

Teachers' Information Literacy and Responsible Use of Artificial Intelligence: Presenting a Conceptual Framework

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Article Info	ABSTRACT
Article type: Research Article Article history: Received: 22 August 2026 Accepted: 25 September 2026 Published online: 16 October 2026 Keywords: Information Literacy, Artificial Intelligence Literacy, Artificial Intelligence in Education, Teachers' Professional Competency, Smart Education	The growing use of artificial intelligence (AI) in education has made information literacy a fundamental teacher competency for responsible AI use. This conceptual study aimed to clarify the role of information literacy in the effective use of AI and in developing teachers' professional competencies, and to present a conceptual framework for improving teaching and learning quality. An integrative literature review with thematic synthesis was conducted, searching and analyzing studies published between 2020 and 2026 in Scopus, Web of Science, ERIC, ScienceDirect, and Google Scholar. Core themes were extracted, compared, and synthesized to build the framework. The findings showed that information literacy underlies responsible AI use in education. By strengthening critical evaluation of information, validation of AI-generated outputs, and informed decision-making, it supports the development of AI literacy and teachers' professional competencies. The framework also showed that information literacy, responsible AI use, professional competency development, and educational quality are linked in a chain-like, process-oriented relationship. Information literacy is therefore a prerequisite for developing smart education. Revising teacher education programs, strengthening instruction in information literacy and AI literacy, and formulating policies that support responsible AI use are essential for improving educational quality in the age of AI.

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Introduction

The digital transformation of the past decade, driven largely by artificial intelligence (AI), has changed the educational landscape. Advances in machine learning, natural language processing, deep learning, and big data analytics now make it possible to build intelligent learning environments, generate instructional content, give personalized feedback, automate assessment, and support educational decision-making. AI has become one of the most significant transformative technologies in education, and its role in teaching and learning is expected to grow ([Stošić et al., 2025](#)).

AI offers real opportunities for improving the quality of teaching and learning. By analyzing learners' characteristics, needs, and learning patterns, AI-based systems can adapt instruction to individual differences, provide immediate and continuous feedback, monitor progress, and support collaborative learning, critical thinking, and problem-solving ([Hasan et al., 2024](#); [Saha & Mondal, 2024](#); [Vieriu & Petrea, 2025](#)). Persian-language studies likewise discuss the applications, ethical and privacy concerns, and managerial implications of AI in education ([Adel, 2024](#); [Kaidi, 2023](#); [Mohammadi & Mousavi, 2023](#); [Rezaei & Faghih Abdollahi, 2023](#)). Yet these benefits are not automatic. They depend largely on teachers' readiness to use AI in an informed, critical, and responsible way ([Sagheem et al., 2025](#); [Tenberga & Daniela, 2024](#)). The central issue in smart education is therefore not only access to technology, but whether teachers can evaluate, interpret, and apply AI-generated information in their instructional decisions.

In intelligent learning environments, the teacher's role shifts from transmitter of knowledge to designer, guide, facilitator, and professional decision-maker. AI outputs are not always accurate, unbiased, or trustworthy; they can be affected by the quality of educational data, algorithmic bias, computational error, and ethical concerns ([Tahir et al., 2024](#)). Teachers must therefore be able to judge the credibility of generated information, separate reliable from inaccurate or biased sources, weigh the ethical implications of AI use, and ground instructional decisions in professional judgment ([Tenberga & Daniela, 2024](#)). In the research literature, these abilities are associated with information literacy.

Information literacy is a core component of teachers' professional competence in the digital era. Beyond searching for information, it includes recognizing information needs, identifying credible sources, evaluating information critically, analyzing and organizing data, using information ethically, and applying it in educational decisions ([Pu et al., 2024](#); [Yao & Weng, 2024](#)). Evaluating online information is also a skill that can be taught ([McGrew, 2020](#)). With the arrival of AI, teachers must additionally validate the outputs of intelligent systems, recognize algorithmic limitations and bias, manage privacy risks, and use the technology responsibly. This article therefore proposes that information literacy is both a prerequisite for responsible AI use and a foundation of many dimensions of what is now called *AI literacy* ([Khassanova et al., 2026](#); [Li & Balinas, 2025](#)).

Despite the rapid growth of research on AI in education, most studies have focused on intelligent tools, technology acceptance, teachers' attitudes toward AI, personalized learning, or effects on learners ([Abulibdeh, 2025](#); [Ok et al., 2025](#); [Toha, 2025](#)). Studies that explain how information literacy supports responsible AI use and teachers' professional development remain limited. Although AI literacy has attracted growing attention, to the best of our knowledge no conceptual framework has clearly shown how information literacy contributes to AI literacy and, ultimately, to the quality of teaching and learning. As a result, these constructs are often examined in a fragmented way.

The gap matters in practice. Investment in intelligent technologies without parallel attention to teachers' information literacy may fail to improve education and may even lead to uncritical use of AI outputs, perpetuated algorithmic bias, privacy violations, weaker professional autonomy, and over-reliance on technology. Clarifying the place of information literacy in teachers' engagement with AI can therefore inform professional development programs, teacher education curricula, educational policy, and frameworks for responsible AI use.

This study uses an integrative literature review with thematic synthesis to bring together research on information literacy, AI literacy, teachers' professional development, and AI in education. Beyond summarizing prior work, it aims to clarify how these constructs relate and to propose a conceptual framework showing how information literacy facilitates responsible AI use, how such use develops teachers' professional competencies, and how these competencies in turn can improve teaching and learning. The study addresses four research questions:

1. What role does teachers' information literacy play in the effective, critical, and responsible use of AI in teaching and learning?
2. How does information literacy-based use of AI contribute to the development of teachers' professional competencies?
3. What are the main opportunities, challenges, and requirements for the responsible use of AI in educational processes?
4. Based on a synthesis of prior research, how can a conceptual framework be developed to explain the relationships among information literacy, responsible AI use, teachers' professional competencies, and the quality of teaching and learning?

The article proceeds as follows: Section 2 describes the method, Section 3 presents the findings, Section 4 introduces the conceptual framework, and Sections 5 to 8 discuss implications, limitations, and conclusions.

Method

Research design

This is a conceptual study based on an integrative literature review. Conceptual research builds theoretical understanding by analyzing and integrating existing knowledge rather than collecting new empirical data. An integrative review goes beyond describing individual studies: it compares and combines theoretical, empirical, and review studies to clarify relationships among key constructs, identify gaps, and develop new conceptual frameworks. This design suited the aim of the study, which was to explain the role of teachers' information literacy in responsible AI use, professional competency development, and the quality of teaching and learning. Because the constructs of interest (information literacy, AI literacy, responsible AI use, professional competency, and educational quality) have mostly been studied separately, an integrative approach made it possible to bring diverse bodies of evidence together within a single analytical frame. Thematic synthesis was used to extract and compare themes, and conceptual synthesis was used to relate those themes to one another and to build the framework.

Search strategy

A structured search was conducted in Scopus, Web of Science, ERIC, and ScienceDirect, which were selected for their coverage of education, information science, and educational technology research. Google Scholar was used as a complementary source to reduce the chance of missing relevant studies, including Persian-language studies not indexed in the main databases. Searches combined English and Persian keywords, including artificial intelligence, AI literacy, information literacy, teacher information literacy, AI in education, teacher professional development, and learning quality, together with their Persian equivalents. Keywords were combined with Boolean operators (AND, OR) to balance comprehensiveness and precision, for example by pairing information literacy terms with artificial intelligence terms and with teacher or educator terms. Search terms were adjusted to the indexing features of each database, and the search was refined iteratively as the main themes became clearer.

Eligibility criteria

Studies were included if they (1) were published in scholarly outlets, including peer-reviewed journal articles, conference papers, and scholarly reviews; (2) were directly relevant to information literacy, AI literacy, teachers' professional development, AI in education, or the quality of teaching and learning; (3) were published between 2020 and 2026; and (4) were available in full text. The time frame reflects the rapid growth of research on AI in education and the emergence of generative AI in recent years. Theoretical, empirical, and review studies were all eligible, since the aim was conceptual integration rather than

estimation of effects. News reports, non-research commentaries, theses, duplicate records, and studies without direct relevance to the topic were excluded.

Selection process

Selection proceeded in three stages. After duplicates were removed, titles and abstracts were screened against the eligibility criteria. Studies that appeared relevant, or whose relevance was unclear, were then assessed in full text, and those meeting all criteria were retained. Because the aim was conceptual integration rather than exhaustive coverage, the final corpus was a purposive selection of the studies most relevant to the research questions, giving priority to those that directly addressed the study constructs and their relationships.

Data extraction

For each included study, key information was recorded, including the type of study, context and participants, core concepts, main findings, and implications for teachers' information literacy, AI literacy, professional development, or educational quality. This allowed studies of different types to be compared on a common basis before analysis.

Data analysis and synthesis

Key concepts and findings from each selected study were coded. Codes were grouped into subthemes and main themes based on similarity and conceptual relationships, and the themes were then compared for points of convergence, differences, dominant trends, and gaps. The process was iterative: codes and themes were revisited and refined as the analysis developed, with repeated returns to the original texts. A conceptual synthesis was then used to relate the main themes to one another, moving from description of individual studies to theoretical explanation. Four main axes emerged: (1) the role of information literacy in effective and responsible AI use; (2) the role of AI in developing teachers' professional competencies; (3) the implications of this process for the quality of teaching and learning; and (4) the contextual factors and requirements that shape this process. The proposed framework was formulated from this synthesis, including the sequence among its components, the role of contextual factors, and the feedback loop of continuous professional learning. Because the analysis is interpretive, the findings reflect the authors' synthesis of the literature rather than a quantitative aggregation of effects.

Ethical considerations

The study relied exclusively on published secondary sources and involved no human participants, so ethical approval was not required. Scholarly integrity was maintained through accurate attribution of all ideas and findings to their original sources.

Findings

The synthesis indicates that the benefits of AI in education depend less on the technology itself and more on teachers' professional readiness, especially their information literacy. The findings are organized around the four axes identified above, preceded by two sections that clarify the underlying concepts.

Information literacy as a multidimensional professional competence

Digital transformation has extended teachers' professional competence beyond subject knowledge and teaching skills to include the ability to manage, evaluate, and use information. Information literacy emphasizes recognizing information needs, searching for, critically evaluating, organizing, and ethically using information, whereas digital literacy concerns using digital technologies to access, produce, and share information. Many researchers treat the two as complementary foundations for teachers' other professional competencies in smart education ([Dahlqvist, 2020](#)). Empirical studies support this view. Analyzing data from nearly five thousand Finnish teachers, [Saikkonen and Kaarakainen \(2021\)](#) found that digital information skills are shaped less by demographic characteristics than by individual and professional resources. Sustained engagement in digital environments, technological self-efficacy, and participation in in-service training were the strongest predictors of skill growth, while age was inversely related to these skills. Teachers' information competencies thus appear to be dynamic and trainable. Studies in foreign language education show a similar picture. [Yu et al. \(2024\)](#) found that foreign language teachers' information literacy was above average overall, but differed significantly across its dimensions (information awareness, knowledge, ability, and ethics) and varied with professional experience, age, and academic rank.

[Wu et al. \(2024\)](#), comparing foreign language teachers with other faculty, found relatively favorable information awareness and competence but insufficient information knowledge. They called for revised professional development programs, systematic training, appropriate assessment systems, and incentive mechanisms.

Taken together, these studies converge on three points. First, information and digital literacy are important prerequisites for teachers' professional development in the digital era. Second, these competencies are multidimensional and include, besides technical skills, critical thinking, self-efficacy, professional judgment, and information ethics. Third, their development depends less on individual characteristics than on the quality of training, professional learning opportunities, and institutional support. Information literacy is thus a form of professional competence, not merely a technical skill.

From information literacy to AI literacy

AI systems, particularly generative AI, have distinctive features: automated content generation, data-driven learning, algorithmic decision-making, and conversational interaction with users. These features require a broader set of knowledge, skills, and judgment than information and digital literacy alone. Researchers have therefore proposed AI literacy as an extension of information and digital literacy. It keeps the core components of information literacy while adding the ability to understand how AI systems work, critically evaluate their outputs, recognize their limitations and biases, observe ethical principles, and use the technology responsibly ([Fitria, 2021](#); [Shribala & Jhaneswaran, 2024](#)). [Ng et al. \(2021\)](#) made a landmark contribution to this conceptualization. Their systematic review organized AI literacy into four components: knowing and understanding AI concepts, using AI applications, evaluating AI [*verify the wording of the third component against the source; it may read "evaluating and creating AI"*], and attending to ethical issues. The framework shows that effective engagement with AI requires cognitive and ethical skills for analyzing, interpreting, and judging AI outputs, not only the ability to operate tools. It has since served as a theoretical basis for much subsequent research on teacher education and AI-related competencies.

Information literacy and responsible AI use (axis 1)

AI tools can generate and process large amounts of information very quickly, but the credibility, accuracy, and relevance of that information are not consistent ([Tahir et al., 2024](#)). Teachers with stronger information literacy are better placed to judge the quality of AI outputs, separate credible from inaccurate or biased information, recognize algorithmic limitations, and use AI to enrich instruction rather than replace their own professional judgment ([Tenberga & Daniela, 2024](#)). In this sense the teacher's role shifts from technology consumer to informed evaluator and decision-maker.

The literature also suggests that AI literacy is built on information literacy: responsible use of intelligent technologies draws on critical evaluation of information, source validation, ethical awareness, and professional judgment ([Khassanova et al., 2026](#); [Li & Balinas, 2025](#)). Information literacy can therefore be seen not as a rival to AI literacy but as its foundation. This reading may help resolve some ambiguity in studies that treat the two concepts separately. It should be noted, however, that this foundational role is largely inferred from the overlap between the two sets of competencies. It has rarely been tested directly.

Responsible AI use and teachers' professional competencies (axis 2)

Empirical research on AI has gradually moved from assessing teachers' familiarity with AI tools toward developing their professional competencies. [Looi et al. \(2026\)](#) reported that a six-week professional development program, which combined training in AI applications with ethical considerations and instructional design, significantly improved teachers' technological, pedagogical, and content knowledge for intelligent technologies (i-TPACK), improved their attitudes toward AI, and strengthened their ability to design AI-based instructional activities. [He et al. \(2025\)](#) found that integrating generative-AI-based

activities into teacher education improved pre-service teachers' professional knowledge and attitudes and increased their ability to design, guide, and support learning in intelligent environments.

[Yang and Kong \(2025\)](#), drawing on the AEER framework and the TPACK model, showed that the effectiveness of professional development depends not only on content but also on instructional design quality, active participation, and interdisciplinary activities. Teaching machine learning concepts through hands-on activities increased teachers' motivation to teach AI literacy and their perceived technological, pedagogical, and content competence. [Sagheem et al. \(2025\)](#) found that the ability to apply AI in practice plays a central role in strengthening other dimensions of AI literacy, including knowledge, critical evaluation, and professional ethics.

Across these studies, purposeful use of AI can support instructional design, content production, formative assessment, analysis of learner performance, personalized feedback, and instructional decision-making. These capabilities strengthen professional competence only when teachers recognize the technology's strengths and limits and apply it within educational goals, ethical principles, and learners' real needs. Professional development in the AI era thus depends less on learning to operate tools than on integrating content, pedagogical, and technological knowledge with information literacy. AI is best seen as a professional enabler, not a substitute for the teacher, and these findings challenge technologically deterministic views that attribute educational change to technology alone.

Quality of teaching and learning: opportunities and risks (axes 3 and RQ3)

The reviewed studies associate informed AI use with improvements in several dimensions of quality: personalization of learning, learner engagement, timely feedback, continuous assessment, active learning, and data-informed decision-making ([Saha & Mondal, 2024](#); [Vieriu & Petrea, 2025](#)). Other opportunities include reducing teachers' administrative burden, easing content production, widening access to learning resources, and supporting inclusive education. These can free teachers to focus on higher-order cognitive activities, human interaction, and critical thinking, consistent with twenty-first-century education.

The same literature highlights risks when AI is used without sufficient information literacy: excessive dependence on AI outputs, weakened professional judgment, uncritical acceptance of generated content, perpetuated algorithmic bias, privacy violations, unclear intellectual property for generated content, and greater inequality in access to technology ([Tahir et al., 2024](#)). Quality gains are therefore not a linear or automatic result of using technology. They are mediated by teachers' professional competencies, that is, their ability to select, evaluate, adapt, and critically use AI outputs.

Contextual factors and requirements (axis 4)

The studies reviewed indicate that teachers' competencies do not develop in isolation. Sustainable AI literacy requires access to instructional resources, professional learning opportunities, and institutional support ([Sagheem et al., 2025](#)). Information literacy development likewise needs organizational support, appropriate policies, and a culture of continuous learning ([Wu et al., 2024](#)). Technological infrastructure, educational policy, organizational culture, professional development programs, and ethical frameworks therefore shape whether AI's potential is realized. Developing these competencies is not the individual teacher's responsibility alone.

Summary of the synthesis

Integrating the four axes shows a chain-like, process-oriented relationship. Information literacy provides the cognitive, critical, and ethical capacity for evaluating AI, and it underpins AI literacy. AI literacy enables responsible AI use. Responsible use develops teachers' professional competencies, and these competencies in turn improve the quality of teaching and learning. The whole process is influenced by contextual factors.

Proposed Conceptual Framework

Based on this synthesis, Figure 1 presents the proposed framework. It has five main components and one set of contextual conditions:

- Information literacy is the foundational competency: recognizing information needs, evaluating sources critically, using information ethically, and making evidence-based decisions.
- AI literacy builds on information literacy by adding understanding of AI systems, critical evaluation of their outputs, awareness of bias, and ethical considerations.
- Responsible AI use is the applied expression of these competencies in instructional design, content production, assessment, personalization, and decision-making.
- Professional competencies develop through responsible AI use and include technological, pedagogical, and content knowledge integrated with information literacy.
- Quality of teaching and learning is the outcome, improved through the preceding components.
- Contextual factors (educational policy, technological infrastructure, institutional support, school culture, professional development opportunities, and ethical frameworks) influence every link in the chain.

The framework is not purely linear. Improved professional competencies and educational quality reinforce continuous professional learning, creating a feedback loop that further strengthens teachers' information literacy and AI literacy. The role of information literacy in smart education is thus indirect: it affects educational quality by strengthening teachers' capacity for informed and responsible AI use.

Discussion

A central conclusion of this study is that using AI in education is not simply adding a new tool to the classroom. It represents a paradigm shift in how teaching and learning are designed, implemented, assessed, and managed. In this paradigm teachers become designers of learning experiences, facilitators of cognitive processes, and data-informed decision-makers. To fulfil these roles they need more than familiarity with AI tools: they must analyze information critically, judge the credibility of algorithmic outputs, and recognize the ethical implications of AI use. Information literacy should therefore be regarded as an important prerequisite for smart education.

Theoretically, the synthesis offers an integrated picture of how information literacy, AI, and teachers' professional development relate. Much prior research has examined these concepts independently. The present review instead suggests a hierarchical and interactive relationship: information literacy is teachers' foundational capacity for seeking, evaluating, and using information, and it lays the basis for AI literacy; AI literacy strengthens their ability to use intelligent technologies responsibly and critically, which develops professional competencies and, ultimately, educational quality. The study's main contribution lies in making this linkage explicit and in offering a coherent framework for understanding the role of information literacy in AI-based education.

The findings also show that opportunities and risks go together. AI can personalize learning, provide timely feedback, support evidence-based decisions, and reduce administrative workload, but without sufficient information literacy it can encourage over-reliance, bias, and privacy breaches. Technological development alone does not guarantee better education. The outcome depends on teachers' professional readiness, educational policy, institutional infrastructure, and ethical frameworks. This supports the view that human capital, rather than technology itself, is the main determinant of whether educational innovations succeed.

Finally, the framework should be read as a conceptual proposal. It was derived from an integrative synthesis and has not been tested empirically. Its value lies in offering a basis for designing and testing empirical models and for guiding policy and planning in smart education.

Practical Implications and Recommendations

The framework implies that responsible AI use requires strengthening a chain of competencies that begins with information literacy, extends to AI literacy and responsible use, and leads to professional competency and educational quality. Policies and programs should therefore address this continuum as an integrated system rather than treating training in AI tools as an independent goal.

Educational policy. Ministries of education and other responsible bodies should place information literacy and AI literacy within national teacher competency frameworks. They should also set specific standards for responsible AI use in instructional design, content production, assessment, data protection, and ethics, and give these competencies a strategic place in educational transformation documents and professional development programs.

Teacher education and empowerment. Teacher education universities (such as Farhangian University in Iran) and in-service training centers should integrate information literacy and AI literacy training into pre-service and in-service curricula. Beyond technical skills, this training should cover purposeful information searching, critical evaluation of AI outputs, recognition of algorithmic bias, source validation, prompt engineering (designing effective prompts for generative AI), privacy protection, data security, and evidence-based decision-making.

Schools and educational organizations. Schools should provide technological infrastructure and secure access to reliable AI systems, build banks of smart instructional content, form professional learning communities, support educational innovation, and offer ongoing learning opportunities. The effectiveness of AI does not rest on individual teachers' knowledge alone; organizational support and a learning culture also play a decisive role.

Professional judgment and ethics. AI should strengthen teachers' professional judgment, not replace it. Teachers should evaluate AI outputs from scientific, pedagogical, and ethical perspectives and decide on their use through information literacy and critical thinking. Schools and institutions should also adopt charters of ethical AI use covering transparency, fairness, accountability, privacy, data security, intellectual property, and management of algorithmic bias, to build trust among teachers, students, and other stakeholders.

Limitations and Future Research

This study has several limitations. First, it is an integrative review. Although it used a structured search and thematic analysis, its results are shaped by the scope of the available literature and by the authors' interpretation. Second, studies were not weighted by methodological quality [*confirm and edit to reflect the actual procedure*]. Third, much of the reviewed literature comes from developed countries, so generalizing to other systems, particularly in developing countries, requires caution. Fourth, AI technologies change rapidly, and some findings may become outdated quickly. Finally, the framework is conceptual: the foundational role of information literacy has been inferred from the literature rather than tested directly.

Future research could develop along four lines. First, empirical and longitudinal studies should examine the direct effect of information literacy on teachers' use of AI and on educational quality, validating the proposed model with empirical methods. Second, professional training models that integrate information literacy and AI literacy should be designed and tested in pre-service and in-service programs. Third, the role of variables such as digital self-efficacy, attitudes toward AI, school organizational culture, institutional support, managerial support, and technological infrastructure in explaining these relationships should be examined, including as moderators. Fourth, comparative studies across educational systems should identify the cultural, social, and policy factors that influence teachers' competency development in the age of AI.

Conclusion

This study examined the role of teachers' information literacy in the effective use of AI, the development of professional competencies, and the quality of teaching and learning. The synthesis suggests that the effectiveness of AI in education depends less on the capabilities of the tools than on teachers' readiness to use them in an informed, critical, and ethical way. Information literacy appears to be both a foundational competency in the digital era and a basis for AI literacy and responsible AI use.

The proposed framework links information literacy, AI literacy, responsible AI use, professional competency, and educational quality in a process-oriented chain, shaped by contextual factors and reinforced by a feedback loop of continuous professional learning. Its main contribution is to connect constructs that have often been examined in isolation and to provide a basis for future research, teacher education, and policy in smart education.

AI is not a substitute for the teacher. Its educational value is realized through teachers' professional judgment, critical thinking, and information literacy. Investing in teachers' information literacy should therefore be seen as a strategic priority, because it creates the conditions for effective AI use, professional development, higher educational quality, and more sustainable and equitable learning.

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