

AI Literacy and Teachers' Digital Competencies

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Abstract:

Artificial intelligence (AI) is increasingly transforming teaching practices, learning processes, and the production of digital educational resources, creating the need for teachers to develop competencies that go beyond the instrumental use of technological tools. This study analyzes AI literacy and the pedagogical competencies associated with the use of AI among teachers participating in an applied training experience. A mixed-method, descriptive study was conducted with 46 teachers who took part in the course-workshop AI for Teachers: Transforming Education, held in May 2026 at the Cuetzalan campus of the Benemérita Universidad Autónoma de Puebla, Mexico. The training experience included activities involving information search and organization, content generation, instructional planning, and the design of educational materials using different AI tools. The analysis focused on four interconnected dimensions of AI literacy: understanding and awareness, practical use, pedagogical integration, and critical and responsible use. The findings indicate that sustained practical experience contributed to greater familiarity with AI tools and to more intentional forms of use linked to academic and professional purposes. Participants increasingly considered criteria such as relevance, usability, reliability, pedagogical appropriateness, and ethical implications when selecting and applying AI tools. The results also highlight digital material design as a particularly relevant space for integrating technological knowledge, pedagogical judgment, critical evaluation, and ethical responsibility. The study concludes that teacher AI literacy should be understood as an integrated professional competence that enables educators not only to use AI, but also to decide when, how, why, and under what criteria it should be incorporated into educational practice.

Keywords: artificial intelligence literacy; teacher education; digital competencies; artificial intelligence in education; digital educational materials; pedagogical integration

1. Introduction

The integration of artificial intelligence (AI) into education is transforming how teaching, learning, and the production of instructional resources take place. While AI has long been present in specialized applications, it is now extending to specific activities such as information search and organization, content generation, the creation of educational materials, feedback provision, and the personalization of specific learning experiences (Gulen & Kucuk, 2026; Pargmann et al., 2025; Sun & Liu, 2026). This expansion and adoption create a need for educational institutions to prepare teachers and students to use new technologies based on criteria that go beyond mere technical operation (Aleman et al., 2025; Daher, 2025).

Artificial intelligence literacy can be defined as an integrated set of knowledge, skills, and criteria that enable individuals to understand the functioning and capabilities of AI systems, use them appropriately, and critically evaluate their outputs (Deshen et al., 2026; Ning et al., 2026). While related to other forms of contemporary literacy—particularly digital, media, and data literacy—it encompasses specific issues arising from interaction with systems

capable of generating, classifying, recommending, or transforming information (Hachem et al., 2026). Consequently, AI literacy entails more than simply knowing how to use an application or formulate prompts; it also involves recognizing the technology's scope and limitations, scrutinizing the quality of its responses, and making informed decisions regarding its use (Andersson et al., 2026).

We maintain that this form of literacy is particularly important in teacher training. Access to AI tools does not, in itself, guarantee appropriate pedagogical integration. Teachers must learn to select technologies aligned with learning objectives, assess the relevance of generated content, identify potential errors or biases, and determine when their use genuinely contributes to the educational process (Gulen & Kucuk, 2026; Mahala & Chauhan, 2025; Mimoudi & Bouabid, 2026). An ethical dimension—encompassing aspects such as privacy, data processing, transparency, authorship, and the responsible use of artificially generated content—complements these capabilities (Chen & Delaney, 2026; Cruz et al., 2026; Morandín-Ahuerma, 2024a; Morandín-Ahuerma, 2024d). Thus, AI literacy encompasses at least four closely interrelated areas: understanding and awareness of AI, the ability to use it, critical evaluation, and consideration of its ethical implications (Daher, 2025; Gulen & Kucuk, 2026; Ning et al., 2026).

Initial teacher training needs to move beyond general knowledge of AI toward practical experiences in educational integration. University courses—such as the continuing education programs offered by the Benemérita Universidad Autónoma de Puebla (BUAP)—can provide environments where teachers can experiment with these tools, design lesson plans and materials, analyze outcomes, and reflect on the pedagogical decisions involved (Gulen & Kucuk, 2026; Morandín-Ahuerma et al., 2024; Pargmann et al., 2025).

The goal is not to train technical specialists in artificial intelligence, but rather teachers capable of determining which tool to use, its purpose, how to incorporate it into a learning activity, and the criteria by which to evaluate the results (Daher, 2025; Mimoudi & Bouabid, 2026). This need is particularly relevant in the design of digital instructional materials, where the use of AI must be aligned with pedagogical decisions rather than being limited to the automated generation of content (Gulen & Kucuk, 2026; Mahala & Chauhan, 2025).

AI tools enable the rapid production and modification of texts, images, presentations, activities, and other resources; however, the ease of generation does not in itself guarantee educational quality (Aleman et al., 2025). Teacher competence entails transforming these technological possibilities into materials that align with curricular objectives, student characteristics, and instructional design principles, as well as critically evaluating the relevance, reliability, and utility of the resulting products (Andersson et al., 2026; Pargmann et al., 2025).

Consequently, AI literacy and the competence to design digital materials can be viewed as complementary capabilities within a teacher's professional development, insofar as both require the integration of technological knowledge, pedagogical judgment, and criteria for responsible use (Daher, 2025; Mimoudi & Bouabid, 2026; Ning et al., 2026).

2. Literature Review

Research on AI literacy among teachers reveals a rapidly expanding field—particularly given the currency of the literature—that can be organized into four main lines of inquiry: curricular integration, attitudes and perceptions regarding AI, ethical implications, and teacher professional development (Aleman et al., 2025; Daher, 2025; Deshen et al., 2026; Mimoudi & Bouabid, 2026). Early studies focused primarily on understanding how to incorporate these technologies into educational processes and the knowledge required by teachers to do so; over time, the focus has shifted toward broader training models that combine technological, pedagogical, critical, and ethical competencies (Gulen & Kucuk, 2026; Mahala & Chauhan, 2025; Ning et al., 2026).

This evolution is particularly relevant given the expansion of generative artificial intelligence. Current tools enable the production of text, images, and other resources, yet their educational value extends beyond mere content generation: they can be integrated into lesson planning, material development, assessment, and the personalization of specific learning activities (Gulen & Kucuk, 2026; Pargmann et al., 2025; Sun & Liu, 2026).

Literacy programs need to integrate technical knowledge with pedagogical criteria and an understanding of ethical and social implications (Chen & Delaney, 2026; Daher, 2025; Morandín-Ahuerma, 2024a). From this perspective, the aim is for future teachers to develop competencies that enable them to select, use, and evaluate AI technologies in the context of specific educational challenges (Andersson et al., 2026; Gulen & Kucuk, 2026; Mimoudi & Bouabid, 2026).

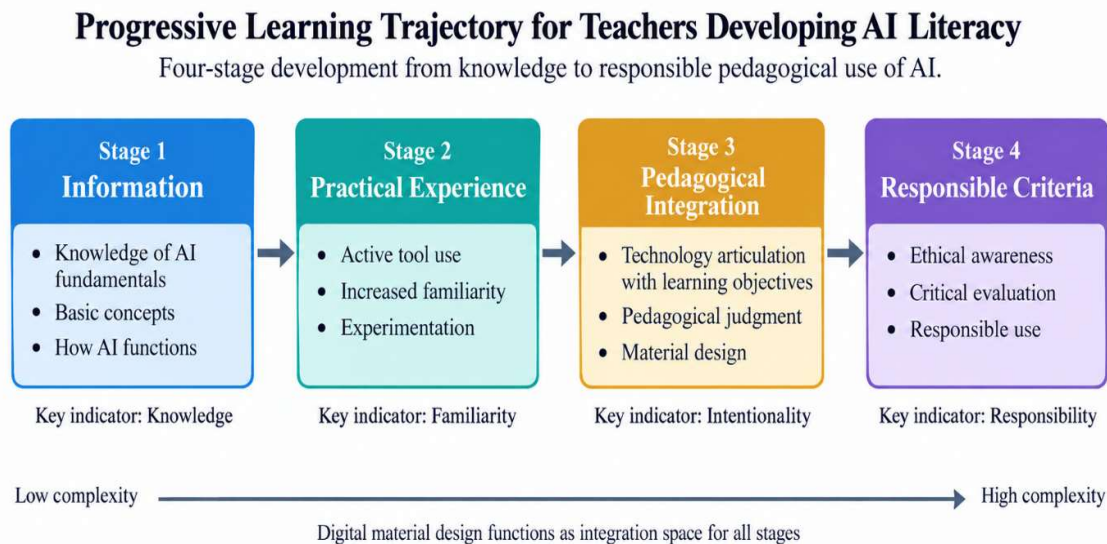
Recent evidence suggests that teachers' characteristics and prior experiences must be taken into account when designing AI-related training experiences. Participants do not start with the same level of technological familiarity, nor do they necessarily possess the same competencies to critically evaluate outputs generated by AI systems. Consequently, it has been noted that training initiatives should be sensitive to participants' initial knowledge and skills, combining practical activities with reflection on the educational use of these technologies (Andersson et al., 2026; Deshen et al., 2026; Pargmann et al., 2025).

AI literacy is also linked to broader digital and techno-pedagogical competencies. Teacher training requires integrating technological knowledge with decisions regarding content, teaching strategies, and student characteristics, ensuring that technical proficiency translates into meaningful pedagogical integration (Gulen & Kucuk, 2026; Mimoudi & Bouabid, 2026; Morandín-Ahuerma et al., 2024). From this perspective, the central issue lies not only in determining whether teachers know how to use AI tools but, above all, in establishing whether they can transform that technological knowledge into well-founded pedagogical decisions.

The relationship between AI literacy and the design of digital instructional materials is a particularly relevant issue for teacher training. While the availability of generative tools facilitates the production of texts, images, and other resources, automated content generation does not in itself guarantee pedagogical relevance. Teachers must be able to assess the alignment between the produced material and learning objectives, evaluate its quality and reliability, make necessary modifications, and consider ethical implications before incorporating it into the educational process (Mahala & Chauhan, 2025; Pargmann et al., 2025; Morandín-Ahuerma, 2024b).

In this context, the design of digital instructional materials offers a suitable setting for analyzing how teachers understand AI, utilize its capabilities, critically evaluate its outputs, and make responsible decisions during the design process. The interplay between AI literacy, techno-pedagogical competence, and the production of educational materials therefore constitutes one of the conceptual pillars of this study.

Figure 1: *Sequence for developing teaching competencies for the educational use of artificial intelligence.*



Note. Prepared by the authors. The figure illustrates a progression from basic knowledge of artificial intelligence and practical experience with its tools to its pedagogical integration and critical, responsible use. The design of digital educational materials serves as a connecting link between the various stages.

3. Case and Methodology

A study with a mixed-methods approach and descriptive scope was conducted to analyze artificial intelligence (AI) literacy and the competencies associated with the pedagogical use of AI tools among teachers participating in an educational technology training initiative. The intervention consisted of an applied workshop—titled "AI for Teachers: Transforming Education"—held by invitation on May 8 and 9, 2026, at the Cuetzalan del Progreso campus of the Northeastern Regional Complex of the Benemérita Universidad Autónoma de Puebla. Forty-six teachers participated, engaging in activities such as information search and organization, content generation, lesson planning, and the creation of educational materials using various AI tools.

Figure 2: Overview of the teacher training workshop on artificial intelligence.



Note. In-person session of the “AI for Teachers: Transforming Education” workshop, featuring hands-on activities to explore and use artificial intelligence tools in a computer lab. The image shows the general working dynamic of the participants during the training experience.

It is important to note that the authors of this study did not participate in the design or delivery of the workshop. Their involvement was limited to analyzing the training experience and the data derived from the teachers' participation. This distinction allowed for the separation of the training function from the research function, thereby reducing potential biases associated with the researchers' direct involvement in the intervention's implementation.

The training design was structured around four dimensions of AI literacy: understanding and awareness, usage capability, critical evaluation, and ethical considerations. Activities prioritized practical application, the analysis of generated outputs, and reflection on their pedagogical relevance, aiming to link tool usage to concrete educational objectives rather than focusing exclusively on technical proficiency. To evaluate the training experience, quantitative and qualitative data regarding the educational use of AI and the design of digital instructional materials were collected. The analysis focused on how participants understood, selected, and utilized the tools, as well as the criteria applied to assess the quality, reliability, and pedagogical relevance of the content produced. Additionally, ethical aspects such as privacy, data security, transparency, authorship, and the responsible use of information were taken into account. The interpretation integrated both sources of evidence, with particular attention to the participants' ability to transform technological knowledge into well-founded pedagogical decisions.

4. Discussion

The results support the argument that the systematic incorporation of artificial intelligence tools into educational technology courses contributes to the development of competencies that go beyond the mere technical operation of these technologies. Teachers' experiences demonstrate that practical training fosters greater familiarity with AI tools and encourages their more intentional use, aligned with academic and professional objectives. This finding is significant because it suggests that AI literacy can be developed in conjunction with the pedagogical competencies required to design educational materials and activities (Gulen & Kucuk, 2026; Pargmann et al., 2025).

One of the most significant aspects is the shift in how participants selected and utilized the tools. Teachers reported considering criteria such as relevance to their specific needs, ease of use, reliability, and the capabilities offered by each application. This result aligns with the concept of AI literacy as a multidimensional competency: it involves not only knowing how to use a tool but also selecting it, evaluating its outputs, and determining its suitability for a specific educational purpose. In this regard, the findings complement the work of Ayanwale et al. (2024)—who linked AI literacy to knowledge, ethical awareness, and problem-solving—and Yi and Siquan (2025), who highlighted its relationship with self-efficacy and the intention to use these technologies.

A second finding relates to the development of ethical awareness. There is increased attention to issues concerning privacy, data security, transparency, information reliability, and the responsible use of AI systems. This is particularly important in initial teacher training, as decisions regarding the use of these technologies impact students and the content integrated into the educational process. Therefore, AI training must explicitly incorporate an analysis of the ethical implications associated with their use (Morandín-Ahuerma, 2024a; Morandín-Ahuerma, 2024d). The results also highlight the importance of the practical and sustained nature of the training experience. Teachers did not merely receive information about AI; they utilized various tools to produce materials and complete tasks related to educational scenarios (Pargmann et al., 2025; Morandín-Ahuerma et al., 2024).

Collaborative work in small groups and individual access to computing equipment fostered an environment where AI knowledge could be transformed into applied experience. This feature distinguishes the model under study from approaches focused exclusively on measuring knowledge, attitudes, or intentions to use the technology. While research such as that by Erdem-Coşgun (2025) has examined specific AI applications in assessment, the current results suggest the value of studying AI within pedagogical experiences where future teachers must produce, select, evaluate, and revise concrete materials.

The study's findings can be interpreted through the relationship between AI literacy and technopedagogical competence. The use of artificial intelligence tools derives educational value not merely from the capacity to generate content, but from how teachers select, adapt, evaluate, and utilize those outputs in alignment with specific learning objectives. This interpretation aligns with research highlighting the need to move beyond a purely instrumental mastery of AI toward more critical and contextualized forms of pedagogical integration (Daher, 2025; Gulen & Kucuk, 2026; Mimoudi & Bouabid, 2026).

The training experience can also be understood as a process in which the design of digital materials serves as a practical application of AI literacy. When teachers create educational resources with AI support, they must assess the tool's efficiency as well as the quality, relevance, and reliability of the generated content. This fosters the integration of technological knowledge and pedagogical judgment—a relationship highlighted in studies on teacher training and AI-supported instructional design (Gulen & Kucuk, 2026; Pargmann et al., 2025; Morandín-Ahuerma et al., 2024).

Finally, the ethical dimension is an integral part of the process of integrating AI into education. Issues such as privacy, transparency, authorship, reliability, and the responsible use of information must be considered alongside technical and pedagogical aspects. Consequently, AI literacy geared toward teaching practice should promote the ability to use tools, while evaluating their implications and establishing criteria for their responsible use in educational contexts (Chen & Delaney, 2026; Hachem et al., 2026; Morandín-Ahuerma, 2024a).

5. Conclusion

Literacy in artificial intelligence must be understood as an integrated professional competence that goes beyond the instrumental use of technological tools. In teacher training, its relevance lies in the fact that it requires combining understanding of AI, ability to use it, critical evaluation and consideration of its ethical implications. The results of

this work show that a practical training experience can help teachers become familiar with different applications, and develop criteria to select them, evaluate their results and use them with a defined pedagogical purpose.

Likewise, the design of digital teaching materials appears as a particularly pertinent space to develop and observe these competencies. Producing content with AI support does not, by itself, guarantee its educational quality; It is necessary to analyze its coherence with the learning objectives, review its reliability, detect possible errors or biases and consider aspects such as privacy, transparency, authorship and responsible use. For this reason, we consider that the integration of AI in educational technology courses offers a concrete way to link technological knowledge with pedagogical decision-making.

Finally, we consider that teacher training in artificial intelligence should not be limited to technical learning of tools, but rather be oriented towards the development of professionals capable of deciding when, how, for what and under what criteria to incorporate them into educational processes. This integration requires articulating technological, pedagogical, critical and ethical competencies, especially when AI is used to design learning materials and activities. Future research should expand this type of experiences in different institutional contexts and disciplines, as well as analyze in greater depth the pedagogical quality of the materials produced and the permanence of these competencies over time.

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