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AI as ethical and pedagogical mediator in initial teacher education: a case study

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This study investigates the role of generative artificial intelligence AI as an ethical and pedagogical mediator in the initial training of primary education teachers, particularly in strengthening the family-school relationship. A quasi-experimental intervention was conducted with a single group of 103 students from two Spanish universities, structured into four phases: theoretical instruction, collaborative resolution of practical cases, analysis with AI, and critical reflection. Pre- and post-intervention questionnaires assessed competencies such as critical thinking, creativity, personalized learning, and feedback. Findings indicate that AI was positively perceived for its ability to offer timely guidance, generate customized educational materials, and provide innovative solutions, with scores exceeding 3 out of 4 across all evaluated dimensions. Nonetheless, activities conducted without AI were also appreciated for promoting deeper reflection, empathy, and learner autonomy. The study concludes that AI, when critically and ethically integrated, can serve as a valuable complement in teacher education, bridging academic theory and classroom realities.

KEYWORDS

artificial intelligence, educational ethics, higher education, teacher education, technology perception

1 Introduction

The advent of artificial intelligence has precipitated a profound metamorphosis in the dynamics of knowledge construction and the mechanisms of communication and interpretation of reality. As [Casanovas-Combalia \(2023\)](#) cautions, in a future where AI is widely prevalent, verisimilitude—that is, what appears to be true—may come to hold more weight than truth itself. This potential inversion of values gives rise to a series of fundamental ethical and epistemological inquiries: will we continue to prioritize objective truth, or will what is credible, efficient, or emotionally compelling suffice?

Nevertheless, learning and truth maintain a profound and inextricable relationship. The objective of this pedagogical approach is to cultivate critical thinking skills in students, fostering holistic thinking and independent reasoning ([Ayuso del Puerto and Gutiérrez, 2022](#); [Timotheou et al., 2023](#)). These competencies enable them to analyze information objectively and form their own judgments. In light of this paradigm, a pertinent question emerges: can artificial intelligence serve as a facilitator for enhanced learning and ethical and value-based decision-making?

Recent empirical research suggests that generative artificial intelligence AI is already reshaping pedagogical practices in higher education. Systematic reviews indicate that GenAI tools can improve instructional efficiency through immediate feedback and personalized learning materials, enhance student engagement and motivation, and support the development of critical thinking and problem-solving skills (Wang et al., 2025). Concurrently, case-based evidence demonstrates that effective implementation necessitates alignment with pedagogical frameworks such as TPACK and the SAMR model to ensure meaningful integration rather than superficial substitution (Belkina et al., 2025). These findings underscore the notion that the educational impact of AI is not intrinsic to the technology itself, but rather contingent on the manner in which it is pedagogically facilitated.

The integration of AI in education poses significant challenges for educators, who must adapt to a rapidly evolving technological ecosystem. Thus, educators may experience a sense of uncertainty, exhibit reluctance to adopt AI, or perceive it as a potential threat, particularly when it is regarded as a dehumanizing technology or a substitute for fundamental pedagogical functions. Research underscores the necessity to cultivate technical proficiencies such as AI literacy and prompt engineering, in conjunction with critical competencies to evaluate the validity and reliability of intelligent systems (Heredia et al., 2025). Furthermore, studies focusing specifically on teacher education students reveal a dual perception: while GenAI tools are valued for information retrieval, study support, and efficiency, concerns persist regarding over-reliance, diminished critical engagement, and risks to academic integrity (Athanasopoulos et al., 2026).

It is imperative to acknowledge that ethical reflection remains central, even when considering instrumental factors. Instead of undermining academic integrity, generative AI has the potential to serve as a catalyst for its reinforcement, provided it is framed within clear ethical guidelines and explicit instruction in responsible use (Tan and Maravilla, 2024). From this perspective, cultivating AI literacy entails not only technical mastery but also normative discernment, fostering autonomy, responsibility, and reflective judgment in prospective educators. Quinde et al. (2025) posit that motivation and personalization are also essential for effective training, as adoption depends on meaningful integration into daily practice. Consequently, educators are required to function not solely as content transmitters but also as critical mediators between human learning and AI. This role necessitates a synthesis of technical proficiency with robust ethical and reflective capabilities.

In this transformational framework, university students training to become future teachers will increasingly encounter educational scenarios characterized by ethical dilemmas and decisions of high formative value (Ertesvåg et al., 2024).

1.1 Values, education and teaching

Values are defined as ideals and desires, but also as behaviors and special words that give meaning to life. These values are reflected in the priorities that are chosen and acted upon consistently and repeatedly (Hall, 2004). Upon introspection, individuals invariably encounter novel value priorities that

catalyze the development of new competencies. As posited by Korres Alonso, et al. (2025), values are the driving factors that influence an individual's behavior, lifestyle, and personality.

Education should not be confined to academic content, but rather should be oriented towards cultivating responsible, conscious, and critical citizens. When exploring the ethical obligations of educators, it is crucial to underscore that values are predominantly acquired through experience and role modeling as opposed to through direct imposition. This involves engaging the educational community in a comprehensive cultural and moral initiative that extends beyond the confines of specific subjects. According to Savater (2024), teachers are placed at the epicenter of an ethical commitment in the face of contemporary social challenges. The author indicates that “ethics cannot be taught in a thematic way, but must be exemplified in the daily life of the center” (p. 23).

It is imperative that educators assume the role of conscious mediators, capable of fostering coexistence, ethical reasoning, and the comprehensive development of students within an environment shaped by plurality, dialogue, and respect for diversity (Terrones-Rodríguez, 2022). Teaching, in this sense, should be understood not merely as the transmission of disciplinary content, but as a formative practice oriented toward the construction of shared values, the critical examination of social realities, and the development of moral judgment. Educators are expected to guide students in the recognition of ethical tensions, the negotiation of differing perspectives, and the responsible exercise of freedom within collective life. This implies promoting attitudes such as empathy, justice, solidarity, and responsibility, while also encouraging students to reflect on the social consequences of their decisions and actions. From this perspective, education becomes an intentional ethical process through which students are supported in their intellectual, emotional, and civic development, preparing them to participate actively and responsibly in democratic and plural societies (Ausín, 2021).

1.2 Challenges and opportunities of AI in the formation of critical and ethical teacher training

The integration of artificial intelligence (AI) into teacher training requires a pedagogical approach that does not reduce its use to a mere transfer of technical skills, but rather links it to critical, ethical, and humanistic criteria. In this vein, UNESCO's competency framework for teachers identifies the understanding, evaluation, and contextualized use of AI as essential components of professional development, emphasizing that technology must serve learning and not replace educational judgment (UNESCO, 2026). Complementarily, the European Commission's guidelines emphasize that the use of AI and data in education must be governed by principles of transparency, protection, equity, and accountability, so that teachers can make informed and ethically grounded decisions (European Commission, 2022). For its part, the OECD warns that the opportunities offered by AI in education can only be fully realized when safeguards are put in place to minimize risks, prevent bias, and strengthen professional capacity to critically evaluate its outcomes (OECD, 2024).

Thus, the three supranational organizations cited above agree on a central idea: teacher training in AI must be geared toward professional development, understood as the ability to use these technologies with judgment, discernment, and responsibility.

In the domain of education, the integration of information and communication technologies (ICT) introduces novel challenges that extend beyond the mere facilitation of access to information and the automation of tasks. In this regard, their integration within educational settings necessitates a thorough examination of their influence on the cultivation of the competencies of prospective educators (Burgueño-López, 2024). It is imperative to evaluate their contribution to the enhancement of discernment skills, critical reasoning, and ethical reflection of future teachers.

Given the marked increase in the use of generative AI tools in higher education, as well as the academic community's evident interest in the subject, as evidenced by the exponential growth in the number of published studies (Jiménez-García et al., 2025), it is imperative to establish training programs that focus on the critical use of AI. These programs should aim to cultivate an ethical and responsible perspective, thereby enabling educators to recognize the limitations and moral implications of AI in educational practice. Recent conceptual analyses further suggest that the integration of generative AI may generate forms of cognitive dissonance in academic contexts, as tensions arise between core academic values—such as originality, intellectual ownership, and integrity—and the efficiency and convenience afforded by AI tools (Seran et al., 2025). When addressed explicitly within the context of teacher education, such tensions have the potential to transform potential ethical conflicts into opportunities for reflective and value-oriented professional growth.

As Milto et al. (2020) observe, teacher training must evolve beyond mere technical literacy to encompass critical analysis and ethical deliberation concerning the integration of AI in education. Integrating digital resources entails more than merely utilizing tools or designing prompts; it necessitates a thorough examination of the automatisms these technologies may engender and the biases inherent in their models. It is imperative to recognize that artificial intelligence should not be regarded as a universal solution that absolves educators of their responsibility to contextualize learning, promote humanization, and make informed decisions that are attuned to the cultural, social, and emotional diversity inherent in the classroom. Consequently, the integration of AI into the initial teacher education curriculum presents a valuable opportunity to nurture reflective practices, evaluate knowledge sources, and anticipate ethical implications.

2 Objectives

In this study, generative AI is conceptualised as an ethical and pedagogical mediator—not merely a tool—from a sociocultural perspective emphasising artefacts and interactions that guide critical interpretation of complex situations through scaffolding. It mediates family–school cases by structuring information, the way in which teachers interact with parents and work together to support pupils, proposing alternative framings and scenarios

that make values and ethical dilemmas visible (without deciding what is right), functioning as a cognitive scaffold for moral reasoning when students contrast generated proposals, detect biases and rearticulate decisions according to class-discussed ethical principles. We distinguish three interrelated roles—tool (efficiency), cognitive scaffold (conceptual reorganisation) and limited ethical interlocutor (argumentative contrast)—always subordinate to teacher mediation and contextual deliberation.

The objectives of this study are twofold: first, to examine the pedagogical and ethical potential of generative artificial intelligence in initial teacher training; and second, to assess its capacity to foster critical analysis, informed decision-making, and responses to complex situations requiring ethical sensitivity and contextual understanding. The specific objectives are presented below.

- To explore the pedagogical and ethical potential of generative AI as a mediator in initial teacher training.
- To evaluate its efficacy in facilitating critical learning, ethical decision-making, and connection between university theory and school-family practical challenges, considering student perceptions regarding inclusion/diversity.
- To identify risks and limitations associated with its educational implementation.

3 Method

In order to ensure methodological transparency, it is imperative to clarify that this study employs a pre-experimental, single-group, sequential, within-subject design with repeated measures. The entire sample of 103 participants experienced both learning conditions successively: firstly, students resolved the practical cases collaboratively without the mediation of artificial intelligence; subsequently, they addressed the same cases individually with the support of the generative AI tool. The evaluation instruments applied immediately following each sequential phase enabled the collection and contrast of student perceptions regarding both learning modalities. It is acknowledged that the methodological limitations of the study, namely its sequential, non-probabilistic, within-subject design and the absence of an external control group, preclude the establishment of causal inferences regarding the efficacy of the intervention on the objective development of students' competencies. Consequently, both the terminology and the analysis of results have been reoriented to focus exclusively on assessing perceived usefulness, perceived learning support, and the subjective reflective interpretations reported by future teachers under both working conditions.

The thematic analysis approach was adopted for the qualitative data, following the six-stage methodology proposed by Braun and Clarke (2006). This choice enabled a more comprehensive understanding of students' interpretations of their learning processes, including the ethical, critical, and socioemotional complexities involved.

To standardize students' prompt development, an explanatory chart was utilized as a practical guide. The program assisted students in organizing prompts in accordance with AI

capabilities by delineating a role, specifying the task, and identifying the primary objective (e.g., teaching, informing, evaluating, or inspiring). Additionally, it guided them in selecting an appropriate tone and style. This approach enhanced precision, promoted the utilization of concrete examples, and fostered creative idea generation. It also ensured that all students adhered to a consistent workflow and employed the resource effectively.

The questionnaire included 5-point Likert items (1 = strongly disagree to 5 = strongly agree) assessing:

- Personalized learning: “AI adapted content to my specific needs and interests”
- Critical thinking: “AI helped me analyze the case from multiple perspectives”
- Creative problem-solving: “AI suggested innovative solutions I hadn’t considered”
- Adapted materials: “AI generated resources suitable for diverse learners”
- Feedback: “AI provided clear, constructive guidance for case analysis”

Qualitative analysis followed Braun and Clarke’s (2006) 6-phase thematic approach: (1) data familiarization, (2) initial coding, (3) theme search, (4) theme review, (5) theme definition, (6) reporting. Categories emerged inductively from student responses: Without AI - “autonomy”, “empathy”, “collaboration challenges”; With AI - “efficiency”, “bias detection”, “complementarity”.

With regard to the qualitative analysis, a total of 103 open-ended responses (one from each participant, yielding 103 distinct textual units of analysis) were analyzed. The coding process was conducted inductively, with the primary researcher undertaking line-by-line open coding on the complete dataset to capture the raw student meanings. These meanings were then grouped into broader conceptual categories. To ensure the trustworthiness and interpretive rigor of the analysis, a randomly selected 20% of the material (21 responses) was

independently double-coded by the second author. Discrepancies that arose during the double-coding phase were addressed through iterative, deliberative discussions and consensus-building efforts until reaching 100% agreement on code definitions and their application. In this context, “consistency” was defined as interpretive agreement and conceptual stability (trustworthiness) rather than mechanical, positivist reliability. This approach ensured that the codebook was applied with a shared understanding of the qualitative data to minimize individual subjective bias.

Data analysis was purely descriptive, reporting means and standard deviations (SD) for each competency dimension by condition (AI vs. non-AI). No inferential statistics were conducted due to the quasi-experimental single-group design and focus on student perceptions rather than hypothesis testing. Variability measures (SD) are presented in Figures 1, 2 to enable assessment of within-group spread and practical significance of differences.

The study employed an *ad hoc* questionnaire administered through Google Forms, structured into three sections: contextual data, a 5-point Likert scale, and open-ended questions. The contextual section included information on the Catholic University of Murcia, the subject Society, Family and School, the Primary Education degree programme, gender, age, and the work condition (with AI/without AI). The sample comprised 103 students, including 37 men and 66 women, aged between 19 and 24 years. The Likert scale assessed five dimensions—personalized learning, critical thinking, creative problem-solving, adapted materials, and feedback—while the open-ended questions explored perceived benefits, difficulties, comparisons between working with and without AI, and the ethical and contextual implications of the experience. The qualitative analysis was organized through category systems that, in the non-AI condition, included critical thinking and autonomy, empathy and emotional involvement, enriching social feedback, and associated difficulties, and, in the AI-supported condition,

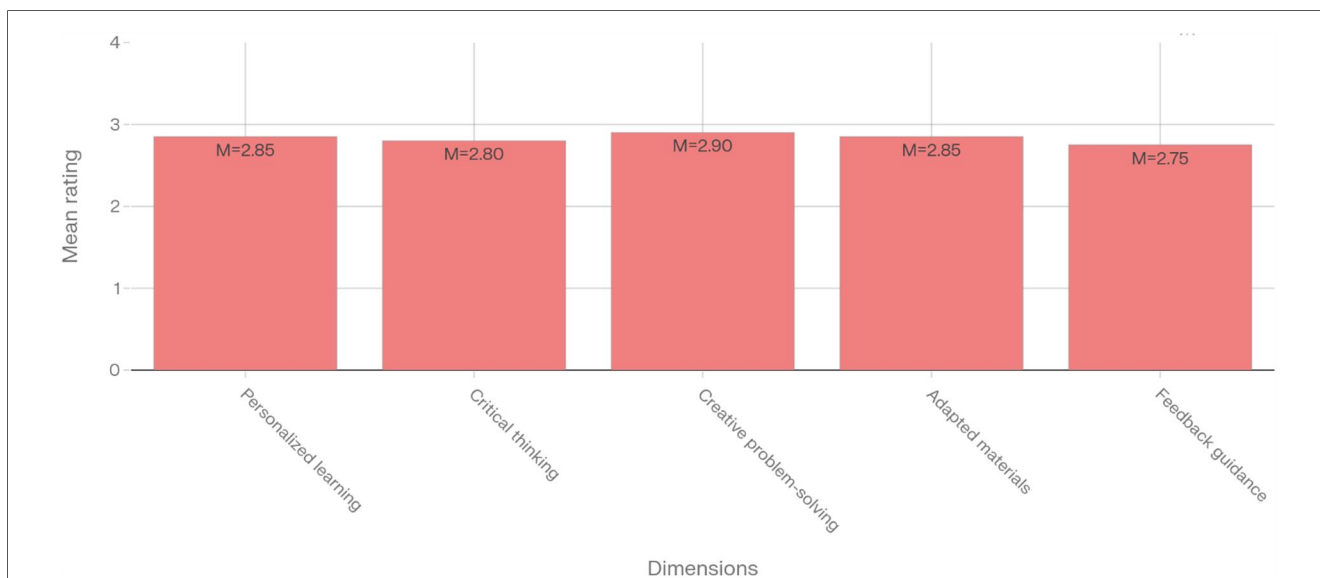
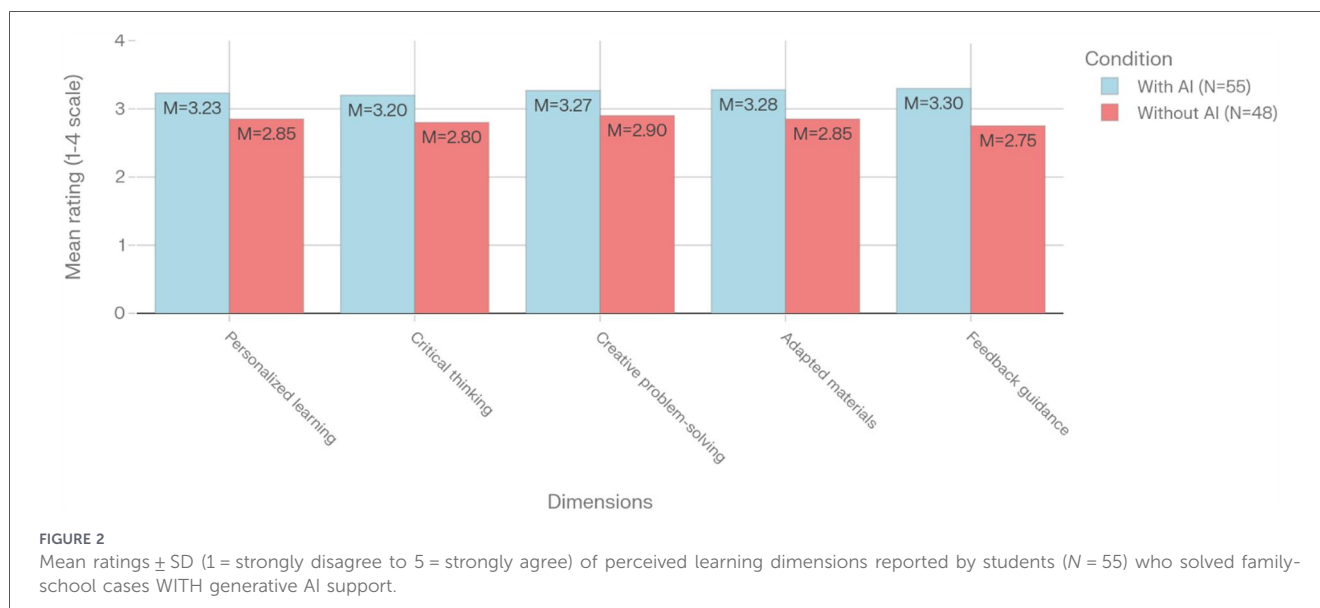


FIGURE 1 Mean ratings ± SD (1 = strongly disagree to 5 = strongly agree) of perceived learning dimensions reported by students (N = 48) who solved family-school cases WITHOUT generative AI support.



included quick and organized access to information, complementarity of AI, motivation and personal involvement, lack of depth in critical thinking, and formative and emotional impact. In addition, students' prompt use was guided by a structured framework requiring the definition of role, task, objective, context, tone, and expected response type. The ethical framework of the study was grounded in care and relational responsibility, professional judgement under uncertainty, and justice and fairness in decision-making, so that AI was approached not as an autonomous decision-maker but as a pedagogical support tool subordinate to human mediation, contextual interpretation, and ethical reflection (Braun and Clarke, 2021, Kosmyna et al., 2025).

3.1 Intervention procedure

The educational intervention was integrated into the official syllabus of the courses "Society, Family, and School" and "Family and School" across both participating universities. The intervention was designed as a 4-week program consisting of four weekly sessions of 2 h each (totaling 8 h of direct intervention), structured as follows:

Phase 1: Theoretical Instruction (Week 1, 2 h): The course instructors delivered a lecture on the ethical and legal foundations of the school-family relationship (focusing on communication, diversity, and professional responsibility). Students were also introduced to basic generative AI literacy, including an overview of Large Language Models (LLMs) and their potential cognitive biases (such as "hallucinations" and cultural stereotypes).

Phase 2: Collaborative Human Resolution (Week 2, 2 h): In groups of 3–4, students analyzed and resolved three complex, pre-designed practical cases involving family-school conflicts without any digital or AI support. Case 1 presented a communication breakdown and cultural barriers with an immigrant family whose child was showing signs of academic

disengagement. Case 2 presented a tense conflict regarding academic evaluation and overprotective parental behavior. Groups had to debate, reach a consensus, and draft a manual intervention proposal based strictly on their prior knowledge and class lectures.

Phase 3: AI-Mediated Analysis (Week 3, 2 h): Working individually, students interacted with OpenAI's ChatGPT (specifically version 4.0) to re-evaluate the same cases. To standardize the interaction, students were provided with a structural prompt engineering framework (the RTOS model: Role, Task, Objective, and Style). For instance, students configured prompts such as: "Act as an experienced primary school counselor. Analyze the communication barrier in Case 1 to suggest three inclusive action strategies that rebuild parental trust [Objective] using an empathetic, professional, and non-prescriptive tone". Students conducted an iterative dialogue with the chatbot, asking it to challenge their own Week 2 assumptions and provide alternative perspectives.

Phase 4: Critical Reflection and Evaluation (Week 4, 2 h): Teachers mediated a whole-class debriefing session. Students were guided through a Socratic dialogue to contrast their manual group proposals (Phase 2) against the AI's automated suggestions (Phase 3). Students completed a double evaluation task: first, they mapped out a comparative matrix identifying which AI recommendations were highly useful/creative vs. those that were generic, ethically questionable, or insensitive to the local school context. Second, they individually completed the study's quantitative-qualitative questionnaire on Google Forms, reflecting on how this technological contrast reshaped their professional judgment and ethical sensitivity.

Throughout the process, the teachers' role transcended traditional lecturing: they acted as meta-cognitive facilitators, prompting students to question the AI's suggestions, highlighting when the chatbot provided standard bureaucratic protocols that ignored the family's emotional stress, and ensuring that ChatGPT was treated as a limited, argumentative interlocutor rather than an absolute pedagogical authority.

3.2 Ethics approval and consent

This study was conducted in accordance with the ethical standards of the institutions involved (Catholic University of Murcia and Comillas Pontifical University) and Spanish data protection regulations [GDPR, Regulation (EU) 2016/679]. As part of regular course evaluation activities, informed consent was obtained from all 103 participating students via the digital questionnaire platform (Google Forms). Participants were informed about the study's purpose, voluntary nature, data anonymity, and right to withdraw at any time. No sensitive personal data were collected beyond age, gender, and university affiliation. Questionnaire responses were anonymized immediately upon collection. Institutional ethics approval was not required as the study constituted routine educational assessment with minimal risk, per institutional guidelines for teaching innovation projects.

3.3 Instrument

An *ad hoc* questionnaire was developed based on extant literature on teachers' digital competence, active learning, and the pedagogical use of artificial intelligence. The aim of the questionnaire was to collect both quantitative ratings and open-ended responses regarding the learning experience. The items' wording underwent a meticulous review to ensure semantic clarity, appropriateness for the students' level, and alignment with the dimensions under analysis. Prior to the implementation of the final administration, a pilot phase was conducted with a subgroup of 12 students who exhibited characteristics similar to the final sample and were not included in the analysis. This pilot phase was conducted to verify the comprehensibility of the items and the time required to complete the questionnaire. According to the findings of this review, minor modifications were made to the wording of certain statements in order to prevent ambiguity. In the final sample, the scale demonstrated adequate internal consistency, with a Cronbach's alpha of $\alpha = 0.85$ and a McDonald's omega of $\omega = 0.86$, thereby supporting its utilization for the descriptive analysis conducted.

The questionnaire comprised three sections: (1) contextual data on AI usage (with/without AI case completion for comparative classification); (2) competency assessment via 5-point Likert scale (1 = strongly disagree to 5 = strongly agree) measuring AI's perceived impact on personalization, critical thinking, creativity/problem-solving, adapted materials production, and feedback; and (3) open-ended reflection on a specific AI experience, including benefits, difficulties, and comparison to non-AI work, capturing ethical/contextual dimensions.

3.4 Sample

The present study's sample comprised a total of 103 students enrolled in the Degree in Primary Education at two Spanish universities: the Comillas Pontifical University and the Catholic University of Murcia University. The selection of the sample was guided by the principle of accessibility, employing a non-

TABLE 1 Characteristics of the sample.

University	Subject	Male students	Female students	Total
Catholic University of Murcia	Society, Family and School	30	41	71
Comillas Pontifical University	Family and School	7	25	32
Total		37	66	103

probabilistic sampling method by convenience and focusing on subjects related to the family-school relationship, such as "Society, Family and School" and "Family and School". Table 1 presents the characteristics of the sample, which exhibits a notable female representation, with 66 women and 37 men. This observation is indicative of the social and cultural reality of the profession.

4 Results

To provide stronger empirical grounding for the ethical dimension, we re-analyzed open-ended responses using a professional teaching ethics framework focusing on three core dimensions: care and relational responsibility, professional judgement under uncertainty, and justice/fairness in decision-making. This analysis reveals that non-AI work fosters autonomous ethical deliberation through direct confrontation with dilemmas—students emphasized understanding families beyond rules, weighing competing values without easy answers, and ensuring equitable representation of all voices. In contrast, AI-mediated reflection develops critical ethical judgement: students identified limitations in AI proposals, including standard protocols that ignored family stress, unrealistic options, and cultural biases, and consciously rejected or adapted them based on professional standards and diversity training. As one student noted, "We had to do a lot more thinking because there was no one to give us the direct solution", a testimony that illustrates how the non-AI condition encouraged deeper moral reasoning rather than passive acceptance of ready-made answers. These patterns demonstrate explicit ethical reasoning processes rather than merely pedagogical interpretation, showing how both conditions surface distinct but complementary forms of moral deliberation in teacher education.

4.1 Qualitative findings

The qualitative analysis of the open-ended responses allowed for a deeper understanding of how students attributed meaning to the experience of solving cases with and without AI support, showing that the pedagogical value of the tool does not lie solely in its ability to streamline tasks, but in the way it reshapes reflection, argumentation, and decision-making processes. In this regard, the testimonies collected reveal a nuanced

understanding of AI as a formative resource: useful for broadening perspectives, organizing ideas, and providing initial guidance, yet insufficient on its own to replace professional judgment, ethical deliberation, and peer interaction.

In activities carried out without AI, students particularly highlighted the role of intellectual autonomy, deeper analysis and the personal construction of knowledge. Several participants noted: “Without automatic answers, we were forced to compare information, justify our decisions and critically examine their assumptions”. This absence of technological mediation was seen as an opportunity for more careful and rigorous reflection, which fostered more complex thought processes. Furthermore, the students highlighted that “working without AI has fostered greater emotional engagement with the cases, as we had to put ourselves in the shoes of the families and the various educational stakeholders without resorting to pre-designed solutions”. In this regard, the experience was associated with greater empathy, active listening and heightened sensitivity towards the diversity of family and school situations.

Likewise, working without AI was perceived as a particularly valuable setting for collaborative learning. Students reported that peer interaction helped them refine ideas, question initial interpretations, and build stronger responses through the contrast of perspectives. Group discussion was described as a shared deliberative space that fostered ethical reasoning and the joint development of more context-sensitive proposals. However, they also acknowledged that this process required more time, greater organizational effort, and higher cognitive load, which some interpreted as a necessary formative challenge for strengthening autonomy and argumentation skills.

By contrast, in the activities completed with AI, students consistently valued the speed of access to information, the clarity of suggestions, and the tool’s capacity to broaden the range of possible solutions. The open-ended responses show that AI was perceived as an effective support for starting the task, structuring ideas, and overcoming initial blocks. Many participants noted that the tool helped them consider aspects of the case they had not initially taken into account, thereby promoting a broader understanding of the problem. In this sense, AI was understood as a cognitive mediator that facilitates thought organization and the generation of alternatives without replacing human analysis.

However, alongside these positive views, a more critical perspective also emerged. Several students pointed out that “AI-generated proposals could be too general, insufficiently sensitive to context, or not deep enough from an ethical and pedagogical standpoint”. This limitation became especially visible when participants compared automatic responses with group discussion and personal reflection. In their comments, they stressed that “AI can provide useful ideas, but it requires constant review to detect biases, simplifications, or unrealistic solutions”. In this way, the experience with AI was not understood as a replacement for critical thinking, but as an opportunity to exercise it more consciously.

One particularly relevant finding was that many students did not set up a strict opposition between both conditions, but rather a complementary relationship. In their view, “the most valuable experience arises when AI is used as a starting point to organize work, broaden perspectives, and generate hypotheses”,

while “human reflection, peer dialogue, and teacher mediation provide depth, ethical judgment, and contextualization”. This idea appears repeatedly in the testimonies and suggests that initial teacher education should promote a critical, limited, and pedagogically oriented use of AI, avoiding both technological dependence and uncritical rejection.

4.1.1 Without AI

The results obtained through the application of the questionnaire in cases not involving IA intervention demonstrate moderate mean scores across all evaluated dimensions. As illustrated in [Figure 1](#), the means for each competency are shown, with the data having been collated using a Likert scale ranging from 1 to 5 points.

The findings obtained without generative AI suggest a moderately positive learning experience, albeit with evident limitations in key domains. Personalization scores remained below 3, indicating minimal adaptation to individual needs. The mean average of critical thinking and creative problem solving was approximately 2.8–2.9, suggesting that practical scenarios are conducive to the development of these competencies. However, there is a potential for enhancement, particularly with regard to multi-perspective analysis and innovation.

The qualitative analysis of open-ended responses ([Table 2](#)) lends further support to these findings. Students evaluated work without AI positively in terms of depth, personal involvement, and the development of critical and ethical competencies. However, they also recognized its higher cognitive and organizational demands. A recurring theme in the data was critical thinking. Without an automatic tool to “solve” the case, students reported being forced to analyze information from multiple perspectives, justify decisions, and question their assumptions. They considered this approach more authentic and formative. Furthermore, the autonomy granted to students in this program was a notable aspect, as their learning was dependent on their own initiative in searching, organizing information, and producing written reports.

Furthermore, students placed significant emphasis on emotional engagement and empathy, noting that working without external suggestions enabled them to establish more profound connections with family realities and cultivate social sensitivity, active listening skills, and tolerance. Collaborative work was also prioritized for its ability to generate richer peer feedback and more meaningful dialogue than that offered by a virtual assistant. However, students identified several challenges, including increased time investment, a sense of insecurity due to the lack of immediate references, and greater effort in structuring ideas. Many students perceived these challenges as a beneficial formative challenge that fosters autonomous thinking and creativity.

4.1.2 With AI

Students using generative AI rated all learning dimensions positively ([Figure 2](#)), with means >3 (1–4 Likert scale): feedback ($M = 3.30$), adapted materials ($M = 3.28$), creativity/problem-solving ($M = 3.27$), personalization ($M = 3.23$), and critical thinking ($M = 3.20$). They valued AI’s clear guidance, innovative

TABLE 2 Thematic analysis of cases worked without AI.

Theme	Description	Illustrative quote	Interpretation
Development of critical thinking and autonomy	Students are forced to analyze from multiple perspectives, argue and make decisions without automated help.	“We had to do a lot more thinking because there was no one to give us the direct solution.”	Work without AI enhances independent reasoning and autonomous knowledge construction.
Empathy and emotional involvement	Increased ability to “put oneself in the shoes” of the actors in the case, generating understanding of complex family realities.	“I felt I understood better what the family was going through, I put myself in their situation.”	The absence of AI favors the development of socioemotional skills essential for teaching practice.
Enriching social feedback	Group dialogue encourages the exchange of ideas, constructive confrontation and the co-creation of solutions.	“Talking with colleagues brought up ideas I hadn’t thought of.”	Collaborative work without technological mediation stimulates collective reflection and strengthens group cohesion.
Associated difficulties	Greater demand in organization, information search and argumentation without automatic references.	“It took us a lot longer to organize everything and it took us a lot longer.”	Although challenging, this difficulty is seen as formative, developing responsibility and planning skills.

TABLE 3 Thematic analysis of cases worked with AI.

Theme	Description	Illustrative quote	Interpretation
Quick and organized access to information	AI provides structured and detailed data, broadening perspectives and offering innovative solutions.	“It gave us ideas we hadn’t thought of and a lot of clear information.”	AI acts as a cognitive facilitator, enriching the information base and opening new lines of reflection.
Complementarity of AI	Recognition of AI as a support tool and not as a substitute for personal or group reasoning.	“It’s very helpful, but it’s not a substitute for talking to colleagues.”	Encourages a critical view of the role of technology, stressing the importance of human mediation.
Motivation and personal involvement	The use of AI stimulates interest, facilitates the task and helps maintain commitment to solving the case.	“I was more motivated because I had a lot of ideas to work with.”	AI can act as a catalyst for intrinsic motivation, if integrated in a pedagogically meaningful way.
Lack of depth in critical thinking	Students notice a lower argumentative demand due to the availability of automatically suggested answers.	“It’s easier, but you don’t think as much yourself.”	It highlights the need to design training strategies that combine the use of AI with autonomous critical analysis activities.
Formative and emotional impact	It helps to anticipate real classroom problems and construct more complete and thoughtful responses.	“It helped me to imagine how I would react as a teacher.”	Contributes to professional development by facilitating the projection of real situations and training in decision making.

approaches, customized resources, and idea augmentation without replacing reasoning. Descriptive results show highly similar patterns across genders (females $N = 36$, $M = 3.25$ overall; males $N = 19$, $M = 3.22$ overall), suggesting consistent positive perceptions across groups.

The findings were further substantiated by open-ended responses (Table 3). Students underscored the expeditious and methodical delivery of pertinent information by AI, which facilitated more profound analysis and the identification of solutions that had not been initially contemplated. Additionally, many noted its value in broadening perspectives and generating new ideas, including alternative viewpoints and actors. However, participants emphasized that AI is most effective when utilized as a complement rather than a substitute. While AI can facilitate work processes, it cannot replace personal reflection or dialogue with colleagues. Constant feedback and creative suggestions were identified as significant strengths. However, some students reported that motivation and engagement were enhanced in group work, where peer exchange enriches learning.

A recurrent limitation pertained to the perceived paucity of depth in critical thinking, as students placed a premium on independent reflection and peer comparison to cultivate contextualized judgments. Consequently, many have described an integrated approach as the most effective, positing that the utilization of AI to structure ideas and expand information should be done while maintaining individual work and collaborative dynamics that foster reflection, empathy, and debate. Finally, several testimonials highlighted the experience’s formative and emotional impact, suggesting that combining AI support with personal engagement helped prospective teachers better anticipate classroom challenges and develop more informed, comprehensive, and humane educational proposals.

5 Discussion

The findings of this study, despite being aware that these results are based on students’ perceptions, rather than fixed and

solid constructs, align with the growing consensus that AI is increasingly becoming a prominent element in initial teacher education, technological, pedagogical and ethical. This perspective critical and humanistic approach to the integration of AI in educational environments (Aparicio-Gómez, 2023; Ayuso del Puerto and Gutiérrez, 2022).

Initially, the collected data demonstrate that students perceived the implementation of AI as a highly useful resource for structuring answers, obtaining immediate feedback, and broadening perspectives through the generation of creative solutions (Parra-Sánchez, 2022; Pimienta and Mosquera-Martínez, 2022). These competencies are especially relevant in the context of teacher training, as they prepare future educators to navigate and respond effectively to a variety of educational scenarios. As Timotheou et al. (2023) have demonstrated, the capacity of digital systems to adapt contributes to the enhancement of the training process when integrated with reflective pedagogy.

In accordance with these findings, the thematic analysis discloses that students working with AI perceived it as a cognitive facilitator that provided expeditious, structured access to information and expanded the range of possible solutions. However, this facilitation was accompanied by a perceived reduction in the depth of critical thinking, as participants acknowledged a lower argumentative demand due to the availability of automated responses. This tension is consistent with previous research on automation bias and over-reliance on intelligent systems (Parasuraman and Riley, 1997), as well as with recent studies warning about the superficialization of cognitive processes when AI is used without pedagogical scaffolding (Holmes et al., 2019). By contrast, students who engaged in work without the utilisation of AI reported a process that was more arduous but intellectually enriching, marked by increased autonomy, profound critical reflection, and robust collaborative discourse. The findings of this study indicate that while artificial intelligence has the potential to enhance efficiency and ideation, the absence of technological mediation may offer a more conducive environment for the development of higher-order thinking skills and socioemotional competencies, which are paramount for effective teaching practice.

Furthermore, by addressing pragmatic cases involving social, familial, and educational variables, the critical application of AI enabled the discernment of contrasting perspectives and the identification of biases, stereotypes, and automatisms inherent in the responses generated (Barrón-Estrada et al., 2018; Luzardo et al., 2014). This dialogic exercise with technology is consistent with the approach proposed by Leão et al. (2022) and Karataş and Yüce (2024), who underscore the necessity for training in digital ethics, particularly in sensitive formative contexts such as education.

Moreover, the thematic findings indicate that the absence of AI resulted in heightened empathy and emotional engagement. Students reported an augmented capacity to comprehend the lived experiences of the actors in the cases and to engage in collective meaning-making through peer interaction. Concurrently, while this process demanded greater temporal and organisational investment, the participants regarded these challenges as formative, thereby contributing to the development of responsibility, planning skills and professional judgment.

Conversely, AI-supported work, while efficient, was consistently perceived by students as complementary rather than substitutive, thereby reinforcing the necessity to maintain human mediation and collaborative spaces in teacher education. This complements the view of AI as an augmentative rather than replacement technology in education (Luckin et al., 2016).

A pivotal component of this study is critical literacy in AI, which is identified as a prerequisite for an ethical and meaningful utilization of these tools. As Moreno Padilla (2019) and Domínguez-Figaredo (2020) have indicated, the incorporation of AI cannot be considered a neutral process; rather, it must be accompanied by pedagogical, digital, and ethical competencies on the part of teachers.

It is noteworthy that, despite AI's perceived merits in terms of functionality, students have expressed reservations regarding its ability to substitute for the emotional, empathic, and collaborative dimensions inherent in teaching and learning processes. This finding aligns with the warnings articulated by Stuart and Norvig (2016), who cautioned that AI systems, operating without human intervention, are deficient in their capacity to make contextual judgments and demonstrate moral sensitivity. As Casanovas-Combalia (2023) emphasizes, in a hyperdigitized environment, the risk is not only in disinformation, but in the substitution of truth for verisimilitude, a phenomenon that education must address with critical thinking and ethical sense.

This research provides empirical evidence in favor of a hybrid and situated vision of the use of AI in teaching: neither technophilic nor technophobic. AI is presented as an ally in educational decision-making if it is incorporated from an active, inclusive pedagogy oriented to the development of competencies for the 21st century (Ertesvåg et al., 2024; Quinde et al., 2025). The training of prospective educators in the ethical, critical, and creative application of AI is an imperative that cannot be disregarded if the pursuit of a more humane, contextualized, and transformative education is to be realized.

6 Conclusions

The present study explores the potential of AI as a pedagogical and ethical resource in initial teacher training, with a particular focus on Primary Education. The findings indicate that students perceived AI as a useful complementary resource in their initial training, particularly for generating ideas, structuring instructional designs, and broadening their pedagogical perspectives (Kim and Kwon, 2023). Rather than demonstrating an objective development of skills, student ratings reflect a high perceived utility of the tool in assisting with continuous feedback, personalization of learning, and the generation of adapted materials.

A salient finding of the present study is that artificial intelligence was perceived by future teachers as a supportive cognitive scaffold that prompted them to compare alternative perspectives, thereby complementing their reflective process and critical thinking. Future teachers acknowledge that, while artificial intelligence can facilitate structured access to information and offer innovative proposals, it is incapable of replacing the depth of personal analysis or the richness of

collective debate. Indeed, when utilized in a judicious manner, these tools can engender the confrontation of perspectives, the identification of biases, and informed decision-making, thereby providing a space for ethical reflection situated in authentic educational contexts.

The practical application of knowledge in real contexts that address complex social and family issues is an essential element in the training process. In this context, AI was perceived as a useful tool for generating diverse scenarios to anticipate potential school-family challenges and structuring initial intervention proposals, which in turn supported the students' reflective analysis and ethical sensitivity (Henriksen et al., 2025), such as empathy, active listening, and cultural sensitivity. The integration of collaborative work, critical reflection, and technological support has emerged as a promising approach to prepare future teachers to function as conscious mediators between knowledge, values, and the needs of their students.

6.1 Study limitations and prospective

The quasi-experimental single-group design with convenience sampling limits generalizability and causal attribution, while the *ad hoc* questionnaire lacks prior psychometric validation. Future research should include longitudinal and comparative studies across contexts to assess the sustained impact of critical AI use in teaching practice, integrating AI literacy with reflective methodologies to develop both technical competence and ethical judgement.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary Material, further inquiries can be directed to the corresponding author.

Author contributions

JO-M: Resources, Validation, Data curation, Project administration, Conceptualization, Methodology, Visualization, Formal analysis, Supervision, Investigation, Funding acquisition, Writing – review & editing, Software, Writing – original draft. JB-L: Conceptualization, Methodology, Formal analysis, Project administration, Data curation, Writing – original draft, Supervision, Investigation, Visualization, Software, Writing – review & editing, Funding acquisition, Resources, Validation. JG-O: Writing – original draft, Project administration, Data curation, Methodology, Investigation, Visualization,

Conceptualization, Resources, Validation, Writing – review & editing, Funding acquisition, Software, Formal analysis, Supervision.

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Conflict of interest

The author(s) declared that this work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declared that generative AI was not used in the creation of this manuscript.

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