

Toward Human-Centered AI Literacy in Education: A Systematic Literature Review of Ethical Challenges and Teachers' Pedagogical Readiness

Sajid Fiestighfarilah¹, Sholahuddin Al Ayyubi²

¹Sidi Mohamed Ben Abdellah University, Fez, Maroko

²Sekolah Tinggi Agama Islam Nurul Abror Al Robbaniyin, Banyuwangi, Indonesia

ABSTRACT

Keywords:

AI Literacy;
Educational Ethics;
Pedagogical
Readiness; Artificial
Intelligence.

The burgeoning development of generative Artificial Intelligence (AI) has profoundly transformed global educational systems while simultaneously creating complex ethical and pedagogical challenges. This study aims to systematically examine AI literacy in education by focusing on the ethical challenges and pedagogical readiness of teachers in responding to AI integration within learning environments. The study employed a Systematic Literature Review (SLR) approach guided by the PRISMA protocol to ensure transparency, rigor, and replicability in the literature selection process. The findings reveal that the most dominant ethical concerns involve academic integrity, algorithmic bias, and data privacy, whereas teachers' pedagogical readiness remains largely concentrated on technical AI utilization rather than transformative AI-based pedagogy. The literature synthesis further indicates a substantial competency gap between technological proficiency and teachers' reflective-ethical capacity to critically and responsibly employ AI in educational practices. This study underscores that AI literacy should not be narrowly conceptualized as a technical skill; rather, it must be understood as an integrative competence encompassing digital capability, ethical awareness, and adaptive pedagogical readiness. The implications of this study highlight the urgency of developing teacher education curricula grounded in Human-AI Collaboration to foster adaptive, humanistic, and sustainable education in the era of digital transformation.

Article History:

Received : 27/05/2026

Revised : 13/06/2026

Accepted: 24/07/2026

Available online: 30/07/2026

Please cite this article in APA style as:

Fiestighfarilah, S., & Al Ayyubi, S. (2026). Toward human-centered AI literacy in education: A systematic literature review of ethical challenges and teachers' pedagogical readiness. *EDUNOVATION: Journal of Education and Innovation*, 1(2), 167-183.

DOI: <https://doi.org/>

*Corresponding Author: sajid.sajidfiestighfarillah@usmba.ac.ma

INTRODUCTION

Artificial Intelligence (AI), particularly the rapid evolution of generative AI, has emerged as one of the most transformative forces reshaping contemporary education. Beyond functioning as a technological aid for information retrieval or administrative efficiency, AI is increasingly embedded

in teaching, learning, and assessment practices, enabling adaptive feedback, personalized learning experiences, and data-informed instructional decision-making (Strielkowski et al., 2025). This transformation has gradually shifted educational paradigms from technology-assisted instruction toward more collaborative human–AI learning environments, where intelligent systems are expected to complement rather than replace human expertise (Järvelä et al., 2023). As educational institutions across different contexts continue to integrate AI into curriculum design, classroom practice, and academic support services, the central challenge is no longer whether AI should be adopted, but how it can be integrated in ways that enhance educational quality while preserving the pedagogical and ethical foundations of learning (Adel et al., 2024).

Artificial Intelligence Literacy (AI Literacy) has consequently evolved into a fundamental competency for educators navigating AI-enhanced learning environments. Rather than referring solely to the technical ability to operate AI-powered applications, AI Literacy encompasses a broader constellation of knowledge, critical judgment, ethical awareness, and pedagogical decision-making required to engage with intelligent technologies responsibly (Biagini, 2025). This conceptual shift reflects the growing recognition that educators must not only understand how AI systems function but also critically evaluate their outputs, identify algorithmic limitations, and determine when human expertise should prevail over automated recommendations (Omodan, 2025). Accordingly, AI Literacy is increasingly recognised as a multidimensional construct that integrates technological competence with pedagogical reasoning and ethical responsibility, enabling teachers to leverage AI as an educational partner while maintaining meaningful human agency throughout the teaching and learning process (Mouta et al., 2025).

Despite its transformative potential, the widespread adoption of AI in education has generated a range of ethical concerns that extend well beyond technical implementation. The increasing reliance on generative AI for completing academic tasks, producing instructional materials, and supporting assessment practices has intensified debates surrounding academic integrity, authenticity of student work, and the erosion of critical thinking when AI-generated outputs are accepted without sufficient scrutiny (Adamakis & Rachiotis, 2025). At the same time, AI systems remain susceptible to algorithmic bias, opaque decision-making processes, and inaccuracies commonly referred to as AI hallucinations, raising important questions about the reliability and trustworthiness of AI-assisted educational practices (Zhai et al., 2024). These concerns are further compounded by issues of data privacy, informed consent, and the responsible use of learners' personal information, particularly as AI-driven educational platforms increasingly rely on large-scale data collection and predictive analytics (Ungerer & Slade, 2022). Consequently, the educational

challenge is no longer confined to ensuring access to AI technologies but increasingly revolves around cultivating educators who possess the ethical judgment necessary to critically evaluate, regulate, and responsibly integrate AI within pedagogical contexts.

Beyond ethical considerations, the educational value of AI ultimately depends on teachers' pedagogical readiness to integrate intelligent technologies into meaningful learning experiences. The rapid proliferation of AI-powered educational tools has expanded teachers' responsibilities from selecting digital resources to orchestrating complex interactions among learners, instructional content, and AI systems in ways that promote critical inquiry, creativity, and reflective learning (Lameras & Arnab, 2022). This evolving role requires educators to exercise informed pedagogical judgment in determining when AI can effectively support learning and when direct human intervention remains indispensable for fostering higher-order thinking, socio-emotional development, and authentic classroom engagement (Shahzad et al., 2025). Consequently, pedagogical readiness extends beyond digital proficiency to encompass instructional design, assessment literacy, classroom facilitation, and the capacity to critically mediate AI-generated content within diverse educational contexts. Such a perspective reinforces the view that successful AI integration is fundamentally a pedagogical endeavour, where technological innovation derives its educational value only when guided by sound instructional principles and human-centred teaching practices (Huang et al., 2024).

Although the body of literature on AI in education has expanded considerably over the past few years, existing scholarship remains fragmented in both its conceptual orientation and analytical focus. Current studies have predominantly examined AI from discrete perspectives, including technology acceptance, instructional effectiveness, digital competence, or ethical governance, with relatively limited attention given to how these dimensions collectively shape teachers' AI Literacy (Kundu et al., 2025). Reviews addressing ethical implications frequently concentrate on concerns such as academic integrity, algorithmic bias, and data privacy, whereas investigations into teachers' readiness tend to emphasise technological adoption, self-efficacy, or professional development without explicitly incorporating ethical reasoning into pedagogical decision-making (Shardey et al., 2025). As a result, AI Literacy is often treated as an operational or technical competency rather than as an integrative educational construct that simultaneously requires technological understanding, pedagogical expertise, and ethical discernment (Chiu et al., 2024). This conceptual fragmentation has constrained the development of a comprehensive framework capable of explaining how educators can meaningfully collaborate with AI while preserving human agency, professional judgment, and the broader educational purposes of teaching and learning.

Although previous studies have generated valuable insights into AI adoption, ethical governance, and teachers' professional competencies, a coherent conceptual framework that integrates these interrelated dimensions remains underdeveloped. Existing systematic reviews have largely synthesised evidence by categorising technological opportunities and implementation challenges, yet relatively few have sought to reconceptualise AI Literacy as a holistic educational competency that simultaneously embraces technological capability, pedagogical judgment, and ethical responsibility. This conceptual limitation leaves an important gap in understanding how educators can develop the professional capacity required not merely to use AI effectively, but to collaborate with intelligent systems in ways that preserve human agency, educational values, and sound pedagogical decision-making. Addressing this gap, the present study advances the concept of Human-Centered AI Literacy, positioning AI Literacy as a multidimensional educational construct that extends beyond digital competence to encompass ethical discernment, reflective pedagogical practice, and purposeful human–AI collaboration. Rather than viewing AI as an autonomous instructional solution, this perspective emphasises that its educational value ultimately depends on educators' capacity to critically mediate, contextualise, and govern AI-supported learning within human-centred pedagogical environments.

Building upon these considerations, this study conducts a Systematic Literature Review (SLR) to critically synthesise current scholarship on AI Literacy in education, with particular attention to the intersection of ethical challenges and teachers' pedagogical readiness. Rather than merely consolidating existing evidence, the review seeks to advance a more comprehensive understanding of AI Literacy by articulating a Human-Centered AI Literacy perspective that integrates technological competence, ethical discernment, and pedagogical judgment into a unified conceptual framework. By repositioning AI Literacy as a multidimensional educational competency, this study contributes to the ongoing discourse on educational transformation in the age of artificial intelligence while offering a conceptual foundation that may inform future research, teacher professional development, curriculum innovation, and policy formulation for the responsible integration of AI in education.

METHOD

This study employed a Systematic Literature Review (SLR) to synthesise and critically evaluate existing evidence on Artificial Intelligence (AI) Literacy in education, with a particular focus on ethical challenges and teachers' pedagogical readiness. The review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure methodological

transparency, replicability, and systematic reporting throughout the review process (Page et al., 2021). Unlike conventional narrative reviews, the SLR approach enables a structured identification, selection, appraisal, and synthesis of relevant studies, thereby reducing selection bias while providing a comprehensive understanding of research trends and conceptual developments (Marzi et al., 2025). Given the conceptual nature of this study, the review sought not only to map the existing body of knowledge but also to identify recurring themes, unresolved issues, and emerging perspectives that informed the development of a Human-Centered AI Literacy framework.

A systematic search was conducted across four internationally recognised academic databases, namely Scopus, Web of Science, ERIC, and Google Scholar, to capture peer-reviewed studies published between 2020 and 2025, reflecting the rapid evolution of generative AI within educational contexts. The search strategy combined keywords and Boolean operators, including "Artificial Intelligence Literacy" OR "AI Literacy" AND Education, Ethics, Teachers, Pedagogical Readiness, and Generative AI. Studies were included if they (1) focused on AI implementation within educational settings, (2) discussed AI Literacy, ethical issues, teachers' competencies, or pedagogical readiness, (3) were published in peer-reviewed journals, and (4) were available in English. Conversely, conference abstracts, editorials, book reviews, non-peer-reviewed publications, duplicate records, and studies unrelated to educational contexts were excluded. The identification and screening processes were conducted sequentially following the PRISMA workflow, encompassing identification, screening, eligibility assessment, and final inclusion of eligible studies.

Table 1. Search Strategy and Eligibility Criteria

Criteria	Inclusion	Exclusion
Publication type	Peer-reviewed journal articles	Conference abstracts, editorials, books, book chapters, reports
Language	English	Non-English publications
Publication period	2020–2025	Published before 2020
Research focus	AI Literacy, AI in Education, Ethical Challenges, Teachers' Pedagogical Readiness	AI outside educational contexts
Study context	Schools, higher education, teacher education	Healthcare, engineering, business, industry
Accessibility	Full-text available	Abstract only or inaccessible full text
Quality	Empirical or high-quality conceptual studies	Opinion papers lacking methodological rigor

The selected studies were analysed using a thematic synthesis approach to identify recurring patterns, conceptual relationships, and emerging research

directions across the literature. Following the eligibility assessment, bibliographic information, research objectives, methodologies, educational contexts, and principal findings were extracted and organised into an evidence matrix to facilitate cross-study comparison. The analysis proceeded through iterative coding, category refinement, and theme development, enabling the integration of findings into broader conceptual dimensions. Particular attention was given to the interplay between ethical challenges, pedagogical readiness, and AI Literacy, which ultimately informed the synthesis of the proposed Human-Centered AI Literacy perspective. This analytical approach allowed the review to move beyond descriptive mapping by generating an integrative conceptual interpretation that highlights both the current state of knowledge and future directions for research and educational practice.

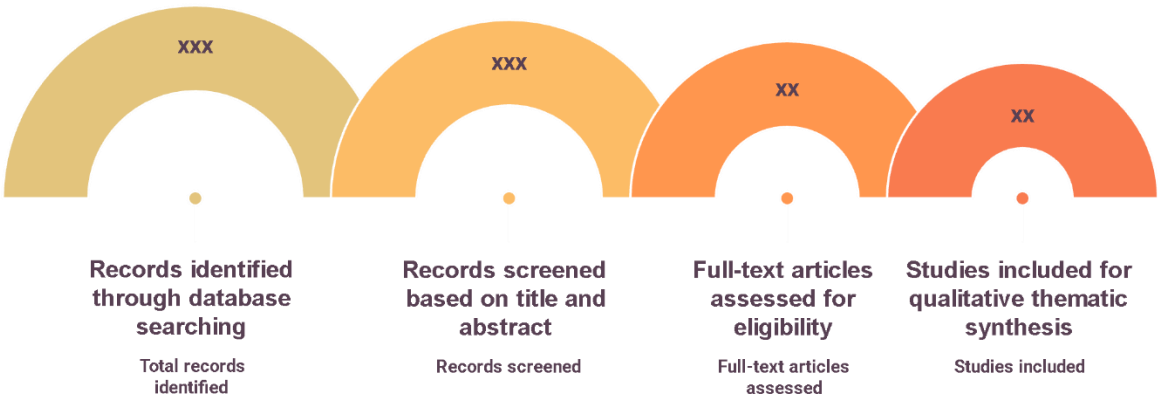


Figure 1. PRISMA 2020 Flow Diagram of the Study Selection Process

RESULT

Toward Human-Centered AI Literacy Framework

The results of the literature search through the Google Scholar, Sinta, and Scopus databases resulted in a number of articles which were then selected using the PRISMA protocol until 26 articles were obtained that met the research inclusion criteria. The literature analyzed is dominated by publications in 2023–2025, which shows that the issue of AI literacy in education has developed significantly after the emergence of generative AI technology based on Large Language Models (LLM) (Balaji, 2025). Based on the research domicile, most of the studies came from the United States, China, South Korea, the United Kingdom, and several Southeast Asian countries including Indonesia (Putera et al., 2022). Meanwhile, the focus of the study was most found at the higher and secondary education levels, especially related to the implementation of generative AI in learning, academic evaluation, and teacher competency transformation (Bahroun et al., 2023). Several studies have also shown increased attention to the development of AI ethics policies and critical digital literacy in

response to the acceleration of AI integration in the educational environment (Daher, 2025).

In general, the results of the synthesis show that the literature on AI literacy develops in two major trends, namely studies oriented towards ethical risk mitigation and studies that emphasize the pedagogical transformation of teachers. The two tendencies are interrelated because teachers' pedagogical ability to utilize AI greatly determines the quality of ethical risk control in the learning space. Thus, AI literacy is not only understood as a technical competence in the use of applications, but also includes a critical awareness of the epistemological, social, and moral implications of the use of AI in education.

Taxonomy of Ethical Challenges

Analysis of the selected articles shows that the issue of academic integrity is the most dominant ethical challenge discussed in the literature. Most studies identify the increasing use of generative AI in assignment composing, essay writing, and auto-response production that has the potential to obscure learners' cognitive originality (Taye, 2023). In some studies, AI is even seen as being able to shift students' reflective thinking processes if its use is not balanced with clear academic regulations (Bozkurt et al., 2024). This phenomenon has prompted various educational institutions to begin formulating new academic integrity policies that set limits on the use of AI in learning activities.

In addition to academic integrity, the issue of data privacy is also an issue that has received a lot of attention. The literature shows that the use of educational AI platforms often involves collecting students' personal data, including learning patterns, academic preferences, and other digital activities (Gligorea et al., 2023). Several studies highlight the weak transparency of AI systems in data management, which has the potential to cause privacy violations and misuse of user information (Shahriar et al., 2023). This concern is growing with the use of cloud-based AI that allows cross-border data transfer without adequate controls (Tewari & Chitnis, 2024).

On the other hand, algorithmic bias emerges as the most complex ethical category because it is directly related to the data structure and logic of the AI system itself. A number of studies have found that educational AI systems have the potential to produce unfair recommendations due to the use of unrepresentative datasets (Shah & Sureja, 2025). These biases can affect the evaluation process, personalization of learning, and academic decision-making. The literature also shows that most teachers do not have the ability to identify algorithmic bias or critically verify AI outputs (Gouseti et al., 2025). This condition shows that the ethical challenge of AI is not only technological, but also closely related to the critical literacy readiness of educators.

Profil Kesiapan Pedagogis Guru

The findings of the study show that most teachers have had a fairly good initial level of adaptation to the use of AI devices, especially in administrative activities, search for learning resources, and the creation of learning media (Almuhanna, 2025). Nevertheless, such technical mastery has not been fully followed by a deep pedagogical ability to integrate AI into meaningful learning designs. Many teachers still use AI as an operational tool, not as a transformative pedagogical instrument that can improve the quality of learning interactions (Katsenou et al., 2025).

Several studies have also found a gap between tool literacy and pedagogical literacy. Teachers in general are quite familiar with the use of AI chatbots, material generators, and automated evaluation applications, but still experience difficulties in designing AI-based learning strategies that are able to encourage students' critical thinking and creativity (Melisa et al., 2025). In this context, competencies such as prompt engineering, evaluation of the validity of AI outputs, and the integration of AI-based TPACK models are beginning to be seen as new needs in the modern teaching profession (Eyal, 2025). The literature also shows that teachers' pedagogical readiness is greatly influenced by professional training factors, institutional support, and available digital education policies (Amemasor et al., 2025).

In addition, the results of the synthesis show that teachers who have a higher level of AI literacy tend to show better ability to mitigate ethical risks in the classroom (Zhang & Rhee, 2025). They are not only able to utilize AI productively, but are also more critical in explaining the limits of AI use to learners. Thus, pedagogical readiness in the AI era is no longer just related to technological capabilities, but includes reflective, ethical, and adaptive competencies in the face of digital education transformation (George, 2023).

DISCUSSION

The results of this study show that ethical issues in the integration of AI in education do not arise solely because of the existence of technology itself, but because of the imbalance between the acceleration of digital innovation and the epistemological readiness of education users, especially teachers and students. The phenomenon of increasing violations of academic integrity, for example, can be understood as a logical consequence of the presence of generative AI systems that are capable of generating texts, answers, and arguments instantly without being balanced by a mature pedagogical regulatory framework. In the perspective of constructivism, learning is ideally built through the process of active construction of meaning by learners (Milad, 2021). However, when AI is used passively as an "answer machine", then the process of knowledge construction has the potential to be replaced by cognitive automation (Watts,

2025). This is where the paradox of contemporary digital education lies: technologies designed to expand access to knowledge can actually weaken the process of internalizing knowledge if it is not pedagogically directed.

The issue of data privacy and algorithmic bias also shows that the education system is not fully prepared to face the work logic of AI based on massive data collection and processing. Many teachers still view AI as a practical learning tool without understanding how algorithms work, how data is processed, and how system bias can affect learning outcomes (Dieterle et al., 2024). As a result, the use of AI tends to be instrumentalist, that is, it focuses only on technical efficiency without considering the broader ethical and social dimensions (Chan, 2023). These findings are in line with the view that low algorithmic literacy makes it difficult for technology users to conduct critical evaluations of AI outputs (Shin et al., 2022). In other words, ethical challenges in AI education are actually a reflection of the weak digital critical awareness in the education ecosystem itself.

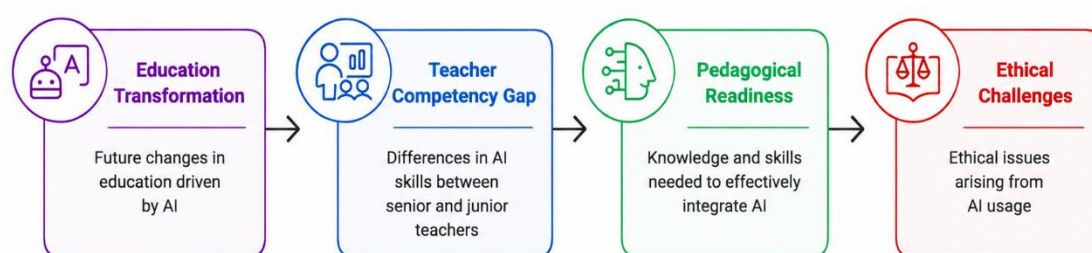


Figure 2. Transformation Flow of AI Literacy in Education

This study also shows a close relationship between understanding AI ethics and teachers' confidence levels in managing technology-based learning. Teachers who have a better understanding of the limits of AI use, the risk of bias, and the importance of information validation tend to show stronger pedagogical control in the classroom (Nazaretsky et al., 2022). On the other hand, teachers who only master the technical aspects of using AI applications often experience pedagogical uncertainty when it comes to determining the extent to which AI can be used in the learning process (Velandar et al., 2024). This situation shows that pedagogical readiness cannot be separated from ethical readiness. Within the framework of TPACK (Technological Pedagogical Content Knowledge), technology integration is not enough to rely only on the mastery of digital devices, but requires the ability to connect technology with pedagogical strategies and scientific substance in a reflective manner (Araújo & Saúde, 2024). Therefore, AI literacy for teachers needs to be positioned as an integrative competency that unites aspects of technology, pedagogy, and ethics in a single educational praxis unit.

On the other hand, the results of the literature synthesis also reveal a significant competency gap between senior teachers and junior teachers in

dealing with AI disruption. Junior teachers are generally more adaptive to the use of AI platforms because they have closer experience with digital culture and the modern technology ecosystem (Liu & Shang, 2025). However, this adaptability is not always followed by a depth of pedagogical and ethical reflection. In contrast, some senior teachers have strong pedagogical experience, but face obstacles in technical aspects and technological adaptation (Lucas & Vicente, 2023). This gap shows that the transformation of AI-based education is not only a matter of age or technological ability, but a matter of reconstructing academic culture as a whole. If these conditions are ignored, then educational institutions risk experiencing competency dualism: one group is technically superior but pedagogically weak, while the other group excels pedagogically but is digitally lagging behind.

Furthermore, this study emphasizes that AI literacy should not be reduced to just a technical skill using artificial intelligence-based applications. An overly technocentric approach has the potential to generate a new dependence on automation systems and weaken human intellectual autonomy (Wiklund, 2022). In the context of education, AI literacy should be understood as human-centered wisdom, which is the ability of humans to use AI wisely, critically, ethically, and responsibly to support a meaningful learning process (Peters & Green, 2024). It is not enough for teachers to be taught how to make effective prompts, but also need to be equipped with the ability to question the validity of information, understand the social impact of technology, and maintain the human dimension in educational interactions (Kasneci et al., 2023). The fundamental question is no longer "how sophisticated is AI used in the classroom", but "does the use of AI still maintain the values of education as a humanization process?". It is at this point that this research offers conceptual novelty, namely by placing AI literacy not just as a new digital competence, but as a pedagogical-ethical paradigm oriented towards the sustainability of humanity in the era of artificial intelligence.

Thus, the results of this study show that the success of AI integration in education is highly dependent on the ability of educational institutions to build a balance between technological innovation and strengthening the ethical-pedagogical awareness of teachers. The development of education policy in the future is no longer enough to focus only on the provision of digital infrastructure, but must also be directed at the formation of an academic culture that is critical, adaptive, and oriented towards human values (Whittaker & Montgomery, 2022). If AI literacy is only understood as a technological operational ability, then education risks losing its basic substance as a space for character formation, moral reflection, and the development of human critical reasoning. On the other hand, if AI literacy is developed in an integrative and humanistic manner, AI can become a strategic instrument to strengthen transformative pedagogy in the era

of digital education (He et al., 2025).

CONCLUSION

As a final synthesis, this study confirms that AI literacy in education can no longer be understood narrowly as an operational ability in using artificial intelligence devices. AI literacy is a multidimensional competency construction, which integrates ethical awareness, reflective skills, and pedagogical readiness in facing digital education transformation. The results of the literature study show that ethical challenges such as academic integrity, algorithm bias, and data privacy arise not only due to the development of AI technology itself, but also because teachers' pedagogical readiness to manage technology critically and meaningfully is uneven. In this context, it was found that most teachers have demonstrated the ability to adapt technically to the use of AI, but still face limitations in aspects of transformative pedagogy, information validation, and ethical risk control in the learning space. Thus, the relationship between ethical challenges and pedagogical readiness is mutually influential, so strengthening AI literacy must be directed at the development of competencies that are not only technological, but also humanistic and reflective.

The theoretical and practical implications of these findings lead to the urgency of reconstructing the paradigm of teacher education in the era of artificial intelligence. Educational institutions and policymakers are no longer enough to focus on providing digital infrastructure or training on the use of AI applications alone, but need to design a learning ecosystem based on Human-AI Collaboration. The teacher training curriculum needs to be developed integratively through strengthening algorithmic literacy, digital ethics, adaptive pedagogy, and the ability to build learning interactions that remain oriented towards the development of students' critical reasoning and character. This research ultimately places AI not as a substitute for the role of humans in education, but as a cognitive partner that must be directed to strengthen the humanization process of learning. The future of education is not determined by how sophisticated technology is used, but by the extent to which it is able to support the birth of an education system that is ethical, reflective, inclusive, and still maintains human dignity in the midst of global digital disruption.

ACKNOWLEDGMENT

The authors express their sincere gratitude to Sidi Mohamed Ben Abdellah University for providing the necessary facilities and support for this research. We would also like to extend our appreciation to the reviewers and colleagues for their insightful feedback, as well as to all participants whose involvement and contribution made the successful completion of this study possible

REFERENCES

- Adamakis, M., & Rachiotis, T. (2025). Artificial Intelligence in Higher Education: A State-of-the-Art Overview of Pedagogical Integrity, Artificial Intelligence Literacy, and Policy Integration. *Encyclopedia*, 5(4), 180. <https://doi.org/10.3390/encyclopedia5040180>
- Adel, A., Ahsan, A., & Davison, C. (2024). ChatGPT Promises and Challenges in Education: Computational and Ethical Perspectives. *Education Sciences*, 14(8), 814. <https://doi.org/10.3390/educsci14080814>
- Almuhanna, M. A. (2025). Teachers' perspectives of integrating AI-powered technologies in K-12 education for creating customized learning materials and resources. *Education and Information Technologies*, 30(8), 10343–10371. <https://doi.org/10.1007/s10639-024-13257-y>
- Amemasor, S. K., Oppong, S. O., Ghansah, B., Benuwa, B. B., & Essel, D. D. (2025). A systematic review on the impact of teacher professional development on digital instructional integration and teaching practices. *Frontiers in Education*, 10, 1541031. <https://doi.org/10.3389/feduc.2025.1541031>
- Araújo, J. L., & Saúde, I. (2024). Can ChatGPT Enhance Chemistry Laboratory Teaching? Using Prompt Engineering to Enable AI in Generating Laboratory Activities. *Journal of Chemical Education*, 101(5), 1858–1864. <https://doi.org/10.1021/acs.jchemed.3c00745>
- Bahroun, Z., Anane, C., Ahmed, V., & Zacca, A. (2023). Transforming Education: A Comprehensive Review of Generative Artificial Intelligence in Educational Settings through Bibliometric and Content Analysis. *Sustainability (Switzerland)*, 15(17), 12983. <https://doi.org/10.3390/su151712983>
- Balaji, A. C. (2025). AI Literacy in Higher Education: A Scoping and Integrative Review. *Empowering Learners With AI: Strategies, Ethics, and Frameworks*, 119–151. <https://doi.org/10.4018/979-8-3373-7386-7.ch006>
- Biagini, G. (2025). Towards an AI-Literate Future: A Systematic Literature Review Exploring Education, Ethics, and Applications. *International Journal of Artificial Intelligence in Education*, 35(4), 2616–2666. <https://doi.org/10.1007/s40593-025-00466-w>
- Bozkurt, A., Xiao, J., Farrow, R., Bai, J. Y. H., Nerantzi, C., Moore, S., Dron, J., Stracke, C. M., Singh, L., Crompton, H., Koutropoulos, A., Terentev, E., Pazurek, A., Nichols, M., Sidorkin, A. M., Costello, E., Watson, S., Mulligan,

- D., Honeychurch, S., ... Asino, T. I. (2024). The Manifesto for Teaching and Learning in a Time of Generative AI: A Critical Collective Stance to Better Navigate the Future. In *Open Praxis* (Vol. 16, Issue 4, pp. 487–513). International Council for Open and Distance Education Oslo, Norway. <https://doi.org/10.55982/openpraxis.16.4.777>
- Chan, A. (2023). GPT-3 and InstructGPT: technological dystopianism, utopianism, and “Contextual” perspectives in AI ethics and industry. *AI and Ethics*, 3(1), 53–64. <https://doi.org/10.1007/s43681-022-00148-6>
- Chiu, T. K. F., Ahmad, Z., Ismailov, M., & Sanusi, I. T. (2024). What are artificial intelligence literacy and competency? A comprehensive framework to support them. *Computers and Education Open*, 6, 100171. <https://doi.org/10.1016/j.caeo.2024.100171>
- Daher, R. (2025). Integrating AI literacy into teacher education: a critical perspective paper. *Discover Artificial Intelligence*, 5(1), 217. <https://doi.org/10.1007/s44163-025-00475-7>
- Dieterle, E., Dede, C., & Walker, M. (2024). The cyclical ethical effects of using artificial intelligence in education. *AI and Society*, 39(2), 633–643. <https://doi.org/10.1007/s00146-022-01497-w>
- Eyal, L. (2025). Developing and Validating an AI-TPACK Assessment Framework: Enhancing Teacher Educators’ Professional Practice Through Authentic Artifacts. *Education Sciences*, 15(11), 1452. <https://doi.org/10.3390/educsci15111452>
- George, A. S. (2023). Preparing Students for an AI-Driven World : Rethinking Curriculum and Pedagogy in the Age of Artificial Intelligence Partners Universal Innovative Research Publication (PUIRP). *Partners Universal Innovative Research Publication (PUIRP)*, 1(December), 112–136.
- Gligorea, I., Cioca, M., Oancea, R., Gorski, A. T., Gorski, H., & Tudorache, P. (2023). Adaptive Learning Using Artificial Intelligence in e-Learning: A Literature Review. *Education Sciences*, 13(12), 1216. <https://doi.org/10.3390/educsci13121216>
- Gouseti, A., James, F., Fallin, L., & Burden, K. (2025). The ethics of using AI in K-12 education: a systematic literature review. *Technology, Pedagogy and Education*, 34(2), 161–182. <https://doi.org/10.1080/1475939X.2024.2428601>
- He, J., Zhang, D., Xu, X., & Su, Y. (2025). Research on the role transformation of

- higher vocational education teachers in the era of artificial intelligence. *Proceedings of 2025 2nd International Conference on Digital Society and Artificial Intelligence*, DSAI 2025., 7(4), 115–120. <https://doi.org/10.1145/3748825.3748845>
- Huang, R., Adarkwah, M. A., Liu, M., Hu, Y., Zhuang, R., & Chang, T. (2024). Digital Pedagogy for Sustainable Education Transformation: Enhancing Learner-Centred Learning in the Digital Era. *Frontiers of Digital Education*, 1(4), 279–294. <https://doi.org/10.1007/s44366-024-0031-x>
- Järvelä, S., Nguyen, A., & Hadwin, A. (2023). Human and artificial intelligence collaboration for socially shared regulation in learning. *British Journal of Educational Technology*, 54(5), 1057–1076. <https://doi.org/10.1111/bjet.13325>
- Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeffer, J., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. *Learning and Individual Differences*, 103, 102274. <https://doi.org/10.1016/j.lindif.2023.102274>
- Katsenou, R., Kotsidis, K., Papadopoulou, A., Anastasiadis, P., & Deliyannis, I. (2025). Beyond Assistance: Embracing AI as a Collaborative Co-Agent in Education. *Education Sciences*, 15(8), 1006. <https://doi.org/10.3390/educsci15081006>
- Kundu, A., Bej, T., & Mondal, R. (2025). Exploring teachers' AI literacy: cognitive, pedagogical, ethical, and contextual insights from Indian schools. *Teaching Education*. <https://doi.org/10.1080/10476210.2025.2570227>
- Lameras, P., & Arnab, S. (2022). Power to the Teachers: An Exploratory Review on Artificial Intelligence in Education. *Information (Switzerland)*, 13(1), 14. <https://doi.org/10.3390/info13010014>
- Liu, Y., & Shang, J. (2025). Charting Diverse Pathways to AI Empowerment Among Teachers: A Multi-Case Study in Chinese K-12 Education. *International Journal of Chinese Education*, 14(3), 2212585X251408661. <https://doi.org/10.1177/2212585X251408661>
- Lucas, M., & Vicente, P. N. (2023). A double-edged sword: Teachers' perceptions of the benefits and challenges of online teaching and learning in higher education. *Education and Information Technologies*, 28(5), 5083–5103. <https://doi.org/10.1007/s10639-022-11363-3>

- Marzi, G., Balzano, M., Caputo, A., & Pellegrini, M. M. (2025). Guidelines for Bibliometric-Systematic Literature Reviews: 10 steps to combine analysis, synthesis and theory development. *International Journal of Management Reviews*, 27(1), 81–103. <https://doi.org/10.1111/ijmr.12381>
- Melisa, R., Ashadi, A., Triastuti, A., Hidayati, S., Salido, A., Luansi Ero, P. E., Marlina, C., Zefrin, Z., & Al Fuad, Z. (2025). Critical Thinking in the Age of AI: A Systematic Review of AI's Effects on Higher Education. *Educational Process: International Journal*, 14, e2025031. <https://doi.org/10.22521/edupij.2025.14.31>
- Milad, M. (2021). Translating constructivism into Pedagogy from philosophy to practice: Active project-based learning. *International Journal of Humanities Education*, 19(1), 39–51. <https://doi.org/10.18848/2327-0063/CGP/V19I01/39-51>
- Mouta, A., Torrecilla-Sánchez, E. M., & Pinto-Llorente, A. M. (2025). Comprehensive professional learning for teacher agency in addressing ethical challenges of AIED: Insights from educational design research. *Education and Information Technologies*, 30(3), 3343–3387. <https://doi.org/10.1007/s10639-024-12946-y>
- Nazaretsky, T., Ariely, M., Cukurova, M., & Alexandron, G. (2022). Teachers' trust in AI-powered educational technology and a professional development program to improve it. *British Journal of Educational Technology*, 53(4), 914–931. <https://doi.org/10.1111/bjet.13232>
- Omodan, B. I. (2025). Redefining the role of supervisors in the era of artificial intelligence: implications for hybrid postgraduate research governance. *Cogent Education*, 12(1), 2536534. <https://doi.org/10.1080/2331186X.2025.2536534>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., & Moher, D. (2021). Updating guidance for reporting systematic reviews: development of the PRISMA 2020 statement. *Journal of Clinical Epidemiology*, 134, 103–112. <https://doi.org/10.1016/j.jclinepi.2021.02.003>
- Peters, M. A., & Green, B. J. (2024). Wisdom in the Age of AI Education. *Postdigital Science and Education*, 6(4), 1173–1195. <https://doi.org/10.1007/s42438-024-00460-w>
- Putera, P. B., Suryanto, S., Ningrum, S., Widianingsih, I., & Rianto, Y. (2022).

- Increased Number of Scopus Articles from Indonesia from 1945 To 2020, an Analysis of International Collaboration, and a Comparison with other Asean Countries from 2016 to 2020. *Science Editing*, 9(1), 62–68. <https://doi.org/10.6087/KCSE.265>
- Shah, M., & Sureja, N. (2025). A Comprehensive Review of Bias in Deep Learning Models: Methods, Impacts, and Future Directions. *Archives of Computational Methods in Engineering*, 32(1), 255–267. <https://doi.org/10.1007/s11831-024-10134-2>
- Shahriar, S., Allana, S., Hazratifard, S. M., & Dara, R. (2023). A Survey of Privacy Risks and Mitigation Strategies in the Artificial Intelligence Life Cycle. *IEEE Access*, 11, 61829–61854. <https://doi.org/10.1109/ACCESS.2023.3287195>
- Shahzad, S. A., Raza, M. M., Malhi, S. D., Qurat ul Ain, & Malhi, D. K. (2025). Integrating Artificial Intelligence To Foster Critical Thinking And Problem-Solving In 21st-Century Classrooms. *Research Journal for Social Affairs*, 3(5), 635–648. <https://doi.org/10.71317/rjsa.003.05.0362>
- Shardey, E., Nabi, F., & Vortia, W. (2025). Teacher Readiness for AI and Digital Tools in K-12 Classrooms: A Review of Professional Development Trends and Gaps. *International Journal For Multidisciplinary Research*, 7(5), 17. <https://doi.org/10.36948/ijfmr.2025.v07i05.55119>
- Shin, D., Rasul, A., & Fotiadis, A. (2022). Why am I seeing this? Deconstructing algorithm literacy through the lens of users. *Internet Research*, 32(4), 1214–1234. <https://doi.org/10.1108/INTR-02-2021-0087>
- Strielkowski, W., Grebennikova, V., Lisovskiy, A., Rakhimova, G., & Vasileva, T. (2025). AI-driven adaptive learning for sustainable educational transformation. *Sustainable Development*, 33(2), 1921–1947. <https://doi.org/10.1002/sd.3221>
- Taye, M. M. (2023). Understanding of Machine Learning with Deep Learning: Architectures, Workflow, Applications and Future Directions. *Computers*, 12(5). <https://doi.org/10.3390/computers12050091>
- Tewari, S., & Chitnis, A. (2024). AI and Multi-Cloud Compliance: Safeguarding Data Sovereignty. *IRE Journals*, 7(7), 1–18. <https://www.researchgate.net/publication/391810525>
- Ungerer, L., & Slade, S. (2022). Ethical Considerations of Artificial Intelligence in Learning Analytics in Distance Education Contexts. In *SpringerBriefs in Open*

and Distance Education (pp. 105–120). Springer. https://doi.org/10.1007/978-981-19-0786-9_8

- Velander, J., Taiye, M. A., Otero, N., & Milrad, M. (2024). Artificial Intelligence in K-12 Education: eliciting and reflecting on Swedish teachers' understanding of AI and its implications for teaching & learning. *Education and Information Technologies*, 29(4), 4085–4105. <https://doi.org/10.1007/s10639-023-11990-4>
- Watts, K. J. (2025). Paying the Cognitive Debt: An Experiential Learning Framework for Integrating AI in Social Work Education. *Education Sciences*, 15(10), 1304. <https://doi.org/10.3390/educsci15101304>
- Whittaker, J. A., & Montgomery, B. L. (2022). Advancing a cultural change agenda in higher education: issues and values related to reimagining academic leadership. *Discover Sustainability*, 3(1), 10. <https://doi.org/10.1007/s43621-022-00079-6>
- Wiklund, J. (2022). Working in Bed—A Commentary on “Automation, Algorithms, and Beyond: Why Work Design Matters More than Ever in a Digital World” by Parker and Grote. *Applied Psychology*, 71(4), 1210–1214. <https://doi.org/10.1111/apps.12261>
- 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 Environments*, 11(1), 28. <https://doi.org/10.1186/s40561-024-00316-7>
- Zhang, J., & Rhee, G. S. (2025). *AI Ethics Knowledge Among Chinese Teachers: An Empirical Assessment*. <https://www.researchsquare.com/article/rs-7042877/v1>