Making Thinking Visible in Initial Secondary Teacher Education. AI as a Pedagogical Mediation Environment for Metacognition, Emotion, and Transversal Competences

Rendere visibile il pensiero nella formazione iniziale degli insegnanti della scuola secondaria. L'intelligenza artificiale come ambiente di mediazione pedagogica per la metacognizione, le emozioni e le competenze trasversali

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The article aims to explore a distinctive pedagogical perspective within initial teacher education for secondary schools, focusing on the use of artificial intelligence as a mediating environment to support metacognition, reflective practice, and the development of transversal competences. This perspective, although still emerging and embedded in institutional and cultural contexts partly different from traditional models of teacher preparation, allows the identification of strong pedagogical paradigms capable of consistently connecting theory and practice, cognition and emotion, creativity and responsibility, individual professional growth and educational communities.

KEYWORDS: TEACHER EDUCATION; ARTIFICIAL INTELLIGENCE IN EDUCATION; METACOGNITION; TRANSVERSAL COMPETENCES; REFLECTIVE PRACTICE.

L'articolo si propone di esplorare una prospettiva pedagogica distintiva all'interno della formazione iniziale degli insegnanti della scuola secondaria, concentrandosi sull'uso dell'intelligenza artificiale come ambiente di mediazione a supporto della metacognizione, della pratica riflessiva e dello sviluppo delle competenze trasversali. Questa prospettiva, sebbene ancora emergente e inserita in contesti istituzionali e culturali in parte differenti dai modelli tradizionali di preparazione dei docenti, consente di individuare alcuni paradigmi pedagogici forti, capaci di connettere in modo coerente teoria e pratica, cognizione ed emozione, creatività e responsabilità, crescita professionale individuale e comunità educative

PAROLE CHIAVE: FORMAZIONE DEGLI INSEGNANTI; INTELLIGENZA ARTIFICIALE; METACOGNIZIONE; COMPETENZE TRASVERSALI; PRATICA RIFLESSIVA.

ISSN: 2039-4039

Introduction. Educating Teachers in a Time of Cognitive Complexity, Metacognition, and Technological Mediation

In the contemporary educational landscape, initial teacher education for secondary schools unfolds within a context marked by the convergence of accelerated technological change, increasing complexity of school environments, and a redefinition of the professional competences required of teachers. Within this scenario, a conception of teacher education as a merely preparatory or transmissive phase, primarily oriented toward the acquisition of disciplinary and methodological knowledge, appears increasingly inadequate. Initial teacher education instead emerges as a critical space for the construction of professional identity, in which prospective teachers are called to reflect on their own practice, interrogate decision-making processes, and become aware of the cognitive and emotional dimensions that orient teaching action (Dewey, 1916; Schön, 2017).

In Italy, the introduction of qualifying training pathways for secondary school teachers, established by Law no. 79/2022 and regulated by the Prime Ministerial Decree of 4 August 2023, has renewed the debate on initial teacher education. The early phases of implementation have revealed organizational and design-related difficulties that cannot be reduced to issues of timing or resource allocation. Rather, they point to a more structural challenge: sustaining, within the 60 ECTS pathways, coherent and continuous processes of reflection, metacognition, and integration between theoretical knowledge, practicum, and lived experience, elements consistently identified in the literature as central to the development of teacher professionalism (Darling-Hammond, 2017; Biesta, 2015).

These challenges must be situated within a broader epistemic transformation that is reshaping the production, mediation, and use of knowledge. The emergence of artificial intelligence and advanced digital systems does not simply add new tools to educational practices; it contributes to reconfiguring cognitive processes by increasingly mediating access to information, interpretation, and decision-making (Floridi, 2022; Floridi, 2025). As a result, the relationship between subject and knowledge becomes mediated by technological environments that function as cognitive intermediaries, altering the conditions under which learning and teaching take place.

Within this context, the central issue for initial teacher education is not the presence of technology as such, but the quality of the thinking processes that techno-

ISSN: 2039-4039

logical mediation is able to support. Metacognition therefore assumes a foundational role in teacher professionalism, understood as the capacity to reflect on one's own cognitive processes, make implicit assumptions explicit, critically examine pedagogical choices, and recognize the role of emotions in educational action (Flavell, 1979; Zimmerman, 2002).

From this perspective, Ron Ritchhart's theoretical contribution on making thinking visible offers a valuable lens for rethinking teacher education. Making thinking visible does not merely involve explicating strategies or procedures, but entails the deliberate construction of learning environments in which cognitive, metacognitive, and emotional processes can be articulated, shared, and collectively examined (Ritchhart, Church and Morrison, 2011; Ritchhart, 2015). Applied to initial teacher education, this approach challenges implicit models of professional learning based on imitation or tacit immersion, by foregrounding reflection as a structured and intentional practice.

Metacognition is closely intertwined with the development of transversal competences, which are increasingly recognized as structural components of teacher professionalism in international educational frameworks (OECD, 2020). Among these competences, creativity and emotional competences play a particularly significant role in secondary education, a context characterized by high cognitive, relational, and emotional complexity. Creativity, conceived not as an individual trait but as the capacity to reorganize knowledge, explore alternatives, and tolerate uncertainty, can be understood as a metacognitive competence. Emotional competences, in turn, function as regulatory dimensions that orient attention, motivation, and the quality of pedagogical decision-making (Guilford, 1950; Torrance, 1974; Glăveanu, 2015; Pekrun, 2006; Immordino-Yang, 2017; Damasio, 1994).

Despite their growing recognition in pedagogical research and policy discourse, these competences often struggle to find a systematic and explicit place within initial teacher education pathways. They tend to remain implicit, entrusted to individual dispositions or to the informal reflective capacity of prospective teachers. The absence of structured pedagogical dispositifs capable of making thinking processes, emotional dimensions, and professional choices visible thus represents one of the most significant limitations of current qualifying pathways (Schutz and Zembylas, 2009; Frenzel *et al.*, 2021).

Within this theoretical landscape, artificial intelligence can be interpreted not as an instructional technology or an organizational solution, but as a potential pedagog-

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ical mediating device. When embedded within reflective and metacognitively oriented educational designs, AI may support the visibility of thinking, reflection on experience, and the development of emotional and creative competences in prospective teachers (Vygotskij, 1978; Edwards, Gandini & Forman 2011). In a context in which access to information is increasingly mediated by intelligent systems, the educational challenge for initial teacher education does not primarily concern the accumulation of knowledge, but the cultivation of reflective, emotionally aware, and critically oriented forms of professional thinking capable of transforming experience into shared and meaningful educational knowledge (Stringher, 2021; Brandão de Souza, 2022).

Initial Teacher Education between Pedagogical Paradigms and Organizational Challenges

Initial teacher education for secondary schools represents a crucial juncture within contemporary educational systems, not only as a phase of entry into the profession, but as a foundational space for the construction of teacher identity. From a pedagogical perspective, it cannot be reduced to a certification mechanism or a set of regulatory requirements; rather, it should be understood as a complex learning environment in which theoretical knowledge, professional practices, reflective processes, and emotionally significant experiences are interwoven (Dewey, 1916; Schön, 2017).

This interpretation is particularly relevant in the Italian context, in light of the introduction of qualifying pathways for secondary school teachers established by Law no. 79/2022 and regulated by the Prime Ministerial Decree of 4 August 2023. In the first years of implementation, these pathways have revealed organizational and design-related difficulties that cannot be interpreted solely as issues of management or regulatory transition. On the contrary, they bring to the surface long-standing structural tensions within initial teacher education, concerning the relationship between theory and practice, between academic training and practicum, and between explicit learning and the implicit dimensions of professional experience.

International literature has consistently emphasized that the quality of initial teacher education depends on the capacity of training pathways to coherently integrate theoretical knowledge, situated practices, and reflection on experience

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(Darling-Hammond, 2017). However, in training dispositifs characterized by compressed timeframes and a high density of content — such as the 60 ECTS pathways — this integration proves particularly difficult to achieve. The risk is that of a fragmented trajectory, in which the various components of training proceed in parallel without generating genuine formative dialogue, leaving in the background the processes through which prospective teachers construct meaning from experience.
In this sense, the organizational challenges of initial teacher education cannot be separated from the pedagogical paradigms that guide its design. As Biesta observes, teacher education cannot be conceived exclusively in terms of effectiveness or measurable outcomes; it must instead engage with educational purposes, professional responsibility, and the criteria that orient pedagogical judgment in complex and uncertain situations (Biesta, 2015). Reducing initial teacher education to a sequence of competences to be acquired risks weakening precisely those reflective and value-laden dimensions that enable teachers to act responsibly within school contexts.
A central issue within this debate concerns the role attributed to reflection in initial teacher education pathways. Schön (2017) has shown that professional competence is constructed through a continuous dialogue between action and reflection, in which practitioners are called to interrogate their practices and rework lived experience (*reflection-in-action* and *reflection-on-action*). Within qualifying pathways, however, this dialogue often remains implicit, entrusted either to the individual capacity of prospective teachers or to the sensitivity of individual teacher educators, rather than being supported by structured and intentional pedagogical dispositifs.
It is within this critical space that Ron Ritchhart's contribution on *making thinking visible* offers a particularly relevant interpretative lens. Ritchhart emphasizes that thinking — including reflective and metacognitive processes — is not a purely internal event, but a cultural practice that can be made visible, shared, and cultivated within specific educational environments (Ritchhart, Church and Morrison, 2011; Ritchhart, 2015). Applied to initial teacher education, this perspective makes it possible to move beyond a conception of reflection as an episodic or ancillary activity, restoring it to the status of a pedagogically mediated process.
Making thinking visible in initial teacher education thus means creating conditions that enable prospective teachers to articulate their instructional reasoning, question the implicit assumptions that guide professional choices, and recognize the role of emotions in decision-making processes. Such visibility does not concern the

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cognitive dimension alone, but also encompasses the emotional and value-laden dimensions of teaching practice, contributing to the transformation of formative experience into an object of shared reflection rather than mere individual adaptation.

The difficulty of sustaining continuous reflective processes is further intensified by the emotional complexity that characterizes entry into the teaching profession. Initial teacher education represents a moment of identity transition, in which prospective teachers are required to confront expectations, uncertainties, and relational tensions that deeply affect professional learning processes. Yet these dimensions often remain marginal in the design of training pathways, as if teacher professionalism could be constructed independently of the subjective and emotional experience of those in training.

In light of these considerations, it becomes necessary to rethink initial teacher education as an intentional pedagogical environment, capable of supporting integration between action and reflection, thinking and emotion, individual experience and professional community. The organizational challenges of the 60 ECTS qualifying pathways can thus be interpreted as symptoms of a deeper issue, concerning the underlying model of initial teacher education and its capacity to make visible and thinkable the processes through which prospective teachers construct their professional identity. It is within this framework that a non-technistic reflection on the use of new mediating dispositifs in initial teacher education becomes possible.

Metacognition and the Visibility of Thinking in Teacher Professionalism

Within contemporary pedagogical debate, metacognition has progressively emerged as a key dimension of learning and professional development, particularly in contexts characterized by high cognitive and decisional complexity. In the case of initial teacher education for secondary schools, metacognition assumes a structural value, as it concerns the capacity of prospective teachers to consciously reflect on their own thinking processes, the strategies they adopt, the decisions they make, and the emotions that accompany instructional action.

Flavell (1979) defined metacognition as knowledge of and control over one's own cognitive processes, emphasizing its fundamental role in self-regulated learning. Subsequent research on self-regulation has shown that metacognition is not an isolated competence, but rather a set of dynamic processes involving planning,

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monitoring, evaluation, and the reorientation of action (Zimmerman, 2002). In educational settings, these processes are particularly relevant to teacher professionalism, which is required to operate in complex, uncertain, and often emotionally charged situations.

Despite this theoretical recognition, metacognition tends to remain implicit within initial teacher education pathways.

Prospective teachers often learn 'how things are done' through observation, imitation, or direct experience, without the underlying thinking processes of instructional action becoming the object of explicit and shared reflection. While this mode of learning is partly unavoidable, it risks producing a form of professionalism grounded in routines that are weakly conscious, difficult to transfer, and poorly adaptable to new contexts.

It is within this critical space that Ron Ritchhart's theoretical contribution on making thinking visible becomes particularly significant. Ritchhart conceives of thinking not as an internal and individual event, but as a cultural practice that can be made visible, discussed, and cultivated within intentionally designed educational environments (Ritchhart, Church and Morrison, 2011). Making thinking visible means creating contexts in which cognitive and metacognitive processes are not taken for granted, but instead become objects of exploration, shared language, and collective reflection.

Applied to initial teacher education, this perspective enables a shift away from conceiving reflection as a marginal activity, reconfiguring it as a central, intentionally designed pedagogical dispositif embedded within the training process.

Making the thinking of prospective teachers visible entails, for example, articulating the reasons underlying an instructional choice, interrogating interpretations of classroom situations, opening up possible alternatives to discussion, and recognizing the often tacit criteria that guide professional judgment. In this sense, metacognition is not simply reflection on content, but reflection on the decision-making processes that structure teaching practice.

A particularly relevant aspect of Ritchhart's approach concerns the integration of the cognitive and emotional dimensions of thinking. Making thinking visible does not merely involve explicating strategies or procedures, but also includes emotions, uncertainties, doubts, and tensions that accompany educational experience within the reflective process (Ritchhart, 2015).

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This orientation is especially pertinent in initial teacher education, where practicum experiences and first encounters with classroom teaching are often accompanied by intense emotional experiences that profoundly shape professional learning.
The failure to integrate the emotional dimension into metacognitive processes risks producing a partial form of reflection, focused exclusively on the technical aspects of teaching.
By contrast, acknowledging the role of emotions in thinking processes enables the development of a deeper form of metacognition, capable of supporting prospective teachers in understanding their own reactions, regulating action, and constructing more informed professional judgment (Pekrun, 2006; Immordino-Yang, 2017).
Within the context of the 60 ECTS qualifying pathways, the main challenge therefore does not lie in the mere introduction of reflective moments, but in the construction of learning environments capable of making metacognitive processes systematic and shared. Compressed timeframes and fragmented training activities make it difficult to sustain longitudinal reflection on experience. In the absence of structured dispositifs, metacognition risks remaining a declared objective rather than an enacted practice.
In light of these considerations, the visibility of thinking can be interpreted as a pedagogical response to one of the main critical issues of initial teacher education: the difficulty of meaningfully connecting theory, practice, and lived experience. Making the thinking processes of prospective teachers visible means creating bridges between what is learned in academic contexts and what is lived in practicum settings, fostering a deeper integration between theoretical knowledge and experiential knowledge.
From this perspective, metacognition does not represent an ancillary goal of initial teacher education, but rather a condition of possibility for the development of a reflective, creative, and emotionally competent teacher professionalism. It is within this framework that the following chapters will examine the role of transversal competences and mediating dispositifs, including artificial intelligence, as tools for supporting and operationalizing these processes within initial teacher education for secondary school teachers.

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Transversal Competences in Initial Teacher Education: Creativity and Emotions as Meta-Regulatory Processes

In educational debate over recent decades, transversal competences have progressively assumed a central role in reflections on teacher education, particularly in relation to transformations in school contexts and the new demands placed on the teaching profession. However, despite the growing recognition of these competences within international frameworks for twenty-first-century education, they are still often interpreted as secondary or complementary skills in relation to disciplinary competences, rather than as structural dimensions of professional practice (OECD, 2020).

Within the context of initial teacher education for secondary schools, this ambiguity becomes particularly evident. Transversal competences are frequently invoked in policy documents and learning objectives, yet they struggle to be translated into systematic pedagogical dispositifs and intentional training practices. The risk is that they are reduced to generic statements, lacking a meaningful anchoring in professional learning processes and in the concrete situations of teaching practice.

From a pedagogical perspective, transversal competences can be understood as a cognitive-emotional architecture that supports teachers' capacity to deal with complex situations, make decisions under conditions of uncertainty, and critically reflect on their own practice. In this sense, they do not operate on the same level as technical or procedural competences, but rather at a meta-level, orienting attention, motivation, and the quality of professional judgment.

Among the transversal competences most relevant to initial teacher education for secondary schools, creativity and emotional competences occupy a central position. While creativity has traditionally been associated with artistic or expressive domains, it is now widely recognized as a complex cognitive competence that entails the ability to reorganize knowledge, explore alternative perspectives, tolerate ambiguity, and generate novel solutions in response to ill-structured problems (Guilford, 1950; Torrance, 1974; Glăveanu, 2015). Within educational contexts, creativity thus emerges as a fundamental resource for instructional design, for managing unforeseen situations in the classroom, and for adapting teaching practices to heterogeneous learning environments.

Within this framework, creativity can be interpreted as a deeply metacognitive competence. It requires the ability to distance oneself from habitual patterns of thinking, to interrogate implicit assumptions, and to reflect on the processes

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through which meaning is constructed. In initial teacher education, however, these processes often remain invisible, entrusted to individual spontaneity rather than being supported by learning environments that foster their emergence and shared reflection.

Alongside creativity, emotional competences play an equally significant role in the construction of teacher professionalism, as both are mobilized in situations characterized by uncertainty, relational complexity, and the need for adaptive judgment. Research has widely demonstrated that emotions are not an ancillary component of learning; rather, they function as core factors influencing attention, memory, motivation, and decision-making processes (Damasio, 1994; Pekrun, 2006; Immordino-Yang, 2017). In school contexts, teachers are therefore continuously required to manage emotionally complex situations that involve not only students, but also their own subjective experience.

In initial teacher education, entry into the classroom and practicum experiences represent moments of intense emotional activation, marked by expectations, insecurities, frustrations, and a strong sense of responsibility. Despite their centrality in professional development, these experiences are rarely addressed explicitly within training pathways, where the emotional dimension tends to be implicitly relegated to individual management rather than integrated into pedagogical discourse. Such marginalization of emotions risks weakening professional learning processes, as it limits opportunities for structured reflection on experience and for the development of shared interpretative frameworks.

Emotions influence the quality of reflection, openness to change, and the capacity to learn from experience, while creativity enables the exploration of new courses of action and the reorganization of knowledge in response to educational challenges. Together, they contribute to the construction of a professional judgment that is flexible, situated, and responsible.

In light of these considerations, initial teacher education cannot be confined to the transmission of knowledge or the development of operational competences; it must also foster conditions in which transversal competences become objects of explicit and conscious reflection. Making visible the creative and emotional processes that permeate teaching practice implies recognizing their formative value and integrating them into structured pathways of reflective accompaniment.

This need is particularly evident within the 60 ECTS qualifying pathways, where compressed timeframes and fragmented training activities risk relegating transversal competences to an implicit background, lacking shared tools for elaboration.

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Rethinking initial teacher education from a metacognitive perspective therefore entails questioning which pedagogical mediation dispositifs can effectively support the visibility of thinking, emotions, and creative processes in prospective teachers. This line of inquiry opens up the exploration of new mediation environments capable of sustaining continuity in metacognitive processes and of supporting the integration of cognition, emotion, and creativity within initial teacher education for secondary school teachers.

A comparative glance at international contexts further clarifies the relevance of this issue. In countries such as Finland, initial teacher education has long emphasized reflective practices as a structural component of professional learning. Finnish teacher education is research-based and systematically integrates reflective writing, supervised practicum, and inquiry-oriented approaches, fostering prospective teachers' capacity to critically examine their cognitive, emotional, and ethical positioning in teaching practice (Kansanen, 2003; Toom *et al.*, 2010).

In this framework, creative and emotional dimensions are not treated as incidental aspects of practice, but as integral elements of professional judgment and pedagogical reasoning.

Similarly, in the United States, although teacher education pathways are institutionally diverse, reflective practices are widely adopted through tools such as reflective journals, portfolios, mentoring conversations, and clinical supervision models. These dispositifs aim to support the articulation of beliefs, emotions, and decision-making processes connected to classroom action, aligning with long-standing traditions of reflective practice in teacher education (Schön, 2017; Zeichner & Liston, 2013; Darling-Hammond, 2006). While the depth and coherence of reflection vary across programs, the emphasis on metacognitive awareness and professional self-examination is a recurrent feature in the literature. When contrasted with contexts characterized by compressed and fragmented qualifying pathways, such as the 60 ECTS programs, these international experiences highlight the importance of intentional pedagogical mediation dispositifs capable of sustaining reflective continuity over time. Comparative research suggests that when reflection is treated as a structured and scaffolded process rather than as an implicit or individual responsibility, it more effectively supports the integration of cognition, emotion, and creativity in initial teacher education (Hammerness *et al.*, 2005; OECD, 2020). These insights open the space for exploring alternative mediation environments and tools able to maintain reflective depth even under conditions of limited time and structural constraints.

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Artificial Intelligence as a Pedagogical Mediation Environment and Reflective Co-Tutor

The emergence of artificial intelligence in educational contexts raises questions that extend well beyond the adoption of new instructional tools or the optimization of training processes. In the specific domain of initial teacher education for secondary schools, artificial intelligence opens up pedagogical and epistemological questions concerning the ways in which thinking is supported, mediated, and made explicit within learning environments.
From this perspective, artificial intelligence cannot be understood merely as an applied technology; rather, it may be interpreted as a mediation environment that intervenes in the cognitive, metacognitive, and emotional processes through which prospective teachers construct professional meaning.
A pedagogically grounded reading of artificial intelligence requires situating it within a theoretical tradition that recognizes the constitutive role of cultural tools in the development of higher psychological functions.
The sociocultural perspective has long emphasized that thinking does not develop in isolation, but through the mediation of symbolic, linguistic, and social tools that shape how individuals interpret experience, regulate action, and reflect on their own activity (Vygotskij, 1978). Within this framework, tools are not neutral supports for cognition; they actively reorganize mental processes, opening up specific possibilities for reflection while constraining others.
Interpreted in this light, artificial intelligence can be understood as an advanced cultural tool whose pedagogical relevance depends not on its technical sophistication, but on the forms of mediation it introduces within educational practices.
When embedded in intentional pedagogical designs, AI has the potential to support reflective processes by offering structured opportunities for dialogue, articulation of reasoning, and reworking of experience. Conversely, when adopted in an uncritical or solution-driven manner, it risks reinforcing superficial or procedural forms of engagement with professional knowledge.
This issue becomes particularly salient in the context of initial teacher education, and especially within the 60 ECTS qualifying pathways.
As discussed, these pathways are characterized by strong temporal compression and fragmentation of learning experiences, which make it difficult to accompany prospective teachers' reflective processes in a continuous and systematic way. In

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such conditions, reflection risks remaining episodic, confined to isolated moments or individual initiatives, rather than constituting a shared and pedagogically mediated practice that supports the construction of professional identity.

It is within this space that artificial intelligence can be conceptualized as a reflective co-tutor. This notion does not imply any form of substitution of the human educator, nor does it attribute to AI an evaluative or prescriptive function. Rather, the idea of a reflective co-tutor refers to a dialogic environment capable of sustaining continuity in reflective processes, particularly in contexts where human accompaniment is necessarily discontinuous due to organizational constraints.

From this perspective, AI does not provide correct answers or optimal solutions to pedagogical problems. Its educational value lies instead in its capacity to prompt prospective teachers to articulate their reasoning, interrogate the assumptions underlying their instructional choices, and re-elaborate lived experience through reflective language and narrative. In doing so, AI can function as a mediating space in which professional thinking becomes an explicit object of attention, rather than remaining implicit or taken for granted.

This dialogic function connects directly with the paradigm of making thinking visible. As emphasized by Ritchhart, making thinking visible entails creating learning environments in which cognitive and metacognitive processes can be externalized, shared, and examined collectively, rather than remaining private and opaque (Ritchhart, Church & Morrison, 2011; Ritchhart, 2015). Within initial teacher education, this implies shifting from models of learning based primarily on imitation or tacit immersion toward pedagogical designs that explicitly support reflection on decision-making processes.

In this sense, artificial intelligence can contribute to the visibility of prospective teachers' thinking by offering a structured space in which instructional decisions, interpretations of classroom situations, and professional doubts can be articulated and revisited over time.

The interaction with AI can support the construction of a reflective trace, enabling prospective teachers to return to previous experiences, recognize patterns in their reasoning, and observe the evolution of their professional thinking. Such continuity is particularly difficult to sustain within compressed training pathways, yet it is central to the development of metacognitive awareness.

A particularly relevant aspect of AI-mediated reflection concerns the integration of the emotional dimension into professional learning processes.

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As discussed, emotions play a decisive role in shaping attention, motivation, judgment, and the capacity to learn from experience. However, within initial teacher education, emotional experiences are often left implicit, treated as personal matters rather than as integral components of professional learning.
When intentionally designed, AI-mediated reflective environments may function as dispositifs that facilitate the recognition and naming of emotions connected to teaching practice. By inviting prospective teachers to describe not only what they did, but also how they felt and why, AI can contribute to a more integrated form of metacognition, in which cognitive and emotional dimensions are jointly examined. This does not imply any form of emotional assessment or therapeutic intervention; rather, it supports the pedagogical acknowledgment of emotions as meaningful data for reflection on practice. Such a perspective requires a clear distancing from technicistic and solution-oriented approaches that attribute to artificial intelligence a resolutive role in addressing the structural criticalities of initial teacher education. Rather than eliminating complexity, AI reorganizes it by introducing new forms of mediation that must be critically understood, deliberately governed, and ethically oriented. Within teacher education, this shift entails reframing the guiding question: not what AI can do in itself, but how it is pedagogically integrated and which forms of thinking, professional judgment, and educational intentionality it is meant to support.
From a humanistic pedagogical standpoint, artificial intelligence can therefore be understood as an environment that expands opportunities for reflection without replacing the educational responsibility of teachers and teacher educators. Indeed, education remains a relational and situated process, grounded in listening, interpretation, and the shared construction of meaning within professional communities. Within this framework, AI can support educational processes only insofar as it is conceived as part of a broader educational ecosystem oriented toward the growth of both the person and the profession.
From this perspective, artificial intelligence conceived as a reflective co-tutor does not represent a solution to the organizational challenges of qualifying pathways. Rather, it constitutes a possible pedagogical response to the need to render professional learning processes visible, continuous, and thinkable under conditions of structural constraint. When integrated in a critical and intentional manner, AI may thus contribute to sustaining reflective continuity, supporting the integration of cognition and emotion, and fostering the development of transversal competences within initial teacher education for secondary school teachers.

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Conclusions

Within the context of qualifying pathways for secondary school teachers, the organizational difficulties that have emerged in the first years of implementation can be interpreted as manifestations of a deeper structural tension between the complexity of teacher professionalism and the fragmentation of training dispositifs. This tension does not concern organizational arrangements alone, but reflects an underlying model of initial teacher education that struggles to sustain continuity in reflective and metacognitive processes under conditions of temporal compression. From this perspective, metacognition emerges not as an additional component of teacher education, but as a foundational condition for integrating theory, practice, and lived experience. Without structured opportunities to reflect on cognitive, emotional, and decisional processes, professional learning risks being reduced either to the fulfillment of formal requirements or to an uncritical adaptation to existing instructional routines.

The paradigm of making thinking visible offers a pedagogically grounded response to this criticality by foregrounding the need to render explicit, shareable, and discussable the thinking processes that orient teaching practice. Reflection is thus reconfigured as an intentionally mediated practice, capable of supporting the construction of professional judgment and enabling prospective teachers to transform experience into meaningful educational knowledge. Crucially, this visibility concerns not only cognitive strategies, but also the emotional and value-laden dimensions that permeate instructional decision-making.

In this framework, transversal competences, particularly creativity and emotional competences, can be understood as meta-regulatory dimensions of teacher professionalism. Rather than functioning as secondary or complementary skills, they shape the quality of professional reasoning, the capacity to act under conditions of uncertainty, and the openness to learning from experience. Their systematic integration into initial teacher education therefore represents a structural requirement, rather than an optional enrichment.

Within this theoretical horizon, artificial intelligence can be conceptualized as a potential environment of pedagogical mediation and as a reflective co-tutor. When embedded in intentional and critically oriented educational designs, AI does not substitute professional judgment, nor does it offer prescriptive solutions to pedagogical problems. Instead, it may support the continuity and visibility of metacognitive processes by providing a dialogic space for the articulation, re-elaboration,

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and tracing of prospective teachers' thinking and emotional experiences over time. Reframing AI within a humanistic pedagogical vision allows it to be situated within the broader educational responsibility of teacher education institutions and educators. In this sense, AI does not resolve the structural challenges of qualifying pathways but may contribute to making professional learning processes more thinkable, continuous, and reflective under conditions of constraint.

Rethinking initial teacher education for secondary school teachers thus entails questioning not only how technologies are introduced, but which forms of thinking, reflection, and professional judgment training pathways are designed to cultivate. Within increasingly complex and technologically mediated educational contexts, fostering a form of teacher professionalism capable of reflecting on its own practice, recognizing its emotional dimensions, and exercising responsible pedagogical judgment emerges as a central and non-negotiable educational task.

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ISSN: 2039-4039