to understand and use technology responsibly; and critical thinking enables pupils to evaluate information and make reasoned judgments. In this model, AI should not replace human reasoning but serve as a tool to strengthen pupils' ability to think, question, and learn independently.

Conclusion

This literature review concludes that integrating educational artificial intelligence into primary education plays an important role in transforming digital literacy and strengthening pupils' critical thinking skills. AI is no longer merely a technological tool; it has become part of a learning ecosystem that supports personalization, adaptive learning, automated feedback, interactive activities, and data-driven learning experiences. In this context, digital literacy must be understood more broadly, not only as the ability to use

digital devices, but also as the ability to understand AI systems, evaluate AI-generated information, recognize bias, protect privacy, and use technology ethically and responsibly. The findings also show that educational AI can support critical thinking when it is implemented through active, reflective, and human-centered pedagogy. Pupils should not be positioned as passive recipients of automated responses from AI systems. Instead, they need to be guided to question, compare, verify, and reflect on AI-generated outputs. Therefore, teachers play a crucial role in designing AI-based learning activities that encourage reasoning, problem-solving, information evaluation, and ethical decision-making. Without teacher guidance and clear pedagogical strategies, AI integration may increase dependency and weaken pupils' independent thinking.

Furthermore, this study highlights several challenges in AI integration, including unequal digital infrastructure, limited teacher competence, a lack of an AI literacy curriculum, data privacy concerns, and the risk of algorithmic bias. These challenges indicate that successful AI implementation in primary education requires not only technological readiness but also ethical, pedagogical, institutional, and policy support. Schools and policymakers must ensure that AI is integrated in a way that protects children's rights, supports inclusive learning, and strengthens human intelligence rather than replacing it.

Overall, the integration of educational AI in primary education should be directed toward developing digitally literate, critically minded, and ethically responsible pupils. AI has strong potential to enrich learning, but its educational value depends on how it is used. When supported by appropriate pedagogy, teacher readiness, and ethical frameworks, educational AI can become a powerful medium for transforming digital literacy and cultivating critical thinking skills from an early stage of education.

References

Miao, F., & Cukurova, M. (2024). *AI competency framework for teachers*. UNESCO.

Miao, F., Shiohira, K., & Lao, N. (2024). *AI competency framework for students*. UNESCO.

Stolpe, K., & Hallström, J. (2024). Artificial intelligence literacy for technology education. *Computers and Education Open, 6*, 100159.

UNESCO. (2023). *Guidance for generative AI in education and research*. UNESCO.

Veldhuis, A., Lo, P. Y., Kenny, S., & Antle, A. N. (2025). Critical artificial intelligence literacy: A scoping review and framework synthesis. *International Journal of Child-Computer Interaction, 43*, 100708. doi:10.1016/j.ijcci.2024.100708

Yim, I. H. Y. (2024). A critical review of teaching and learning artificial intelligence literacy: Developing an intelligence-based AI literacy framework for primary school education. *Computers and Education: Artificial Intelligence, 7*, 100319. doi:10.1016/j.caeai.2024.100319

Yim, I. H. Y. (2024). Artificial intelligence literacy in primary education: An arts-based approach to overcoming age and gender barriers—Computers *and Education: Artificial Intelligence, 7*, 100321.

Yim, I. H. Y., & Su, J. (2025). Artificial intelligence learning tools in K–12 education: A scoping review. *Journal of Computers in Education, 12*, 93–131. doi:10.1007/s40692-023-00304-9

Yim, I. H. Y., & Su, J. (2025). Artificial intelligence literacy education in primary schools: A review. *International Journal of Technology and Design Education, 35*, 2175–2204. doi:10.1007/s10798-025-09979-w

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2024). Systematic review of research on artificial intelligence applications in education. *International Journal of Educational Technology in Higher Education*.

Untuk versi yang lebih aman secara akademik, bagian daftar pustaka dapat difokuskan pada 8–9 referensi utama di atas, terutama Yim (2024), Yim & Su (2025), Veldhuis et al. (2025), dan UNESCO (2023, 2024), karena paling relevan dengan pendidikan dasar, AI literacy, critical AI literacy, dan kompetensi AI.