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Abstract: The increasing integration of artificial intelligence (AI) into education has highlighted the importance of understanding how practising and prospective teachers perceive its pedagogical, technological, socio-emotional and ethical implications. This study examined associations between personal, academic and professional characteristics and four dimensions of educational AI perception, drawing conceptually on UNESCO's AI Competency Framework for Teachers and the European Framework for the Digital Competence of Educators (DigCompEdu). A quantitative, non-experimental, cross-sectional research design was employed, involving 1,292 participants from Andalusia, Spain, comprising 1,078 university students preparing for teaching careers and 214 professionally active or non-active teachers. Data were collected using the 39-item ACISE-IA questionnaire, which examines socio-emotional and affective perceptions, positive attitudes towards educational AI, perceived digital competence, and critical perception and ethical responsibility. Statistical analyses included Pearson's correlations, independent-samples t-tests and one-way analysis of variance (ANOVA). Age and teaching experience demonstrated statistically significant but relatively weak negative associations with selected dimensions of educational AI perception, while academic achievement exhibited negligible positive correlations ($r = 0.065–0.077$). Statistically significant differences were also identified across academic disciplines, employment categories and academic years, although their magnitude and direction varied. University students generally reported more favourable socio-emotional perceptions and attitudes towards AI than the combined teacher group, whereas differences in perceived digital competence and ethical responsibility were not statistically significant. Academic-year comparisons revealed non-linear patterns, particularly among master's students. The findings demonstrate that educational AI perceptions vary across personal, academic and professional characteristics, although these factors explain only a limited proportion of the observed differences. The results highlight the importance of considering socio-emotional, attitudinal, technological and ethical dimensions when developing teacher education and professional development opportunities. Further research employing representative samples and multivariable analytical approaches is required to clarify these relationships and inform context-sensitive strategies for responsible AI integration.

Keywords: Artificial Intelligence in Education, Teacher Education, Prospective Teachers, Teacher Perceptions, Digital Competence, AI Ethics, Professional Development.

1. Introduction

Artificial intelligence (AI) has emerged as one of the most influential technological developments in contemporary society, fundamentally transforming how information is processed, interpreted and applied across different sectors (Sakubu, 2025). Within education, AI is increasingly reshaping curriculum development, instructional practices and everyday interactions between educators and learners (Bahroun et al., 2023; Bektik et al., 2024). Although AI-based applications have been present in educational environments for several years, their adoption accelerated considerably during 2022–2023, following the widespread availability of accessible generative AI systems (Bektik et al., 2024; Garzón and Patiño 2025). This technological transition has also highlighted generational differences, as many teachers completed their professional preparation before AI became widely integrated into education, whereas prospective educators are increasingly undertaking their studies within digitally advanced environments where AI supports or automates various educational processes (Sakubu, 2025; Bahroun et al., 2023).

Against this background, examining teachers' perceptions of AI requires consideration of the emotional and ethical dimensions associated with its educational application. Educators' confidence in these technologies, together with their perceived ability to maintain control over teaching and learning processes, represents an important consideration in their acceptance and integration (Cavero et al., 2025; Choi et al., 2023). Nevertheless, attitudes towards AI are also influenced by concerns regarding algorithmic bias, the potential reinforcement of existing social and cultural inequalities, limited transparency in automated decision-making and the collection and processing of students' personal information. Such issues raise significant ethical questions concerning the responsible implementation of AI within educational settings (Garzón and Patiño 2025; Alfaro and Díaz, 2024; Holmes et al., 2022).

Accordingly, the incorporation of AI into educational practice should not be regarded exclusively as the introduction of new technological tools. Both practising and prospective teachers have a fundamental responsibility in determining how AI applications are understood, evaluated and employed within teaching and learning environments. Their preparedness consequently extends beyond technical proficiency to encompass attitudes towards educational AI, perceptions of its pedagogical implications and the ability to critically assess the ethical challenges associated with its use. Investigating these interconnected dimensions is particularly important within a rapidly changing technological landscape, where initial teacher education and continuing professional development must respond to evolving educational expectations and requirements (Garzón and Patiño 2025; Cavero et al., 2025; Choi et al., 2023; Alfaro and Díaz, 2024; Holmes et al., 2022). From the perspective of educational sustainability, the responsible incorporation of AI further requires long-term institutional approaches that reconcile technological advancement with pedagogical effectiveness, ethical accountability and educators' capacity to respond to ongoing innovation. Sustainable educational transformation therefore depends not merely on the availability of AI technologies, but also on strengthening the professional knowledge, critical awareness and adaptive competencies necessary to support their responsible and continued integration into educational systems.

1.1. Review of the Related Literature

Within this context, teachers' and prospective educators' perceptions of artificial intelligence (AI) are closely associated with their academic preparation and previous educational experiences. Differences between generations are particularly relevant, as opportunities to receive AI-related training, engage with emerging technologies and critically examine their educational implications have developed at different stages and under varying circumstances (Alonso-García et al., 2025; Andión and Cárdenas, 2023). Consequently, previous familiarity with digital technologies, alongside opportunities to explore and apply AI during initial teacher education, may contribute to variations in how these tools are understood, assessed and incorporated into educational practice.

Academic discipline represents another factor potentially influencing perceptions of AI. Existing research indicates that disciplines characterised by analytical reasoning, systematic problem-solving and data interpretation may recognise greater pedagogical opportunities associated with AI applications (Bustamante et al., 2025; Miluniec et al., 2025). Conversely, fields emphasising subjective interpretation, cultural expression and artistic creativity may demonstrate more cautious attitudes, particularly where technological applications intersect with activities traditionally dependent on human judgement and creativity (Bustamante et al., 2025; Miluniec et al., 2025). Furthermore, academic achievement during teacher preparation may influence attitudes towards emerging technologies, as stronger perceptions of personal competence and academic self-efficacy can encourage greater confidence and willingness to experiment with AI-supported educational approaches (Bustamante et al., 2025; Espinoza et al., 2024).

Beyond individual and disciplinary characteristics, institutional conditions may also shape educators' attitudes towards AI. The availability of technological infrastructure, organisational culture and support provided by institutional leadership can influence teachers' confidence in adopting and applying these technologies within their professional responsibilities Reza Flores et al. (2025). Similarly, the educational level at which teaching takes place may contribute to differences in AI perceptions. At more advanced educational stages, AI may be regarded as a useful resource for supporting particular instructional activities, whereas its application in earlier educational settings may generate greater reservations because of the importance attributed to direct teacher–student interaction (Sánchez-Trujillo et al., 2025). Employment conditions may also play a role, as greater professional stability can facilitate openness towards educational innovation, while uncertainty surrounding employment may encourage more cautious responses to technological change (Andión and Cárdenas, 2023).

Collectively, the literature indicates that perceptions of AI in education are shaped by interconnected personal, academic, professional and institutional circumstances rather than technological experience alone (Bahroun et al., 2023; Galindo-Domínguez et al., 2024; Prilop et al., 2025). Nevertheless, existing investigations have frequently considered these influences independently, limiting understanding of how different aspects of AI perception interact across diverse educational and professional backgrounds. In particular, socio-emotional responses, attitudes towards educational applications, perceived digital competence and critical and ethical responsibility require examination within a more integrated analytical perspective. Investigating these dimensions collectively may provide a more comprehensive understanding of the diverse ways in which practising and prospective teachers interpret, evaluate and respond to AI within contemporary educational environments.

1.2. Theoretical Framework

The understanding of teachers' readiness to incorporate technology into educational practice has gradually evolved from an emphasis on technical proficiency towards a more comprehensive interpretation of digital competence. Within this development, the European Framework for the Digital Competence of Educators (DigCompEdu) offers an established conceptual foundation, identifying six interrelated areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence (Redecker, 2017). Rather than restricting digital competence to the operational use of technological applications, this framework recognises the importance of their effective pedagogical integration, critical evaluation and responsible implementation across educational settings.

The increasing availability of generative AI and other advanced intelligent systems has introduced further considerations that extend beyond established understandings of educators' digital capabilities. Teachers must develop the knowledge required to engage with AI applications while simultaneously assessing their educational suitability, examining the reliability of generated outputs and considering their potential influence on learners and pedagogical relationships. These responsibilities also involve addressing questions concerning algorithmic transparency, equity, data protection, human autonomy and professional accountability. Consequently, evaluating teachers' preparedness for AI-supported education requires an integrated perspective that considers technological understanding alongside pedagogical judgement, human-centred considerations and ethical awareness (Redecker, 2017; Miao and Cukurova, 2024).

To address these emerging educational requirements, UNESCO introduced the AI Competency Framework for Teachers (AI CFT), which organises educators' AI-related competencies into five interconnected dimensions: a human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning (Miao and Cukurova, 2024). These dimensions are further structured around three progressive levels of competence development-Acquire, Deepen and Create-representing a developmental pathway through which educators can strengthen their understanding and application of AI. Central to this framework is a human-centred orientation that positions technological expertise alongside pedagogical decision-making, professional autonomy, ethical accountability and awareness of the wider educational and societal consequences associated with AI integration.

Drawing upon these conceptual foundations, the present investigation employs UNESCO's AI Competency Framework for Teachers as its principal interpretive reference, while DigCompEdu provides a complementary perspective on the wider dimensions of educators' digital competence. Importantly, the ACISE-IA instrument was not originally constructed from these frameworks; consequently, its dimensions should not be interpreted as directly corresponding to their established competency categories. Nevertheless, several conceptual connections can be recognised. The socio-emotional and affective perception of AI (PSEA) examines perceived consequences for learners and educational relationships; positive attitudes towards educational AI (APIA) concern educators' dispositions towards incorporating AI into teaching practice; digital competence in AI (CD) considers perceived technological knowledge and practical capabilities; and critical perception and ethical responsibility (PCRE) addresses the evaluation of AI applications from critical and ethical perspectives. Considered collectively, these four dimensions offer a multidimensional understanding that corresponds conceptually with the human-centred, technological, pedagogical and ethical principles underpinning the AI CFT. Accordingly, these theoretical perspectives support the interpretation of relationships between personal characteristics, academic experiences, professional circumstances and the different dimensions of AI perception among practising and prospective teachers (Redecker, 2017; Miao and Cukurova, 2024).

Although research examining artificial intelligence in education has expanded considerably, understanding of the combined influence of personal, academic and professional characteristics on teachers' perceptions remains comparatively fragmented. Existing investigations have commonly addressed attitudes towards AI, digital capabilities and ethical considerations as separate areas of enquiry, while fewer have examined these dimensions collectively through an integrated analytical approach. In particular, socio-emotional perceptions, attitudes towards educational applications, perceived digital competence and critical and ethical responsibility have received limited simultaneous consideration. Moreover, potential variations associated with age, academic achievement, disciplinary specialisation, employment circumstances, teaching experience and progression through teacher education have not been sufficiently investigated within a shared multidimensional perspective. Examining these relationships may therefore provide a more comprehensive understanding of the diverse profiles associated with educational AI adoption, while generating evidence capable of informing more appropriately differentiated approaches to teacher preparation and professional development.

From an educational sustainability perspective, examining these variations is particularly important because the continued integration of AI depends on more than the accessibility of technological resources. Its long-term implementation also requires educators who possess appropriate knowledge, confidence and critical capabilities, together with educational institutions capable of adjusting their professional development opportunities and support mechanisms in response to technological advancement. Within this context, the present investigation contributes to discussions of educational sustainability by identifying characteristics that may inform more responsive, contextually appropriate and enduring approaches to preparing teachers for the responsible use of AI.

1.3. Research Question, Objective, and Hypotheses

The present quantitative investigation aims to examine perceptions of artificial intelligence (AI) in educational contexts among teachers (active and non-active) and university students preparing for the teaching profession. Particular attention is given to the

relationships between personal, academic and professional characteristics and four dimensions of AI perception: socio-emotional responses, positive attitudes, perceived digital competence, and critical perception and ethical responsibility.

Drawing upon the existing literature and the theoretical foundations outlined in the preceding sections, the following research question was established: How are personal, academic and professional characteristics associated with the different dimensions of educational AI perception among practising and prospective teachers?

Accordingly, the primary objective of this investigation is to examine the associations between personal, academic and professional characteristics and the various dimensions of educational AI perception among teachers and university students undertaking teacher education.

To address this objective, six research hypotheses were formulated:

- ***H1.*** Age is expected to demonstrate a negative correlation with positive attitudes towards AI, perceived digital competence and the overall questionnaire score.
- ***H2.*** Academic achievement, assessed through grade point average, is expected to correlate positively with positive attitudes towards AI, perceived digital competence, critical perception and ethical responsibility, as well as the overall questionnaire score.
- ***H3.*** Academic discipline is expected to be associated with statistically significant differences in AI perceptions, with students enrolled in Engineering and Architecture and Science programmes anticipated to achieve higher scores in socio-emotional perception, perceived digital competence, critical perception and ethical responsibility, and the overall questionnaire score.
- ***H4.*** Employment status is expected to be associated with statistically significant variations in AI perceptions. University students preparing for teaching careers are anticipated to report higher scores than teachers in socio-emotional perception, positive attitudes towards AI, perceived digital competence and the overall questionnaire score, whereas no statistically significant differences are expected in the ethical dimension.
- ***H5.*** Among teachers, increasing years of professional teaching experience are expected to correlate negatively with positive attitudes towards AI, perceived digital competence and the overall instrument score.
- ***H6.*** Among university students enrolled in teacher education programmes, academic year is expected to be significantly associated with all questionnaire dimensions, with students in advanced undergraduate years and master's programmes anticipated to demonstrate more favourable evaluations than those in the initial stages of their studies.

2. Material and Methods

2.1. Design and Participants

The investigation adopted a quantitative methodological approach, employing a non-experimental, descriptive and exploratory research design characterised by its cross-sectional and ex post facto nature. The study involved a total of 1,292 participants, comprising 29% men (n = 375), 70.8% women (n = 915) and 0.2% individuals identifying as non-binary (n = 2). Participants were drawn from the autonomous community of Andalusia, Spain, and included both teachers (active and non-active) and university students undertaking teacher education programmes. Regarding the sample distribution, 14.6% were actively employed teachers (n = 189), 1.9% were qualified teachers who were not professionally active during the research period (n = 25), and 83.4% were university students preparing for teaching careers (n = 1,078). For the analysis of employment status, practising and non-active teachers were combined into one category because of the relatively limited number of non-active teachers. Consequently, employment status was classified into two groups: university students enrolled in teacher education (n = 1,078; 83.4%) and teachers (n = 214; 16.6%). Participants were recruited through purposive, non-probability sampling, with eligibility requirements established according to their educational or professional circumstances. The inclusion criteria were defined as follows: (CI-1) professionally active teachers were required to be delivering instruction at an officially recognised educational level during the 2024–2025 academic year; (CI-2) non-active teachers were required to have previous teaching experience within formal education; and (CI-3) university students were required to be enrolled in a degree programme associated with Education Sciences or to be undertaking preparation for entry into the teaching profession.

2.2. Instruments

Data collection was undertaken using the Scale of Attitudes, Knowledge, Emotions, and Ethics in Teachers toward the Use of Artificial Intelligence in Professional Performance (ACISE-IA), a 39-item questionnaire designed to assess multiple dimensions of teachers' perceptions of artificial intelligence in educational contexts. The instrument employs a five-point Likert scale, ranging

from 1 (“Strongly disagree”) to 5 (“Strongly agree”). The questionnaire is organised into four distinct dimensions: (1) socio-emotional and affective perceptions of AI (PSEA), encompassing items 1-10; (2) positive attitudes towards educational AI (APIA), covering items 11-20; (3) perceived digital competence in AI (CD), comprising items 21-29; and (4) critical perception and ethical responsibility regarding AI (PCRE), including items 30-39. Illustrative statements representing these dimensions include “AI can improve students’ emotional intelligence” (PSEA), “Using AI technologies could make learning more interesting” (APIA), “I am familiar with various AI technologies” (CD), and “The use of AI could become abusive” (PCRE).

The four questionnaire dimensions were examined separately in the statistical analyses, alongside an overall instrument score. The questionnaire assessed participants' self-reported perceptions, attitudes and perceived competencies concerning artificial intelligence in educational contexts, rather than their objectively demonstrated technological or pedagogical capabilities.

The internal consistency of the four questionnaire dimensions was assessed using Cronbach's alpha (α) and McDonald's omega (ω) within the study sample (n = 1,292). The results demonstrated satisfactory to excellent reliability across the dimensions: socio-emotional and affective perceptions of AI (PSEA; $\alpha = 0.927$, $\omega = 0.928$), positive attitudes towards educational AI (APIA; $\alpha = 0.910$, $\omega = 0.911$), perceived digital competence in AI (CD; $\alpha = 0.888$, $\omega = 0.892$), and critical perception and ethical responsibility (PCRE; $\alpha = 0.797$, $\omega = 0.798$). These coefficients indicate acceptable to high internal consistency within the analysed sample.

2.3. Procedure

The data collection process commenced with communication involving several educational institutions, universities and teacher education centres to introduce the research and explain its objectives and scope. Initial contact was established through emails distributed by the researcher to university academics involved in teacher education programmes, inviting their cooperation in circulating the questionnaire among their students. Additionally, the questionnaire link was forwarded to institutional management teams at schools and universities to support its dissemination among teaching personnel across relevant faculties and academic departments.

Participation in the investigation was entirely voluntary and anonymous, with eligibility restricted to individuals aged 18 years or older. On this basis, formal institutional authorisation was not considered necessary for participation. Nevertheless, informed consent was obtained from all respondents before they accessed the questionnaire. An introductory section outlined the study's objectives, academic purpose, confidentiality arrangements and assurance that the information collected would be used exclusively for research purposes.

The questionnaire was distributed during the first quarter of 2025 through a self-administered online survey platform, allowing participants to complete the instrument independently without the physical presence of the researcher. Data collection proceeded without any significant difficulties or reported incidents. Furthermore, the researcher's contact information was provided to enable participants to request clarification or raise questions concerning the study.

The study was conducted in accordance with established ethical principles governing research involving human participants, including the Declaration of Helsinki and applicable data protection regulations, particularly Regulation (EU) 2016/679 (General Data Protection Regulation). Participation was voluntary, and informed consent was obtained before data collection. The research procedures were designed to protect participants' confidentiality and ensure the responsible handling of collected information. Ethical oversight and approval were provided by the relevant research ethics committee(s), as documented in the study's original approval records.

2.4. Data Analysis

Statistical analyses were conducted using IBM SPSS Statistics, version 28.0.1.0 (IBM Corp., Armonk, NY, USA). Initially, descriptive statistical analyses were performed to determine the frequencies and mean values of the variables under investigation. The distributions of individual questionnaire items were examined descriptively using skewness and kurtosis coefficients, with absolute values not exceeding 2 considered indicative of the absence of substantial univariate asymmetry or kurtosis. However, these item-level assessments alone do not establish that all distributional assumptions associated with the subsequent inferential analyses were satisfied. Comparisons between two independent groups were undertaken using Student's t-test, while one-way analysis of variance (ANOVA) was applied to variables involving more than two groups. Where appropriate, post hoc comparisons were conducted using the Bonferroni adjustment. Associations between continuous variables were examined using Pearson's bivariate correlation analysis. Additionally, the internal consistency of the measurement scales was evaluated using Cronbach's alpha (α) and McDonald's omega (ω) reliability coefficients.

Statistical significance was evaluated using a threshold of $p < 0.05$, corresponding to a 95% confidence level. Alongside statistical significance, the magnitude and practical relevance of observed associations and group differences were considered when interpreting the findings. Given the cross-sectional design of the investigation, the results were interpreted as associations rather than evidence of causal relationships.

3. Results

Initially, Pearson's bivariate correlation analysis was conducted to examine the relationships between participants' age, grade point average and the different questionnaire dimensions (Table 1). The findings revealed statistically significant negative correlations between age and the PSEA, APIA and CD dimensions ($p < 0.01$), as well as the instrument's overall score. The strongest negative association was identified for PSEA ($r = -0.209$), followed by the total questionnaire score ($r = -0.172$), CD ($r = -0.137$) and APIA ($r = -0.133$), which demonstrated the weakest association. Conversely, no statistically significant relationship was identified between age and the PCRE dimension. Accordingly, H1 was supported, as increasing age was negatively associated with positive attitudes towards educational AI, perceived digital competence and the overall questionnaire score, consistent with the proposed hypothesis.

Table 1. *Relationships between participants' age, grade point average, and the different questionnaire dimensions.*

	PSEA	APIA	CD	PCRE	Overall score	Age	Grade point average
PSEA	—	0.470 **	0.543 **	0.014	0.772 **	−0.209 **	−0.002
APIA	—	—	0.587 **	0.242 **	0.817 **	−0.133 **	0.071 *
CD	—	—	—	0.077 **	0.805 **	−0.137 **	0.065 *
PCRE	—	—	—	—	0.399 **	0.031	0.077 **
Overall score	—	—	—	—	—	−0.172 **	0.069 *
Age	—	—	—	—	—	—	−0.035

Note 1: *PSEA = Socio-emotional and affective perceptions of AI; APIA = Positive attitudes towards the educational use of AI; CD = Digital competence related to AI; PCRE = Critical perceptions and ethical responsibility concerning AI.* ***Note 2:*** *** indicates a statistically significant correlation at the 0.01 level (two-tailed), while * denotes statistical significance at the 0.05 level (two-tailed).*

Regarding grade point average, Pearson's correlation analysis identified positive and statistically significant relationships with the APIA, CD and PCRE dimensions, together with the questionnaire's overall score. The strongest positive correlation was recorded for PCRE ($r = 0.077$), followed by APIA ($r = 0.071$) and the total instrument score ($r = 0.069$), whereas CD demonstrated the weakest association ($r = 0.065$). Conversely, no statistically significant correlations were identified between grade point average and either the PSEA dimension or participants' age. Accordingly, H2 was supported, as higher academic achievement was positively associated with attitudes towards educational AI, perceived digital competence, critical perception and ethical responsibility, and the overall questionnaire score, consistent with the proposed hypothesis.

Although several relationships between age and the ACISE-IA dimensions reached statistical significance, the corresponding correlation coefficients were generally weak, with the strongest association observed for socio-emotional and affective perceptions of AI (PSEA; $r = -0.209$). Associations involving grade point average were considerably smaller ($r = 0.065$–0.077), indicating negligible relationships in practical terms despite their statistical significance. These findings suggest that age and academic achievement account for only a limited proportion of the observed variation in participants' perceptions of educational AI. Accordingly, statistical significance should not be interpreted as evidence of substantial predictive or explanatory importance.

The examination of differences across academic disciplines (Table 2) revealed statistically significant associations between field of study and socio-emotional and affective perception of AI (PSEA; $p < 0.001$), digital competence in AI (CD; $p < 0.001$), critical perception and ethical responsibility (PCRE; $p = 0.028$), and the questionnaire's overall score ($p < 0.001$). Participants from Social and Legal Sciences demonstrated the highest mean values for PSEA (2.81 ± 0.91), CD (3.00 ± 0.86) and the total questionnaire score (128.64 ± 22.81). In contrast, the PCRE dimension showed consistently high mean scores across the different academic fields, with Arts and Humanities (3.87 ± 0.67) and Sciences (3.86 ± 0.56) recording marginally higher values. No statistically significant differences were identified between academic disciplines in the APIA dimension. Subsequent pairwise comparisons applying the Bonferroni correction demonstrated that participants from Social and Legal Sciences achieved significantly higher PSEA scores than those from Arts and Humanities, Sciences and Health Sciences. Furthermore, the Social and Legal Sciences group obtained

significantly higher CD scores than the Sciences group, with a statistically significant difference also identified between these two disciplines in the overall questionnaire score. Consequently, H3 was not supported in its predicted direction. Although statistically significant differences were identified across academic disciplines in socio-emotional perceptions, perceived digital competence, critical perception and ethical responsibility, and the overall questionnaire score, participants from Engineering and Architecture and Sciences did not consistently demonstrate the highest values. Instead, participants from Social and Legal Sciences generally recorded more favourable scores across several dimensions. Nevertheless, the corresponding effect sizes were small ($\eta p^2 = 0.007$-0.047), with the largest effect observed for PSEA ($\eta p^2 = 0.047$). These findings indicate that disciplinary background was associated with measurable but relatively limited differences in educational AI perceptions, rather than representing a substantial explanatory factor.

Table 2. *Variations in ACISE-IA questionnaire dimensions across university degree programmes.*

Dimension	Study area	*M*	*SD*	EE	*F*	Sig.	η^2
PSEA	Arts and Humanities	2.35 [a]	0.91	0.12	15.86	<0.001 *	0.047
	Science	2.32 [a]	0.75	0.05			
	Health Sciences	2.31 [a]	0.82	0.13			
	Social and Legal Sciences	2.81 [a]	0.91	0.02			
	Engineering and Architecture	2.46	1.02	0.18			
APIA	Arts and Humanities	3.41	1.05	0.14	2.17	0.07	0.007
	Science	3.71	0.70	0.05			
	Health Sciences	3.60	0.98	0.15			
	Social and Legal Sciences	3.62	0.75	0.02			
	Engineering and Architecture	3.85	0.84	0.15			
CD	Arts and Humanities	2.74	1.00	0.14	10.36	<0.001 *	0.031
	Science	2.60 [a]	0.75	0.05			
	Health Sciences	2.62	0.97	0.15			
	Social and Legal Sciences	3.00 [a]	0.86	0.02			
	Engineering and Architecture	2.90	1.08	0.20			
PCRE	Arts and Humanities	3.87	0.67	0.09	2.72	0.028 *	0.031
	Science	3.86	0.56	0.04			
	Health Sciences	3.69	0.53	0.08			
	Social and Legal Sciences	3.72	0.63	0.02			
	Engineering and Architecture	3.64	0.67	0.12			
ACISE-IA total	Arts and Humanities	121.11	25.74	3.61	5.18	<0.001 *	0.016
	Science	122.49 [a]	16.00	1.18			
	Health Sciences	119.78	21.55	3.49			
	Social and Legal Sciences	128.64 [a]	22.81	0.72			
	Engineering and Architecture	125.79	22.89	4.25			

Note 1: *PSEA = Socio-emotional and affective perceptions of AI; APIA = Positive attitudes towards the educational use of AI; CD = Digital competence related to AI; PCRE = Critical perceptions and ethical responsibility concerning AI.* ***Note 2:*** ** Denotes statistically significant differences identified in the table.* ***Note 3:*** *Superscript identifies pairs of groups exhibiting statistically significant differences based on Bonferroni-adjusted post hoc comparisons.*

To examine differences in perceptions of artificial intelligence according to participant status, comparisons were conducted between university students (n = 1,078) and the combined teacher group (n = 214), comprising 189 active teachers and 25 non-active teachers. The examination of differences according to participant status (Table 3) revealed statistically significant variations in the PSEA ($p < 0.001$) and APIA ($p < 0.001$) dimensions, as well as in the overall questionnaire score ($p < 0.001$). Conversely, no statistically significant differences were identified for digital competence (CD: $p = 0.053$) or critical perception and ethical responsibility (PCRE: $p = 0.698$). Comparisons of mean scores indicated that university students undertaking teacher education achieved higher values than teachers (active and non-active) in PSEA (2.77 ± 0.90 versus 2.34 ± 0.87), APIA (3.66 ± 0.71 versus 3.46 ± 0.97) and the total instrument score (128.33 ± 21.77 versus 121.26 ± 23.56). Although prospective teachers also recorded a marginally higher mean value for CD compared with teachers (active and non-active) (2.94 ± 0.84 versus 2.82 ± 1.01), the observed difference was not statistically significant ($p = 0.053$). Similarly, PCRE scores remained comparable between university students (3.73 ± 0.62) and teachers (3.77 ± 0.64), with no statistically significant difference identified. Consequently, H4 was partially supported. University students preparing for teaching careers demonstrated significantly higher scores than teachers in socio-emotional and affective perceptions of AI (PSEA), positive attitudes towards educational AI (APIA), and the overall

questionnaire score. However, the anticipated difference in perceived digital competence (CD) was not statistically significant ($p = 0.053$), while critical perception and ethical responsibility (PCRE) remained comparable between groups ($p = 0.698$), consistent with the hypothesis that no significant difference would emerge in this dimension. Examination of effect sizes indicated that the largest difference occurred in PSEA ($d = 0.480$), whereas smaller effects were observed for APIA ($d = 0.263$) and the overall ACISE-IA score ($d = 0.320$). The differences in CD ($d = 0.138$) and PCRE ($d = -0.064$) were negligible. Taken together, these findings suggest that participant status was associated primarily with socio-emotional perceptions and attitudes towards educational AI, rather than substantial differences across all measured dimensions.

Table 3. *Variations in ACISE-IA questionnaire dimensions by participants' employment status.*

Dimension	Participant group	*M*	*SD*	*EE*	*T*	*Sig.*	*D*
PSEA	University students	2.77	0.90	0.02	6.55	<0.001 *	0.480
	Teachers (active and non-active)	2.34	0.87	0.05			
APIA	University students	3.66	0.71	0.02	3.50	<0.001 *	0.263
	Teachers (active and non-active)	3.46	0.97	0.06			
CD	University students	2.94	0.84	0.02	1.93	0.053	0.138
	Teachers (active and non-active)	2.82	1.01	0.06			
PCRE	University students	3.73	0.62	0.01	−0.81	0.698	−0.064
	Teachers (active and non-active)	3.77	0.64	0.04			
ACISE-IA total	University students	128.33	21.77	0.66	4.27	<0.001 *	0.320
	Teachers (active and non-active)	121.26	23.56	1.61			

Note 1: *PSEA = Socio-emotional and affective perceptions of AI; APIA = Positive attitudes towards the educational application of AI; CD = Digital competence related to AI; PCRE = Critical perceptions and ethical responsibility concerning AI.* ***Note 2:*** ** Denotes statistically significant differences reported in the table.* ***Source:*** *Authors' own elaboration.*

Following the categorisation of participants by employment status into university students undertaking teacher education and teachers, Pearson's bivariate correlation analysis was performed exclusively within the teacher subgroup, including both professionally active and non-active teachers, to investigate the relationships between years of teaching experience and the questionnaire dimensions (Table 4). The findings identified statistically significant negative correlations between teaching experience and APIA ($p < 0.05$), CD ($p < 0.01$), and the overall questionnaire score ($p < 0.05$). The strongest negative relationship was recorded for CD ($r = -0.195$), followed by the total instrument score ($r = -0.168$) and APIA ($r = -0.145$). Conversely, no statistically significant associations were identified between years of teaching experience and either the PSEA or PCRE dimensions. Accordingly, H5 was supported, as increasing years of teaching experience were negatively associated with positive attitudes towards educational AI (APIA; $r = -0.145$), perceived digital competence (CD; $r = -0.195$), and the overall questionnaire score ($r = -0.168$), consistent with the hypothesised direction of these relationships. Nevertheless, the observed correlations were relatively weak, indicating that teaching experience accounted for only a small proportion of the variation in these dimensions. The strongest association was identified for perceived digital competence, although its magnitude remained limited. Furthermore, the absence of statistically significant relationships with socio-emotional and affective perceptions (PSEA) and critical perception and ethical responsibility (PCRE) suggests that teaching experience was not consistently associated with all aspects of educational AI perception. These findings should therefore be interpreted as modest associations rather than evidence that accumulating teaching experience directly reduces educators' acceptance of or competence in AI.

Subsequently, the analysis was restricted to university students to investigate variations in questionnaire dimensions according to academic year (Table 5). The analysis of variance (ANOVA) revealed statistically significant differences across all questionnaire dimensions and the overall instrument score according to academic year ($p < 0.001$). For PSEA, mean scores increased progressively throughout undergraduate education, rising from 2.71 ± 0.66 among first-year students to 3.08 ± 0.92 among fourth-year students. Nevertheless, this upward trend did not extend to master's students, who recorded a lower mean score (2.34 ± 0.76). This difference suggests that postgraduate participants exhibited a distinct response profile, rather than reflecting a consistent linear progression associated with educational level. Regarding APIA, the results demonstrated significant variation across academic stages. Master's students achieved a relatively high mean score (3.78 ± 0.63), whereas first-year undergraduate students recorded a considerably lower value (3.20 ± 0.65). From the second year onwards, mean scores increased progressively, reaching 3.45 ± 0.78 in the second year, 3.72 ± 0.68 in the third year and 3.75 ± 0.75 in the fourth year. A different pattern emerged for CD, where a noticeable increase was identified between the first and second undergraduate years. Master's students recorded a mean of 2.63 ± 0.80, comparable to the first-year undergraduate mean of 2.72 ± 0.74. However, the second-year mean increased to 3.05 ± 0.84, with similarly elevated scores maintained during the third (3.06 ± 0.83) and fourth (3.06 ± 0.88) years. In contrast, PCRE demonstrated a different

distribution across academic stages. The highest mean score was observed among master's students (3.93 ± 0.52), followed by third-year (3.76 ± 0.59) and fourth-year (3.69 ± 0.65) undergraduate students, while first-year students recorded the lowest mean (3.24 ± 0.53). Finally, the overall ACISE-IA score reflected a generally progressive increase throughout undergraduate education. First-year students demonstrated the lowest total mean (116.08 ± 18.60), followed by progressively higher values in the second (127.00 ± 24.57), third (131.18 ± 21.90) and fourth (133.04 ± 24.33) years. Notably, the fourth-year undergraduate mean exceeded that of master's students (124.31 ± 15.84). Consequently, H6 was partially supported, as statistically significant differences were identified across academic years in all four questionnaire dimensions and the overall ACISE-IA score. Although several dimensions demonstrated generally increasing scores throughout undergraduate education, this pattern was not consistently maintained among master's students. In particular, master's students recorded comparatively lower scores in socio-emotional and affective perceptions of AI (PSEA), perceived digital competence (CD), and the overall questionnaire score, while demonstrating relatively favourable attitudes towards educational AI (APIA) and the highest mean score in critical perception and ethical responsibility (PCRE). These findings indicate that differences across academic stages were multidimensional rather than reflecting a uniform progression in AI-related perceptions. Effect-size analysis identified the largest association for PSEA ($\eta p^2 = 0.089$), while smaller effects were observed for APIA ($\eta p^2 = 0.030$), CD ($\eta p^2 = 0.036$), PCRE ($\eta p^2 = 0.050$), and the overall ACISE-IA score ($\eta p^2 = 0.042$). Although academic year was associated with statistically significant differences, the magnitude of these effects remained generally limited. Furthermore, because the investigation employed a cross-sectional design, these differences should not be interpreted as evidence that AI-related perceptions necessarily improve or decline as individual students progress through their studies.

Table 4. *Associations between years of teaching experience and the ACISE-IA questionnaire dimensions.*

	APIA	CD	PCRE	Overall Score	Years of Experience
PSEA	0.549 **	0.427 **	−0.152 *	0.721 **	−0.008
APIA		0.666 **	−0.002	0.875 **	−0.145 *
CD			−0.033	0.812 **	−0.195 **
PCRE				0.205 **	−0.107
Overall score					−0.168 *

Note 1: *PSEA = Socio-emotional and affective perceptions of AI; APIA = Positive attitudes towards the educational use of AI; CD = Digital competence related to AI; PCRE = Critical perceptions and ethical responsibility concerning AI.* ***Note 2:*** *** Denotes a statistically significant correlation at the 0.01 level (two-tailed), whereas * indicates statistical significance at the 0.05 level (two-tailed).* ***Source:*** *Authors' own elaboration.*

Table 5. *Variations in ACISE-IA questionnaire dimensions across different academic years.*

Dimension	Academic year	*M*	*SD*	*EE*	*F*	Sig.	η^2
PSEA	First year	2.71	0.66	0.08	20.61	<0.001 *	0.089
	Second year	2.90	0.91	0.06			
	Third year	2.86	0.91	0.04			
	Fourth year	3.08	0.92	0.08			
	Master's	2.34	0.76	0.04			
APIA	First year	3.20	0.65	0.08	13.71	<0.001 *	0.030
	Second year	3.45	0.78	0.05			
	Third year	3.72	0.68	0.03			
	Fourth year	3.75	0.75	0.06			
	Master's	3.78	0.63	0.04			
CD	First year	2.72	0.74	0.09	13.48	<0.001 *	0.036
	Second year	3.05	0.84	0.06			
	Third year	3.06	0.83	0.03			
	Fourth year	3.06	0.88	0.07			
	Master's	2.63	0.80	0.05			
PCRE	First year	3.24	0.53	0.07	19.09	<0.001 *	0.050
	Second year	3.59	0.68	0.04			
	Third year	3.76	0.59	0.02			
	Fourth year	3.69	0.65	0.05			
	Master's	3.93	0.52	0.03			
ACISE-IA total	First year	116.08	18.60	2.48	10.45	<0.001 *	0.042
	Second year	127.00	24.57	1.75			
	Third year	131.18	21.90	1.02			
	Fourth year	133.04	24.33	2.16			
	Master's	124.31	15.84	1.02			

Note 1: *PSEA = Socio-emotional and affective perceptions of AI; APIA = Positive attitudes towards the educational use of AI; CD = Digital competence related to AI; PCRE = Critical perceptions and ethical responsibility concerning AI.* ***Note 2:*** *** Denotes*

statistically significant differences identified in the table. ***Note 3****: Superscript letters a, b, c, d, e, and f identify pairs of groups exhibiting statistically significant differences based on Bonferroni-adjusted post hoc comparisons.* ***Source:*** *Authors' own elaboration.*

4. Discussion

The findings of this investigation highlight the multidimensional nature of educational AI perceptions among practising and prospective teachers, revealing differences associated with personal, academic and professional characteristics. Although several statistically significant relationships were identified, their magnitude varied, suggesting that demographic and educational characteristics alone provide only a partial explanation of participants' perceptions. These findings reinforce the importance of examining AI preparedness beyond technological competence, incorporating socio-emotional responses, pedagogical considerations and ethical responsibility. This interpretation is consistent with UNESCO's AI Competency Framework for Teachers, which emphasises human-centred, ethical, technological and pedagogical competencies (Miao and Cukurova, 2024), and with DigCompEdu's broader conceptualisation of educators' digital competence (Redecker, 2017).

Age demonstrated statistically significant but relatively weak negative associations with socio-emotional and affective perceptions of artificial intelligence (AI), positive attitudes towards its educational application and perceived digital competence. The strongest relationship was observed for socio-emotional perceptions (PSEA; $r = -0.209$), suggesting that age was associated with only a limited proportion of the variation in participants' responses. These findings may reflect differences in previous educational experiences, technological exposure and opportunities to engage with emerging AI applications (Dringó-Horváth et al., 2025; Andión and Cárdenas, 2023). Nevertheless, interpreting these associations primarily through generational differences risks overlooking the potential influence of institutional support, professional development and individual technological experiences. Notably, critical perception and ethical responsibility did not demonstrate a statistically significant relationship with age, indicating that ethical evaluations of AI were not consistently associated with participants' demographic characteristics. Furthermore, age and teaching experience may be closely related, while the reliance on bivariate correlations does not establish their independent contributions. Consequently, these findings should be interpreted as modest associations rather than evidence that increasing age directly reduces educators' acceptance of or preparedness for AI-supported education.

Academic achievement demonstrated statistically significant but negligible positive associations with attitudes towards educational AI, perceived digital competence, critical perception and ethical responsibility, and the overall questionnaire score. Although these findings were consistent with H2, the correlation coefficients were particularly small ($r = 0.065$-0.077), indicating that academic performance explained very little of the variation observed across these dimensions. One possible interpretation is that academic achievement may be associated with differences in learning strategies, academic self-efficacy or willingness to engage with emerging educational technologies (Espinoza et al., 2024; Salazar et al., 2024). However, these characteristics were not directly examined in the present investigation, and such explanations therefore remain tentative. Furthermore, the findings do not establish that participants with higher academic achievement possess substantially greater technological competence or ethical awareness, particularly because the questionnaire assessed self-reported perceptions rather than objectively demonstrated capabilities. From the perspective of UNESCO's AI Competency Framework for Teachers, these findings reinforce the importance of distinguishing between technological knowledge, pedagogical preparedness and critical and ethical engagement with AI (Miao and Cukurova, 2024). Consequently, academic achievement should not be considered a reliable standalone indicator of educators' preparedness for responsible AI integration, despite the statistically significant relationships identified.

Academic specialisation was associated with statistically significant differences in several dimensions of educational AI perception, although the observed patterns did not support the original directional prediction established in H3. Contrary to expectations that participants from Engineering and Architecture or Sciences would demonstrate the highest scores, those from Social and Legal Sciences generally reported more favourable socio-emotional perceptions, higher perceived digital competence and higher overall questionnaire scores. One possible explanation is that disciplinary approaches to teaching, learning and information processing may influence how students interpret the usefulness and implications of AI technologies. Nevertheless, the present investigation did not directly measure disciplinary teaching practices or patterns of AI use, and such explanations therefore remain tentative.

The relatively lower scores recorded among participants from certain technically oriented disciplines should not necessarily be interpreted as evidence of lower technological proficiency or reduced acceptance of AI. Instead, they may reflect differences in expectations, familiarity with particular AI applications or the criteria used when evaluating technological competence. Importantly, the effect sizes associated with academic discipline were generally small ($\eta p^2 = 0.007$-0.047), indicating that disciplinary background accounted for only a limited proportion of the observed variation. Furthermore, critical and ethical perceptions remained relatively similar across disciplines, despite statistically significant differences. These findings suggest that academic specialisation alone is insufficient to explain educational AI perceptions and that future investigations should examine disciplinary learning environments, previous AI exposure and institutional training opportunities in greater detail.

Employment status was associated with differences in socio-emotional perceptions, positive attitudes towards educational AI and the overall questionnaire score, with university students preparing for teaching careers generally reporting more favourable

evaluations than the combined teacher group. The largest difference was observed in socio-emotional perceptions (d = 0.480), whereas the differences in positive attitudes (d = 0.263) and the overall questionnaire score (d = 0.320) were smaller. In contrast, no statistically significant differences were identified in perceived digital competence or critical perception and ethical responsibility. These findings indicate that employment-related variation was not consistent across all dimensions of AI perception. Differences in educational experiences, professional responsibilities and opportunities to engage with AI may offer possible explanations, although these factors were not directly examined in the present investigation. Moreover, because the teacher category included both professionally active and non-active teachers, the findings should not be interpreted exclusively as differences between current teachers and university students. Accordingly, the results highlight the importance of considering professional circumstances when examining educational AI perceptions, without establishing employment status as an independent causal influence.

Teaching experience demonstrated statistically significant but relatively weak negative associations with positive attitudes towards educational AI, perceived digital competence and the overall questionnaire score. Although these findings were consistent with H5, they should not be interpreted as evidence that greater professional experience directly reduces teachers' acceptance of AI or their technological capabilities. Differences in initial teacher preparation, opportunities for continuing professional development and previous engagement with emerging technologies may contribute to these associations (Castañeda et al., 2022; Galindo-Domínguez et al., 2024). Furthermore, more experienced teachers may evaluate their own technological competence against different professional expectations, although this possibility was not directly examined. The absence of statistically significant relationships with socio-emotional perceptions and critical and ethical responsibility also indicates that teaching experience was not uniformly associated with every dimension of AI perception. Importantly, age and teaching experience may overlap, and the bivariate analytical approach does not establish their independent contributions. Combined with the purposive sampling strategy, these limitations suggest that the findings should be interpreted cautiously and investigated further using multivariable analytical approaches.

The academic year was associated with statistically significant differences across all four dimensions of educational AI perception and the overall questionnaire score. Although undergraduate students generally demonstrated higher scores in more advanced academic years, the findings did not establish a consistent progression across all educational stages. These variations may reflect differences in previous technological experiences, educational opportunities and exposure to AI-related learning activities (Aghaziarati et al., 2023; Alonso-García et al., 2025). Nevertheless, the cross-sectional design compared different groups of students rather than following the same participants over time. Consequently, the observed differences cannot establish that progression through teacher education directly improves AI-related attitudes, perceived competence or ethical awareness. The relatively limited effect sizes further suggest that academic year alone provides only a partial explanation of the variation in participants' perceptions.

Master's students demonstrated a distinct pattern of educational AI perceptions compared with undergraduate participants. Although they reported relatively favourable attitudes towards educational AI and the highest mean score in critical perception and ethical responsibility, their socio-emotional perceptions, perceived digital competence and overall questionnaire scores were lower than those recorded among students in the later undergraduate years. This non-linear pattern challenges the assumption that higher academic qualifications necessarily correspond to more favourable perceptions or greater perceived competence in AI. One possible explanation is that postgraduate students may approach emerging technologies with greater critical awareness while evaluating their own technological capabilities more cautiously. However, the investigation did not directly assess participants' previous AI training, disciplinary composition or reasons for their evaluations, and this interpretation therefore remains tentative. Furthermore, the findings should not be equated with progression through the Acquire, Deepen and Create levels of UNESCO's AI Competency Framework for Teachers, as these competencies were not directly measured (Miao and Cukurova, 2024). Instead, the results suggest that educational level and AI-related perceptions may be associated in different ways across socio-emotional, technological, attitudinal and ethical dimensions, highlighting the need for further investigation into the educational experiences underlying these differences.

5. Conclusion

The present investigation examined how personal, academic and professional characteristics were associated with perceptions of artificial intelligence (AI) among 1,292 practising and prospective teachers in Andalusia, Spain. The findings revealed statistically significant differences and associations across several dimensions of educational AI perception, including socio-emotional responses, positive attitudes, perceived digital competence, and critical perception and ethical responsibility. Nevertheless, these relationships were not uniform, and their generally small magnitudes indicate that demographic and educational characteristics provide only a partial explanation of how participants evaluate AI within educational contexts.

The findings further demonstrated that increasing age and teaching experience were associated with less favourable perceptions in selected dimensions, while academic achievement exhibited particularly weak positive relationships. Differences across academic disciplines, employment categories and academic years also revealed patterns that did not consistently follow the original hypotheses, highlighting the complexity of educational AI perceptions. Importantly, these associations should not be interpreted as causal relationships or as direct measures of participants' actual technological competence.

The principal contribution of this investigation lies in its multidimensional examination of educational AI perceptions across different academic and professional backgrounds. Rather than approaching AI preparedness exclusively through technological competence or general acceptance, the study highlights the importance of considering socio-emotional, attitudinal and ethical dimensions alongside perceived digital capabilities. These findings provide a context-specific empirical basis for considering differentiated approaches to initial teacher education and continuing professional development. However, their wider applicability requires further investigation using more representative samples and analytical approaches capable of examining the independent contributions of demographic, educational and professional characteristics.

5.1. Practical Implications

The findings of this investigation suggest several implications for initial teacher education, continuing professional development and institutional approaches to the integration of artificial intelligence (AI) within educational practice. Although demographic, academic and professional characteristics were associated with differences in AI-related perceptions, the generally limited magnitude of these relationships indicates that training opportunities should not be determined exclusively by age, academic background or teaching experience. Instead, educational institutions should consider participants' existing knowledge, perceived technological competence, professional responsibilities and individual learning needs when developing AI-related educational activities. This approach may support more inclusive and responsive professional development opportunities while avoiding assumptions about technological preparedness based solely on demographic or educational characteristics.

Within initial teacher education, the findings suggest the value of incorporating AI-related learning opportunities throughout undergraduate and postgraduate programmes rather than restricting them to isolated modules or advanced stages of study. Such opportunities could combine practical engagement with AI applications, critical evaluation of AI-generated information, pedagogical decision-making and consideration of ethical issues, including algorithmic bias, data protection, transparency and academic integrity. Similarly, continuing professional development for teachers could incorporate context-sensitive workshops, collaborative learning activities and opportunities to evaluate the pedagogical suitability of AI applications within different teaching environments. Given the relatively weak negative associations between teaching experience and selected dimensions of AI perception, professional development should prioritise identified learning needs rather than presume that more experienced educators necessarily possess lower technological capabilities.

At the institutional level, the findings highlight the potential value of coordinated approaches that integrate technological, pedagogical, socio-emotional and ethical considerations. Educational institutions could support these approaches through accessible training resources, opportunities for reflective practice and clear guidance concerning the responsible use of AI in teaching and assessment. However, because the present investigation examined self-reported perceptions rather than the effectiveness of specific educational interventions, these recommendations should be understood as implications arising from the observed patterns rather than empirically validated training strategies. Future evaluations should therefore examine whether such approaches improve educators' demonstrated AI competencies, pedagogical decision-making and responsible technology use over time.

5.2. Limitations and Recommendations for Future Research

Several methodological limitations should be considered when interpreting the findings of this investigation. Firstly, although the study included a relatively large sample of 1,292 participants, the adoption of purposive, non-probability sampling restricts the representativeness and generalisability of the findings beyond the population examined. Furthermore, the sample consisted predominantly of university students preparing for teaching careers, while professionally active and non-active teachers represented a considerably smaller proportion of respondents. This imbalance should be considered when interpreting differences between employment categories. The unequal gender distribution, with women accounting for a substantially larger proportion of participants, represents an additional consideration regarding the wider applicability of the results. Moreover, the investigation was conducted within the educational context of Andalusia, Spain, and its findings may not necessarily reflect the institutional, technological and professional conditions experienced by educators in other geographical settings.

Secondly, the cross-sectional and correlational research design limits the interpretation of the identified relationships. Although statistically significant associations were observed between several personal, academic and professional characteristics and dimensions of educational AI perception, these findings do not establish causal relationships or demonstrate changes occurring within individuals over time. In addition, the reliance on bivariate correlations and group comparisons does not allow the independent contributions of potentially overlapping characteristics, particularly age, teaching experience and academic progression, to be established. The examination of multiple statistical relationships also requires caution when interpreting isolated statistically significant findings, especially where effect sizes were small. Consequently, statistical significance should not be regarded as evidence of substantial practical or explanatory importance.

A further limitation concerns the reliance on self-reported questionnaire responses. Although the ACISE-IA instrument enabled the examination of socio-emotional perceptions, attitudes towards educational AI, perceived digital competence, and critical perception and ethical responsibility, these measurements reflect participants' reported evaluations rather than objectively demonstrated AI-related capabilities or actual classroom practices. Responses may therefore have been influenced by individual interpretations of

questionnaire items, social desirability or differences in previous exposure to AI applications. Accordingly, the findings should not be interpreted as direct evidence of participants' technological proficiency, pedagogical effectiveness or ethical decision-making in authentic educational environments.

Future research should address these limitations through more representative and balanced samples, incorporating teachers, prospective educators and participants from diverse institutional and geographical contexts. Longitudinal investigations would be particularly valuable for examining how AI-related perceptions evolve throughout teacher preparation and professional practice, while distinguishing educational development from differences between participant cohorts. Furthermore, multivariable statistical approaches could examine the independent and combined contributions of demographic, academic and professional characteristics, including gender, age, teaching experience and previous AI exposure. Complementary qualitative investigations and performance-based assessments could also provide a more comprehensive understanding of how reported perceptions correspond to actual technological competence, pedagogical decision-making and ethical engagement with AI. Finally, future intervention studies could evaluate the effectiveness of targeted AI training programmes, contributing to the development of evidence-informed approaches to responsible and context-sensitive AI integration within teacher education and professional development.

Author Contributions & Declarations

- **Author Contributions:** Conceptualisation, S.S.D. and G.N.; methodology, S.S.D., G.N. and D.A.; validation, S.S.D., G.N., L.S. and S.C.; formal analysis, S.S.D., G.N. and L.S.; investigation, S.S.D., D.A., S.P. and S.C.; resources, S.S.D., G.N., D.A. and S.C.; data curation, S.S.D., G.N. and D.A.; writing-original draft preparation, S.S.D. and D.A.; writing-review and editing, S.S.D., G.N., D.A., S.P., L.S. and S.C.; visualisation, S.S.D., G.N. and S.P.; supervision, S.S.D. and S.C.; project administration, S.S.D. All authors have read and agreed to the submitted version of the manuscript.

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- **Institutional Review Board Statement:** The study was conducted in accordance with established ethical principles governing research involving human participants and applicable data protection regulations. Ethical approval was obtained from the Research Ethics Committee of Alexander College, Cyprus, and the Cyprus National Bioethics Committee (Protocol No. ΕΕΒΚ ΕΠ 2026/12/44), (approval dated 15 December 2024), prior to the commencement of data collection in 2025. The research procedures were designed to ensure voluntary participation, informed consent, participant confidentiality and the responsible management of collected data in accordance with applicable ethical and regulatory requirements.

- **Informed Consent Statement:** Informed consent was obtained from participants before their involvement in the original investigation. Respondents were informed about the research objectives, the voluntary nature of participation, confidentiality arrangements and the intended academic use of the collected information.

- **Consent for Publication:** The manuscript does not present identifiable participant information. Publication consent from individual research participants is therefore not applicable. All listed authors must approve the final manuscript and agree to its submission.

- **Availability of Data and Materials:** The research data consist of questionnaire responses and associated statistical analyses concerning perceptions of artificial intelligence in education. Participant-level datasets are not publicly accessible because of confidentiality and ethical considerations. Requests for access to anonymised research data may be considered by the authorised corresponding author, subject to the original participant consent arrangements, institutional approval and applicable data protection requirements.

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- **Code Availability**: No custom software code is reported as having been developed specifically for this investigation. Statistical analyses were undertaken using IBM SPSS Statistics, version 28.0.1.0, as described in the Materials and Methods section.

- **Clinical Trial Registration**: Not applicable, as the investigation employed a non-experimental, cross-sectional research design and did not involve a clinical trial.

- **Conflicts of Interest:** The authors declare no conflicts of interest.

Abbreviations

Abbreviation	Description
ACISE-IA	Scale of Attitudes, Knowledge, Emotions, and Ethics in Teachers toward the Use of Artificial Intelligence in Professional Performance
AI	Artificial Intelligence
ANOVA	Analysis of Variance
APIA	Positive Attitudes towards Educational Artificial Intelligence
CD	Digital Competence in Artificial Intelligence
PCRE	Critical Perceptions and Ethical Responsibility concerning Artificial Intelligence
PSEA	Socio-emotional and Affective Perceptions of Artificial Intelligence
SPSS	Statistical Package for the Social Sciences
AI CFT	AI Competency Framework for Teachers
DigCompEdu	European Framework for the Digital Competence of Educators

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