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AI Integration in Education: A Correlational Study on Attitudes, Perceptions and Anxiety Among Pre-Service Teachers

Integración de la IA en la Educación: Un Estudio Correlacional sobre las Actitudes, Percepciones y la Ansiedad entre los Docentes en Formación

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ABSTRACT

This study investigated pre-service teachers' attitudes, perceptions, and anxiety toward artificial intelligence (AI), with gender, age, and socioeconomic status (SES) as demographic factors. Using a descriptive-quantitative correlational design, data were collected through an online survey from 150 valid respondents. Attitude was measured using the General Attitudes toward AI Scale, perception through an adapted 38-item instrument, and anxiety through the AI Anxiety Scale with four subscales. Descriptive statistics summarized levels, while t-tests, ANOVA, and Pearson correlation tested differences and relationships among variables. Results showed that respondents exhibited a generally positive attitude on favorable statements (M = 3,40), but expressed reservations on negative items (M = 2,49). Their overall perception was neutral (M = 2,68), while AI-related anxiety was moderate (M = 4,40), with higher levels in job replacement and sociotechnical blindness. Gender differences were not significant for attitude and perception, but female respondents reported significantly higher anxiety than males (p = 0,010, large effect). No significant differences were observed across age groups, while SES revealed no variation in attitude and perception but showed significant differences in anxiety (p = 0,026), with middle-class and poor respondents scoring higher than low-income groups. Correlation analysis indicated a moderate positive relationship between perception and anxiety (r = 0,464, p < 0,001), while attitude showed weak and nonsignificant links with both. Overall, the findings suggest cautious openness to AI among pre-service teachers, underscoring the need for teacher education programs to integrate AI-focused training and ethical discourse to reduce anxiety and enhance readiness for responsible AI integration.

Keywords: Pre-Service Teachers; Artificial Intelligence (AI); Attitude; Perceptions; Anxiety.

RESUMEN

Este estudio investigó las actitudes, percepciones y ansiedad de los futuros docentes hacia la inteligencia artificial (IA), considerando el género, la edad y el nivel socioeconómico (NSE) como factores demográficos. Mediante un diseño cuantitativo-descriptivo correlacional, los datos se recopilaron a través de una encuesta en línea con 150 respuestas válidas. La actitud se midió utilizando la Escala General de Actitudes hacia la IA, la percepción mediante un instrumento adaptado de 38 ítems y la ansiedad con la Escala de Ansiedad hacia la IA compuesta por cuatro subescalas. Se emplearon estadísticas descriptivas para resumir los niveles, mientras que pruebas t, ANOVA y correlación de Pearson analizaron las diferencias y relaciones entre variables. Los resultados mostraron que los encuestados presentaron una actitud generalmente positiva en los ítems favorables (M = 3,40), pero expresaron reservas en los ítems negativos (M = 2,49). Su percepción global fue neutral (M = 2,68), mientras que la ansiedad relacionada con la IA fue moderada (M = 4,40), con niveles más

altos en las dimensiones de reemplazo laboral y ceguera sociotécnica. Las diferencias de género no fueron significativas en actitud y percepción, pero las mujeres reportaron significativamente mayor ansiedad que los hombres (p = 0,010, efecto grande). No se observaron diferencias significativas por edad, mientras que el NSE no mostró variación en actitud y percepción, aunque sí en ansiedad (p = 0,026), con puntuaciones más altas en los grupos de clase media y en situación de pobreza. El análisis correlacional indicó una relación positiva moderada entre percepción y ansiedad (r = 0,464, p < 0,001), mientras que la actitud mostró vínculos débiles y no significativos con ambas. En general, los hallazgos sugieren una apertura cautelosa hacia la IA por parte de los futuros docentes, lo que subraya la necesidad de que los programas de formación incorporen capacitación y debate ético sobre IA para reducir la ansiedad y fortalecer la preparación hacia una integración responsable.

Palabras clave: Estudiantes de Magisterio; Inteligencia Artificial (IA); Actitud; Percepciones; Ansiedad.

INTRODUCTION

The growing interest among scholars in studying the integration of artificial intelligence (AI) in education helps in understanding how educators perceive and respond to this rapidly evolving technology.[1,2,3,4,5,6,7,8,9,10,11,12] AI has already reshaped pedagogical practices and the learning environment. As these innovations become more prevalent, teachers' readiness and willingness to engage with AI tools have become important areas of concern.[13,14,15,16,17,18,19,20,21] Pre-service teachers, in particular, who are in the formative stages of developing their professional beliefs and competencies, are influenced by this technology-integrated education.[22,23,24,25] Thus, it is crucial to explore the attitudes, perceptions, and levels of anxiety that pre-service teachers have toward AI, as these can greatly impact how they adopt and implement these technologies in their future classrooms.

Central to this study is the adoption and responses of pre-service teachers through examining their attitudes and perceptions toward AI-powered tools. The success of AI integration in pedagogical contexts[26,27,28] depends on their willingness and acceptance to adapt to these changes.[29,30] Factors like age and gender are also pivotal aspects in quantifying the attitudes, perceptions, and emotional responses of pre-service teachers to these technologies. Their positive attitudes may enhance openness to innovation and promote meaningful engagement with AI tools, while negative or resistant attitudes can hinder the effective implementation of AI-driven educational reforms.[31,32] Equally important is the perception of AI's role within the classroom and broader educational systems, which influences how stakeholders interpret the benefits, limitations, and ethical considerations surrounding AI applications in learning environments.[33,34,35,36,37] While positive attitudes can enhance technological acceptance and innovation readiness, negative attitudes may foster resistance or disengagement.[38,39,40,41] It is also essential to investigate the increasing reliance on AI in educational contexts that gives rise to affective barriers, specifically anxiety. AI-related anxiety is dominantly about concerns on data privacy, limited exposure to the emerging technologies and the ethical implications experienced by pre-service teachers. Their perceptions can negatively impact students' and teachers' willingness to engage with AI-based tools, thereby limiting the potential benefits of technological advancements. Moreover, perceptions towards AI among future educators are also critical as they encompass beliefs on AI utilization.

Thus, there is a pressing need to understand how attitudes, perceptions, and anxieties toward AI converge in educational settings. Without such understanding, general views on educational technologies remain a notable gap in research,[42,43,44,45,46,47,48,49,50,51,52,53] specifically focusing on pre-service teachers' affective responses to AI. Furthermore, exploring how demographic factors such as gender, age, and socioeconomic status intersect with attitudes, perceptions, and anxiety toward AI must be addressed. With this, the present study employs a descriptive-quantitative correlational research design with key demographic variables to contribute to a more comprehensive understanding of the factors that shape pre-service teachers' dispositions toward AI. This study, therefore, aims to underpin the importance of embedding AI ethics, human-AI collaboration and educators' exposure to AI tools as partners to improve instructional and learning outcomes.

Literature Review
Attitudes toward Artificial Intelligence in Education

Attitudes toward Artificial Intelligence (AI) in education reflect a complex interplay of perceived benefits, ethical concerns, and contextual familiarity. Learners and educators generally recognize AI's utility in enhancing learning efficiency, academic writing, content generation, and task automation. Studies such as those by Anani et al.[26] and Sáez-Velasco et al.[54] show that students associate AI with improvements in productivity, creativity, and academic quality. These perceptions, however, are not uniformly positive. Anani et al.[26] noted variability in student attitudes, suggesting an underlying ambivalence driven by factors such as trust in AI outputs, the need for human oversight, and concerns over potential misuse.

This ambivalence is echoed in other regional and disciplinary contexts. Farinosi et al.[55] reported that Italian university students utilized ChatGPT for both personal and academic tasks, striking a balance between its practical benefits and concerns over ethical use. Likewise, Niniss et al.[56] found Moroccan students adopted generative AI cautiously, often for general reference and text revision, though many reported favorable impressions, particularly with academic internationalization. Instructors, on the other hand, often adopt a more cautious stance. Alkolaly et al.[57] highlighted this divide, finding that while postgraduate students readily adopted AI for language learning, university lecturers were optimistic yet reserved, suggesting a need for professional skepticism and structured guidelines on integration.

Training and guided exposure appear to significantly influence attitudes. Arkan et al.[58] demonstrated that structured ChatGPT training in nursing education enhanced undergraduate students' problem-solving skills and attitudes toward AI. Özdemir Aydın et al.[59] further found that first-year nursing students exhibited strong innovation skills and positive AI dispositions following early AI integration. At the K–12 level, Bergdahl et al.[14] found that teachers held generally positive attitudes toward AI but varied in confidence and competence based on prior use and perceived relevance. The rise of AI tools like ChatGPT also raised integrity concerns, with Kann[60] showing that student attitudes toward cheating evolved in response to AI availability, underscoring the broader ethical dimensions shaping perceptions.

Age as a Factor in AI Attitudes

Age is a salient factor influencing how individuals perceive and utilize AI in education. While younger learners are often assumed to be more tech-savvy, recent evidence challenges this assumption. [61], in a comprehensive survey of U.S. college students, found that older students—particularly those in their 30s and 40s—reported more frequent use of ChatGPT compared to their younger peers. These older students tended to rely on AI more strategically for academic writing, language support, and workload management. Their usage patterns suggest a more deliberate and purpose-driven engagement with AI, possibly stemming from their life experience, higher academic responsibilities, or professional background.

The connection between age and AI adoption is also visible in how ethical and practical dimensions of AI are weighed. Older learners may approach AI with greater criticality, viewing it both as a learning aid and a potential source of risk. This contrasts with younger students, who may be more experimental in their use but less reflective about long-term implications. Similarly, in the K–12 teaching context, age also appears to influence teacher attitudes. Bergdahl et al.[14] observed that older teachers were less confident in their AI self-efficacy unless they had prior exposure or institutional support. These findings emphasize that age not only shapes technological engagement but also modulates levels of confidence, critical reflection, and ethical concern in AI adoption.

Gender Differences in AI Attitudes

Gender remains a significant variable in shaping familiarity with and attitudes toward AI in educational contexts. Ozbey et al.[62] found a statistically significant gender-based difference in their study among dentistry students, with males generally reporting greater familiarity and engagement with AI tools than females. While both male and female participants recognized AI's potential utility in supporting clinical decision-making—such as radiograph analysis—trust in AI as a replacement for human expertise was low across the board. Nonetheless, the gender disparity in reported familiarity suggests differentiated access, exposure, or comfort levels with technology that may affect broader AI adoption trends.

The implications of these gender-based differences are critical for designing equitable AI education strategies. While the gap in trust toward AI may not differ substantially by gender, differences in prior experience and perceived competence can influence how students and educators engage with emerging tools. If unaddressed, such disparities risk reinforcing existing inequities in digital literacy and technological empowerment. Thus, fostering inclusive training programs and providing equitable opportunities for AI engagement are essential to closing the gender gap in AI readiness and shaping positive, confident attitudes across all learners.

Digital Competence and AI Self-Efficacy

Digital competence—including AI literacy, tool usage experience, and self-efficacy—plays a foundational role in shaping positive attitudes toward AI in education. Bewersdorff et al.[63] provided a typology of students—AI Advocates, Cautious Critics, and Pragmatic Observers—each reflecting varying levels of AI engagement, confidence, and attitude. Students with stronger digital fluency and interest in AI were significantly more likely to adopt AI tools confidently and perceive them as beneficial to academic performance. The findings suggest that competence is not simply a technical skill but a mediating factor between curiosity, affective attitudes, and sustained usage.

This link between competence and attitude is especially relevant in the gap observed between students and faculty. Shittu et al.[64] noted that despite high awareness among students, many educators lacked practical

engagement with tools like ChatGPT. Yadav[65] argued that incorporating AI into continuing professional development (CPD) programs is essential to address this shortfall. Habib[32] further emphasized that educators' attitudes were significantly influenced by performance expectancy, effort expectancy, and information quality—elements that depend heavily on users' digital readiness. These studies collectively highlight that fostering digital competence, through targeted and context-specific training, is crucial to enabling both educators and learners to adopt AI meaningfully and responsibly.

General Perceptions of AI in Education

The integration of Artificial Intelligence (AI) into educational paradigms is fundamentally reshaping pedagogical approaches and learning experiences. A thorough understanding of how both students and educators perceive these technologies is paramount for successful implementation and informed policy formulation. Research consistently reveals a complex tapestry of perceptions, influenced by AI's perceived benefits, associated ethical concerns, and varying degrees of individual digital literacy. Learners often regard AI as a useful supplement for writing, creativity, and academic efficiency, as shown in [26] and [54]. However, these positive attitudes coexist with ambivalence, particularly concerning trust, fairness, and dependency on automated tools.

Across diverse regional and disciplinary contexts, perceptions remain cautious yet receptive. Farinosi et al.[55] observed that Italian university students actively use ChatGPT for academic summarization, clarification, and content generation, with a pragmatic awareness of ethical issues. Likewise, [56] found Moroccan students were inclined to use generative AI tools primarily for general referencing and minor editing, reflecting cautious optimism. These patterns align with Baek et al.[61] who reported increased ChatGPT use among older and non-native English-speaking students, especially for academic writing. Similarly found widespread AI use among students in fields such as computer science and agriculture, with accompanying demands for training and clearer policies to regulate usage. [37,66]

Attitudes within professional and language learning contexts reveal further nuance. Alenazi[67] and Mudhsh et al.[68] documented that Saudi and Omani EFL learners view AI positively for grammar and vocabulary improvement but still prefer human instruction. Zeevy-Solovey[69] and González Pastor[70] highlighted perceived benefits in AI-mediated feedback and translation support, though students expressed concern about AI's influence on future professional roles. Among educators, skepticism often tempers optimism. Alkolaly et al.[57] found that while postgraduate students widely accepted generative AI in foreign language education, lecturers remained more reserved. Arkan et al.[58] and Özdemir Aydın et al.[59] illustrated the advantages of early AI integration in nursing education, which led to enhanced problem-solving and innovation skills. At the K–12 level, [14] emphasized teachers' varying levels of AI self-efficacy and the critical need for targeted professional development. Ethical and societal concerns also permeate discourse, with [14] highlighting the influence of ChatGPT on students' attitudes toward academic dishonesty, while [71] explored AI's promise in supporting students with special education needs.

Age on AI Perceptions

Age plays a significant role in shaping how AI is perceived and utilized in education. Contrary to common assumptions that younger learners are inherently more adept with digital tools, recent evidence reveals that older students often exhibit more frequent and strategic use of AI. A study Found that students in their 30s and 40s engaged with ChatGPT more than their younger counterparts, particularly for writing-intensive tasks, suggesting that age correlates with more goal-oriented and practical use of AI. This trend is likely tied to increased academic responsibility, language proficiency needs, and greater exposure to workplace-relevant tools.[62] Older users may also bring more developed critical thinking to AI engagement, assessing its benefits and limitations in more context-specific ways.

In educational contexts beyond higher education, age also influences instructor perceptions and adoption. A study reported significant variation in K–12 teachers' AI attitudes and self-efficacy, partially attributed to differences in age and prior experience. Younger teachers who had more exposure to AI or professional development showed greater confidence and willingness to explore AI applications.[14] In contrast, older educators, while open to the technology, tended to express reservations about implementation and desired more structured support and training. These findings suggest that age impacts not only usage patterns but also receptiveness, risk tolerance, and professional expectations related to AI integration.

Gender Differences in AI Perceptions

Gender has also emerged as a consistent variable affecting AI perceptions in education, particularly regarding familiarity and engagement. [62], in their study of dentistry students, reported statistically significant gender differences: male students exhibited higher familiarity with AI and were more likely to engage with it in clinical contexts such as radiograph interpretation. While both male and female participants acknowledged AI's usefulness, there was limited trust in AI surpassing human expertise, particularly among female respondents.

These findings point to a potential gender gap in confidence and exposure to AI tools, which could influence broader adoption patterns and comfort levels in using AI-driven systems.

However, not all studies observe such disparities. Al-Raimi et al.[72], in their analysis of Omani EFL learners' perceptions of AI-assisted academic writing tools, found no significant gender-based differences in either usage or attitudes. This discrepancy indicates that gender-based influence on AI perception may be context-dependent, shaped by variables such as cultural norms, discipline-specific practices, and tool familiarity. Together, these findings suggest that while gender can influence attitudes toward AI, interventions must be nuanced and context sensitive. Inclusive training programs and equitable access to AI technologies are essential to ensure balanced adoption and empowerment across genders in educational settings.

Digital Competence in AI Perceptions

Digital competence—including AI literacy, confidence in digital tool use, and self-efficacy—is a foundational determinant of how AI is perceived in education. [63] identified three distinct student groups—'AI Advocates,' 'Cautious Critics,' and 'Pragmatic Observers'—to illustrate how varying degrees of competence and interest shape affective and behavioral attitudes toward AI. Their study showed that students with higher digital literacy and consistent engagement with AI reported more favorable perceptions and greater willingness to explore AI applications in learning. These findings support the view that competence does not merely enable usage but fosters a sense of empowerment, influencing broader openness and acceptance.

Among educators, digital competence also moderates willingness to integrate AI. A study highlighted a notable disconnect: despite high student awareness and use of ChatGPT, many academics lacked practical experience with it.[64] This reinforces the need for targeted professional development, as advocated by [65], who emphasized the role of immersive and adaptive CPD programs in equipping educators for AI-rich environments. A study further demonstrated that factors such as performance expectancy, effort expectancy, and perceived information quality strongly influence attitudes, all of which are conditioned by users' digital fluency.[32] These findings underscore the importance of structured training initiatives that boost self-efficacy while fostering responsible, confident AI engagement among both students and faculty.

Anxiety of AI in Education

The rapid evolution of Artificial Intelligence (AI) in education—spanning intelligent tutoring systems, automated assessment, and AI-generated content—is transforming how learning is delivered and experienced. Yet, alongside the excitement of innovation, a growing wave of anxiety emerges among students, educators, and professionals. This anxiety is not uniform; it reflects a complex interplay of psychological, social, and technological factors.[73,74] Age, gender, and digital competence significantly shape how individuals experience and cope with this technological disruption. Understanding these nuances is crucial for creating supportive and equitable environments for AI integration in education.

Gender Differences and AI Anxiety

The role of gender in AI-related anxiety remains a topic of ongoing inquiry, with findings suggesting both subtle influences and context-specific outcomes. Lund et al.[75] included gender identity as one of several demographic variables that differentiated levels of AI anxiety and fear among over 200 students and professionals in the information sciences. While the study did not isolate gender as the dominant predictor, it highlighted that gender intersects with factors like academic performance and regional background in shaping anxiety responses.

Conversely, other studies found little or no gender-based differences. For instance, Sallam et al.[76] observed that sex did not significantly influence Jordanian medical students' levels of fear, anxiety, or ethical concerns regarding AI. Chow et al.[77], studying Chinese undergraduates' engagement with generative AI tools, also found that gender was statistically controlled and did not mediate the relationship between a technological growth mindset and technology anxiety. These findings suggest that while gender may play a role in AI anxiety under certain conditions, it is not a universally consistent factor across cultural and academic contexts. Nonetheless, the variability calls for further gender-sensitive research to explore how other intersecting variables—such as discipline, digital exposure, or institutional support—may amplify or mitigate gender-based differences in AI-related anxiety.

Digital Competence and AI Anxiety

Digital competence—defined as the confidence, literacy, and mindset required to engage with technology—emerges as one of the most influential moderators of AI anxiety in education. Individuals with higher digital competence generally report lower levels of anxiety, better perceived usefulness of AI tools, and greater intention to adopt AI-based learning systems. A study found that a strong technological growth mindset among Chinese undergraduates reduced technology anxiety and enhanced performance expectancy in using generative

AI tools.[77] This aligns with Adu's [78] findings among academic librarians: frequent AI users experienced significantly lower anxiety levels, reinforcing the notion that active engagement with technology builds confidence and reduces apprehension.

Yet, the inverse is also true—low digital competence can heighten anxiety and resistance to Zhu et al. [79] demonstrated that AI anxiety directly undermined the perceived ease of use and value of AI tools among art and design students. Similarly, Li[80] concluded that perceived risk and anxiety significantly decreased designers' behavioral intentions to use AI-generated content (AIGC), even when their expectations of the tool's performance were high. These results underscore a cognitive-emotional loop where unfamiliarity breeds anxiety, which in turn discourages exploration and adoption, perpetuating the digital divide.

Encouragingly, structured AI training can break this loop. Shi et al.[81] showed that AI-enhanced speaking instruction reduced demotivation and shyness among EFL learners while boosting their social-emotional competence. Wang et al.[82] also noted that anxiety in foreign language classrooms could moderate learners' openness to generative AI, suggesting that reducing context-specific fears may improve AI acceptance. On a societal level, Lacap et al. [83] demonstrated that technology anxiety heightened the perceived "creepiness" of chatbot interactions, while Xie et al.[84] found that face-swapping anxiety led to negative word-of-mouth. Together, these studies reveal that digital competence—more than age or gender alone—may be the most crucial lever for reducing AI anxiety across educational and public domains.

METHOD

Research Design

This study employed a descriptive-quantitative correlational research design to examine the relationships among pre-service teachers' attitude, perception, and anxiety toward artificial intelligence, with gender, age and socioeconomic status as demographic factors. The research design was deemed appropriate as it allowed for the systematic measurement of variables, identifying patterns and relationships among them, and exploration of demographic differences.

Respondents of the Study

The respondents of this study were pre-service teachers enrolled in State Universities. These institutions were purposively selected based on their offering of teacher education programs and current curricular integration of technology-related subjects. Initially, a total of 160 respondents participated in the survey; however, an embedded attention check question was used to ensure response reliability. Based on this quality control measure, 10 responses were excluded, resulting in a final sample of 150 valid respondents.

Of the 150 participants, 59 (39,3 %) were male and 91 females (60,7 %). This aligns with previous studies reporting overrepresentation of women in teacher education programs.[85,86, 87, 88, 87, 88, 89, 90, 91, 92, 93, 94] In terms of age distribution, 83 (55,3 %) were 18≤age≤19 years old, while 67 (47 %) were 20≤age and above.

Regarding socioeconomic status, 55 (36,7 %) identified as coming from families below the poverty line. The majority, 85 respondents (56,7 %), reported coming from low-income households with a monthly income ranging from ₱10,957 to ₱21,914. Meanwhile, 10 participants (6,7 %) classified themselves as belonging to the middle class, with reported family incomes between ₱43,828 and ₱76,669.

For digital competence, respondents were asked to rate their perceived level of ability in handling technology-related tasks based on self-assessment.

Research Tool

Three research instruments were used in this study. Attitude toward AI was assessed using the General Attitudes toward Artificial Intelligence Scale (GAAIS) developed by [95] This scale consists of 20 items divided into positive and negative statements that measures favorable beliefs and concerns about AI. Each item was rated on a five-point Likert Scale ranging from disagree (1) to strongly agree (5), negative statements were reverse-coded.

General Perception towards AI was measured using adapted items from [96], which reflect respondents' evaluations and perceived likelihood of various AI developments. The instrument includes 38 items rated on a four-point Likert Scale, ranging from very unlikely (1) to (4) very likely.

AI-related anxiety was evaluated using the Artificial Intelligence Anxiety Scale (AIAS) developed by [73]. This scale comprises 21 items grouped into four dimensions: AI learning anxiety (8 items), job replacement (6 items), sociotechnical blindness (4 items), and AI configuration (3 items). Each item was rated on a seven-point Likert Scale, ranging from (1) strongly agree to (7) strongly disagree.

In addition to the three main instruments, digital competence was assessed through a self-rating item asking the respondents, "How would you rate your overall digital competence? To minimize bias, the term was not further defined or emphasized. Responses were recorded on a five-point Likert scale, ranging from 1 (very low) to 5 (very high).

Data Collection Procedure

Data were gathered using an online survey distributed to pre-service teachers enrolled in teacher education programs. Respondents were given clear instructions before answering, and an attention-check item was included to ensure the reliability of responses. A total of 160 surveys were completed, but 10 were excluded after screening, leaving 150 valid responses. The cleaned dataset was then prepared for descriptive and inferential statistical analysis.

Data Analysis Procedure

The study utilized descriptive quantitative and inferential statistics to analyze the collected data. Descriptive measures, including mean (M) and standard deviation (SD), were used to summarize the levels of attitude, perception, and AI-related anxiety, and digital competence. To determine whether significant differences existed in the levels of attitude, perception, and anxiety across gender and age groups, independent sample t-tests were performed. For variables with more than two categories, like socioeconomic status, one-way Analysis of Variance (ANOVA) was used. In addition, Pearson's product-moment correlation was employed to examine the relationships between the key variables, namely attitude, perception, and anxiety toward AI.

Ethics Considerations

This study adhered to established ethical standards in educational research. Participation was voluntary, and respondents were informed about the purpose of the study, the nature of their involvement, and their right to withdraw at any time without penalty. Informed consent was secured prior to answering the online survey, and no identifying personal information was collected to ensure anonymity. Confidentiality of responses was maintained by restricting data access to the researchers and by storing the dataset in a secure, password-protected file. The survey also included an attention-check item to safeguard data reliability.

RESULTS AND DISCUSSION
Pre-service Teachers' Attitude toward AI use

Table 1. Frequency Distribution of the Attitudes of Pre-service Teachers Toward AI Use (positive statements)								
	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Weighted Mean	Standard Deviation	Interpretation
Att1	19	40	63	23	5	2,70	0,99	Neutral Attitude
Att2	8	9	60	59	14	3,41	0,94	Positive Attitude
Att4	5	21	63	52	9	3,26	0,89	Neutral Attitude
Att5	6	5	35	66	38	3,83	0,98	Positive Attitude
Att7	5	21	63	50	11	3,27	0,91	Neutral Attitude
Att11	5	11	57	56	21	3,51	0,94	Positive Attitude
Att12	7	12	50	62	19	3,49	0,97	Positive Attitude
Att13	17	38	65	23	7	2,77	1,0	Neutral Attitude
Att14	6	8	44	68	24	3,64	0,95	Positive Attitude
Att16	21	59	70	0	0	2,33	0,71	Negative Attitude
Att17	22	63	65	0	0	2,29	0,71	Negative Attitude
Att18	18	62	70	0	0	2,35	0,69	Negative Attitude
OVERALL MEAN							3,4	Positive Attitude

Table 1 presents the analysis of the positively worded items in the Attitude Toward AI Scale revealed an overall weighted mean of 3,4, indicating that pre-service teachers generally exhibit a positive attitude toward the use of artificial intelligence (AI) in education. This suggests openness to the potential advantages of AI, particularly in enhancing productivity, supporting well-being, and improving societal outcomes. Respondents expressed strong agreement with statements such as "I am impressed by what artificial intelligence can do" (M = 3,83), "There are many beneficial applications of AI" (M = 3,64), and "Artificial Intelligence can have positive impacts on people's well-being" (M = 3,51), reflecting a sense of admiration for AI's capabilities. These findings are consistent with Balasa et al.[39] and Serdenia et al.[41], who reported that future educators often acknowledge AI's societal and educational value, especially when it is framed as a tool for innovation and public good.

Other items such as "Artificial Intelligence can provide new economic opportunities for this country" (M =

3,41), "Artificial Intelligence is exciting" (M = 3,49), and "I am interested in using AI in my daily life" (M = 3,27) further demonstrate respondents' curiosity and recognition of AI's relevance to both national development and everyday life. However, some items yielded more neutral scores. For instance, the statement "I would like to use Artificial Intelligence in my own job" (M = 2,35) received lower endorsement, pointing to uncertainties about practical implementation or readiness to adopt AI in professional contexts.

Notably, the item "An AI agent would be better than an employee in many routine jobs" (M= 2,77) received a neutral rating, suggesting hesitancy to fully embrace AI as a replacement for human labor. As Alieto et al. [38] emphasized, pre-service teachers often express discomfort with the idea of replacing human roles with AI due to concerns about empathy, job security, and ethical implications. Similarly, low ratings for "Artificially intelligent systems can perform better than humans" (M = 2,33) and "Much of society will benefit from a future full of Artificial Intelligence" (M = 2,29) reflect skepticism about AI's long-term societal impact.

Overall, while the data point to measured optimism, they also reveal cautious reservations regarding AI's capacity to replace human functions or define future societal structures. The findings support the idea that although pre-service teachers are intrigued by AI and acknowledge its benefits, their personal and professional readiness remains tentative. These attitudes highlight the need for more targeted exposure, training, and ethical discourse on AI integration in teacher education programs. [38,39,41]

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Weighted Mean	Standard Deviation	Interpretation
Table 2. Frequency Distribution of the Attitudes of Pre-service Teachers Toward AI Use (negative statements)								
Att3	7	36	67	32	8	2,99	0,92	Neutral Attitude
Att6	19	46	68	14	3	2,57	0,90	Negative Attitude
Att7	5	21	63	50	11	2,71	0,86	Neutral Attitude
Att8	18	29	81	22	0	2,48	1,0	Negative Attitude
Att9	32	41	50	27	0	2,57	0,94	Negative Attitude
Att10	24	40	62	24	0	2,23	0,72	Negative Attitude
Att15	26	63	61	0	0	2,16	0,76	Negative Attitude
Att20	26	63	61	0	0	2,23	0,72	Negative Attitude
OVERALL MEAN							2,49	Negative Attitude

Table 2 presents the responses to the negatively worded items of the Attitude Toward AI Scale yielded an overall weighted mean of 2,49, with most items falling below the neutral midpoint of 3,00. This indicates that pre-service teachers generally expressed negative sentiments or concerns regarding specific risks or limitations of artificial intelligence (AI), particularly when it comes to trust, ethical use, and potential societal consequences.

Items with the lowest mean scores include "I think AI is dangerous" (M = 2,23, SD = 0,72), "I shiver with discomfort when I think about future uses of AI" (M = 2,16, SD = 0,76), and "AI is used to spy on people" (M = 2,23, SD = 0,72). These suggest that respondents harbor anxieties about AI's potential misuse, especially regarding surveillance, emotional unease, and loss of human control. As [38] argue, such responses reflect deep-seated concerns over the ethical and social implications of AI, particularly its capacity to infringe on privacy and disrupt human-centered environments.

Similarly, the statement "AI might take control of people" (M = 2,48) was also rated low, underscoring the skepticism toward AI autonomy and trust in automated systems. These findings are consistent with [41], who reported that although future educators may be open to AI, they often express hesitation rooted in fears of dehumanization, data misuse, and algorithmic errors.

Additional negatively rated items such as "AI systems make many errors" (M = 2,57) and "Organizations use AI unethically" (M = 2,99) reveal concerns about accuracy and trustworthiness. These perceptions align with broader debates on algorithmic bias, misinformation, and lack of regulatory oversight, as highlighted in [39]. While respondents did not strongly endorse these concerns, the near-neutral scores suggest an awareness of the issues and a cautious stance rather than a deeply entrenched distrust.

Interestingly, "I find AI sinister" (M = 2,71) and "I am interested in using AI in my daily life" (M = 2,71) despite falling in the neutral range reflect a sense of ambivalence or unresolved concern. These mixed attitudes may stem from limited exposure to AI technologies and insufficient engagement with ethical discourse in teacher education programs.

Overall, the negative attitude reflected by the 2,49 mean score suggests that pre-service teachers are not entirely comfortable with AI integration, particularly when it involves emotional, ethical, or societal implications. These findings highlight the importance of embedding AI ethics, data privacy, and human-AI interaction literacy into the curriculum.

Pre-service Teachers' General Perception towards AI

	Very Unlikely	Unlikely	Likely	Very Likely	Weighted Mean	Standard Deviation	Interpretation
Table 3. Frequency Distribution of Pre-service Teachers' General Perception towards AI							
GenPer1	6	12	101	31	3,0	0,66	Neutral Perception
GenPer2	6	35	92	17	2,8	0,68	Neutral Perception
GenPer3	18	59	62	11	2,4	0,79	Negative Perception
GenPer4	24	57	56	13	2,3	0,85	Negative Perception
GenPer5	8	23	83	36	2,9	0,78	Neutral Perception
GenPer6	8	37	82	23	2,8	0,76	Neutral Perception
GenPer7	4	43	77	26	2,8	0,73	Neutral Perception
GenPer8	6	29	91	24	2,8	0,71	Neutral Perception
GenPer9	3	12	83	52	3,2	0,67	Neutral Perception
GenPer10	7	19	74	50	3,1	0,79	Neutral Perception
GenPer11	18	53	63	16	2,5	0,84	Neutral Perception
GenPer12	43	40	49	18	2,2	1,0	Negative Perception
GenPer13	15	33	64	38	2,8	0,92	Neutral Perception
GenPer14	39	42	52	17	2,3	0,98	Negative Perception
GenPer15	24	46	56	24	2,5	0,94	Neutral Perception
GenPer16	10	41	59	40	2,8	0,89	Neutral Perception
GenPer17	16	38	77	19	2,6	0,83	Neutral Perception
GenPer18	13	38	73	26	2,7	0,84	Neutral Perception
GenPer19	11	25	87	27	2,8	0,79	Neutral Perception
GenPer20	20	43	72	15	25	0,84	Neutral Perception
GenPer21	15	42	73	20	2,6	0,83	Neutral Perception
GenPer22	15	40	74	21	2,6	0,83	Neutral Perception
GenPer23	17	47	67	19	2,5	0,85	Neutral Perception
GenPer24	20	45	64	21	2,5	0,89	Neutral Perception
GenPer25	13	42	70	25	2,7	0,84	Neutral Perception
GenPer26	11	32	77	30	2,8	0,82	Neutral Perception
GenPer27	10	35	83	22	2,7	0,77	Neutral Perception
GenPer28	8	29	89	24	2,8	0,74	Neutral Perception
GenPer29	14	44	70	22	2,6	0,84	Neutral Perception
GenPer30	18	47	60	25	2,6	0,90	Neutral Perception
GenPer31	10	31	91	18	2,7	0,74	Neutral Perception
GenPer32	17	50	72	11	2,5	0,79	Neutral Perception
GenPer33	10	24	81	35	2,9	0,81	Neutral Perception
GenPer34	9	36	77	28	2,8	0,80	Neutral Perception
GenPer35	7	30	80	33	2,9	0,77	Neutral Perception
GenPer36	32	46	61	11	2,3	0,89	Negative Perception
GenPer37	26	44	68	12	2,4	0,87	Negative Perception
GenPer38	18	46	74	12	2,5	0,80	Neutral Perception
OVERALL MEAN					2,68		Neutral Perception

Table 3 presents the overall mean score of 2,68 across 38 items indicates that pre-service teachers hold a generally neutral perception toward artificial intelligence (AI). This suggests a balanced viewpoint—acknowledging both the opportunities and the uncertainties that AI presents, particularly in societal contexts. The majority of item responses fell within the neutral range, such as optimism toward AI's role in solving complex problems (M = 3,0) and promoting innovation (M = 3,2) yet tempered by hesitancy about AI influencing

political decisions (M = 2,3) or becoming emotionally integrated into human life (e.g., AI as a family member, M = 2,3). Respondents expressed concerns about AI potentially leading to loneliness (M = 2,5), the loss of personal communication (M = 2,8), and its influence over private life (M = 2,5). These findings resonate with the work of Brauner et al. [96], who emphasized that public perceptions of AI are rarely extreme and are often shaped by a mix of admiration and concern. Their criticality map analysis revealed that people may view AI as beneficial but not necessarily likely or see certain developments as probable but ethically troubling highlighting the complex cognitive framing behind AI perception. Likewise, the ambivalence shown by pre-service teachers in this study may reflect a combination of limited exposure to practical AI applications, lack of formal instruction in AI ethics, and awareness of ongoing debates around automation, employment, and algorithmic bias. As such, these results underline the need to incorporate structured AI education, ethical dialogue, and hands-on training within teacher preparation programs to equip future educators with the tools to critically and confidently engage with emerging technologies.

Pre-service Teachers' Anxiety towards AI

	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree	Weighted Mean	Standard Deviation	Interpretation
Table 4. Frequency Distribution of Pre-service Teachers' Anxiety towards AI										
L1	12	23	22	39	18	23	13	3,9	1,7	Moderate Anxiety
L2	11	32	21	39	14	25	8	3,8	1,6	Moderate Anxiety
L3	11	28	25	38	14	25	9	3,8	1,6	Moderate Anxiety
L4	12	29	23	37	18	22	9	3,8	1,6	Moderate Anxiety
L5	11	25	28	37	22	17	10	3,8	1,6	Moderate Anxiety
L6	15	22	27	37	15	25	9	3,8	1,7	Moderate Anxiety
L7	16	24	29	33	21	17	10	3,7	1,7	Moderate Anxiety
L8	11	22	22	37	19	25	14	4,0	1,7	Moderate Anxiety
JR1	9	7	15	21	33	28	37	4,9	1,7	High Anxiety
JR2	5	11	12	17	30	39	36	5,1	1,6	High Anxiety
JR3	12	7	17	22	23	33	36	4,8	1,8	High Anxiety
JR4	8	9	11	23	27	35	37	5,0	1,7	High Anxiety
JR5	7	8	12	24	24	35	40	5,1	1,7	High Anxiety
JR6	6	9	10	23	23	37	42	5,1	1,7	High Anxiety
SB1	6	8	10	19	26	39	42	5,2	1,6	High Anxiety
SB2	4	9	11	25	28	40	33	5,1	1,6	High Anxiety
SB3	4	10	9	21	28	41	37	5,2	1,6	High Anxiety
SB4	8	8	15	26	25	36	32	4,9	1,7	High Anxiety
AIC1	12	19	14	31	20	34	20	4,4	1,8	Moderate Anxiety
AIC2	12	19	15	34	26	31	13	4,2	1,7	Moderate Anxiety
AIC3	14	17	18	29	20	32	20	4,3	1,8	Moderate Anxiety
OVERALL MEAN									4,4	Moderate Anxiety

The analysis of the AI Anxiety Scale as shown in table 4 reveals that pre-service teachers generally experience moderate levels of anxiety toward artificial intelligence (AI), with an overall weighted mean of 4,4. This suggests a cautious yet concerned perspective on AI integration, particularly in educational settings. The Learning Anxiety subscale (L1–L8), with item means ranging from 3,7 to 4,0, indicates moderate discomfort toward understanding and interacting with AI tools. These responses suggest that while respondents are not entirely resistant to AI, they may lack confidence in their ability to learn and apply it effectively in their future roles as educators.

However, Job Replacement Anxiety (JR1–JR6) and Sociotechnical Blindness (SB1–SB4) scored significantly higher—ranging from 4,8 to 5,2—indicating high anxiety. These findings align with [74], who reported that sociotechnical concerns (such as the fear of machines overtaking human judgment or decision-making) are a dominant source of AI-related anxiety among educators. Their study highlights that such fears stem from a confusion between human cognition and machine behavior, concerns about being sidelined in AI-driven processes, and persistent misconceptions about technological progress. Teachers, therefore, may not see AI

as a collaborative tool but rather as a replacement, especially in areas of their work that require relational, ethical, or nuanced decision-making.

Moreover, AI Configuration Anxiety (AIC1–AIC3) also registered moderate levels (means ranging from 4,2 to 4,4), reflecting respondents' concerns over AI autonomy, moral decision-making, and lack of transparency. These are consistent with the broader framework discussed by Li and Huang [97], where multiple dimensions of AI-related fear—including privacy violations, bias, ethical violations, and existential concerns—contribute to overall anxiety. The pre-service teachers in this study appear to mirror these global patterns, suggesting unease not just with the technology itself, but with how it might redefine their roles, responsibilities, and human connections in the classroom.

In sum, while respondents demonstrate a willingness to engage with AI, their anxieties are amplified by unfamiliarity, ethical uncertainty, and perceived threats to professional identity. These findings emphasize the importance of embedding AI ethics, human-AI collaboration frameworks, and practical exposure to AI tools within teacher education curricula. Doing so may help educators develop not only the competence but also the confidence to view AI not as a competitor, but as a partner in improving instruction and learning outcomes.

Respondents' Digital Competence

Table 5. Frequency Distribution of Pre-service Teachers' Digital Competence				
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very Low	1	0,7	0,7	0,7
	Low	3	2,0	2,0	2,7
	Moderate	72	48,0	48,0	50,7
	High	62	41,3	41,3	92,0
	Very High	12	8,0	8,0	100
	Total	150	100	100	

For digital competence as shown in table 5, respondents were asked to rate their perceived level of ability in handling technology-related tasks based on practical self-assessment items embedded in the questionnaire. The construct was assessed indirectly, without explicitly labeling it as "digital competence," to reduce bias. Results showed that a majority of respondents rated themselves as having either moderate or high digital competence. Specifically, 72 respondents (48 %) reported a moderate level, 62 (41,3 %) indicated a high level, 12 (8 %) considered themselves very highly competent, while only 4 respondents (2,7 %) identified as having low digital competence. This suggests that most pre-service teachers in the sample possess sufficient digital skills, which may support their readiness to integrate educational technologies such as AI in future teaching practice

Respondents' Attitude toward Artificial Intelligence across Genders

Table 6. Pre-service Teachers' Attitude toward Artificial Intelligence Gender Difference									
Variables	Gender	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
ATTITUDE	Male	59	2,77	0,33	-0,31	148,00	0,759	0,31105	Not Significant/Small Effect
	Female	91	2,79	0,30	-0,30	114,06			

The results of the independent samples t-test as shown in table 6 revealed that female pre-service teachers (M = 2,79, SD = 0,30) had a slightly more favorable attitude toward artificial intelligence (AI) than their male counterparts (M = 2,77, SD = 0,33). However, this difference was not statistically significant (t = -0,31, p = 0,759), and the effect size was small (Cohen's d = 0,31). Both male and female respondents exhibited neutral attitudes, reflecting neither strong support nor opposition to AI integration in education.

This finding contrasts with the results of [39], who reported a statistically significant difference in favor of males (M = 2,91, p = 0,008), suggesting that male prospective teachers exhibited more positive attitudes toward AI than their female counterparts. Similarly, [38], also found a more favorable attitude among males, though their study emphasized the importance of contextual and cultural factors that may influence how attitudes are formed. Meanwhile, the current study's results align with [41], who observed no significant difference in attitude between genders and suggested that as access and exposure to digital tools become more equitable, gender differences in technology-related attitudes may be diminishing.

The observed neutrality across both gender groups may reflect a shared sense of cautious curiosity rather than established stances. Many of the respondents in this study come from a context where AI is still emerging, and direct experience with AI tools in educational practice may be limited. As highlighted in [38,41], this uncertainty likely stems from limited exposure, ongoing ethical concerns, and a need for greater understanding of AI's capabilities and implications.

These findings highlight the need for inclusive AI education in teacher preparation programs. Whether or not significant gender gaps emerge, equipping all future teachers with equal opportunities to learn about AI, question its implications, and explore its applications will be essential to ensuring informed, equitable, and ethical use of emerging technologies in the classroom.

Respondents' General Perception toward Artificial Intelligence across Genders

Table 7. Pre-service Teachers' General Perception toward Artificial Intelligence Gender Difference								
Variables	Gender	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
PERC	Male	59	2,64	0,52	-1,19	148,00	0,238	0,53326	Not Significant/Small Effect
	Female	91	2,75	0,54	-1,19	127,07			

The results of the independent samples t-test as shown in table 7revealed that female pre-service teachers (M = 2,75, SD = 0,54) exhibited a slightly more positive general perception of artificial intelligence (AI) than their male counterparts (M = 2,64, SD = 0,52). However, this difference was not statistically significant (t = -1,19, p = 0,238), and the effect size was small (Cohen's d = 0,53), suggesting that the observed variation in general perception between genders is minimal and not meaningful enough to indicate a consistent pattern of difference.

The general perception scale in this study covered a wide range of anticipated societal, economic, technological, and personal impacts of AI. These include both optimistic projections—such as AI's ability to solve complex social problems, promote innovation, and improve standard of living—and more cautious views related to job displacement, social control, privacy threats, and ethical dilemmas.

The overall neutrality across both gender groups indicates that most pre-service teachers remain uncertain or ambivalent about AI's broader implications. This is understandable, as the full societal integration of AI remains a work in progress, and its long-term consequences are still being debated in public discourse. In the absence of concrete experience or consistent messaging in their academic environments, many teacher aspirants may find it challenging to form definitive views.

Moreover, the neutral stance suggests that perception—unlike attitude or anxiety—may be more influenced by awareness of structural, institutional, and global trends than by personal beliefs or emotions. Since the items touch on complex concepts such as AI governance, labor market disruption, cultural change, and moral decision-making, students' responses are likely shaped by general media narratives, abstract discussions, or secondhand understanding rather than first-person interaction with AI systems.

This finding underscores the need for teacher education institutions to go beyond skills training and offer opportunities for critical reflection and discourse on the societal role of AI. Classroom discussions, debate formats, scenario analysis, and ethical case studies could be used to help teacher aspirants better evaluate and articulate their perceptions of AI's broader impact—not just on education, but on human life, work, and values. When students are given space to explore these dimensions, they are more likely to develop nuanced, balanced, and grounded perceptions that move beyond neutrality.

Respondents' Anxiety toward Artificial Intelligence across Genders

Table 8. Pre-service Teachers' Anxiety toward Artificial Intelligence Gender Difference								
Variables	Gender	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
ANXIETY	Male	59	4,24	1,29	-2,62	148,00	0,010	1,30734	Significant/Large Effect
	Female	91	4,81	1,32	-2,63	126,32			

The results of the independent samples t-test as shown in table 8 revealed a statistically significant difference in artificial intelligence (AI) anxiety levels between male and female pre-service teachers. Female respondents (M = 4,81, SD = 1,32) reported significantly higher levels of AI-related anxiety than their male counterparts (M = 4,24, SD = 1,29), with a t-value of -2,62 and a p-value of 0,010. The effect size was large (Cohen's d = 1,31), indicating that gender is a substantial factor influencing anxiety toward AI.

This finding aligns with existing literature, including the study by Maghanoy et al. [74], which similarly reported

that females exhibited higher levels of AI anxiety than males. Several explanations have been proposed for this disparity. Social norms and gender stereotypes often portray men as more confident and adept in technology-related domains, while women may experience feelings of exclusion, uncertainty, or hesitation when engaging with digital tools—particularly with emerging and complex technologies such as AI.

Furthermore, women are often more reflective about the risks associated with technological advancement, contributing to heightened caution and anxiety. These concerns can be amplified by societal expectations and role perceptions that position women as more risk-aware or emotionally attuned, especially in relation to innovations that could disrupt professional and personal norms. As Maghanoy et al.[74] emphasized, cultural and systemic dynamics surrounding gender roles significantly influence how AI-related anxiety is experienced and internalized.

These findings carry important implications for teacher education. As future educators are expected to play a critical role in modeling and integrating technology in the classroom, heightened anxiety—particularly among female pre-service teachers—can pose a barrier to equitable AI adoption. Educational institutions must therefore design inclusive and responsive support systems that address emotional as well as technical readiness. This includes offering mentorship, guided exposure to AI tools, and reflective spaces to demystify AI and promote confidence in its use.

Moreover, addressing AI anxiety through gender-sensitive pedagogical interventions not only benefits female pre-service teachers but also contributes to a more diverse and representative approach to AI in education. When learners from all backgrounds feel supported and included in the technological landscape, the result is a richer, more equitable learning environment—and ultimately, a more human-centered and accessible AI ecosystem.

Respondents' Attitude toward Artificial Intelligence across Age group

Table 9. Pre-service Teachers' Attitude toward toward Artificial Intelligence Age Group Difference									
Variables	Age	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
ATTITUDE	18≤age≤19 years old	83	2,79	0,29	0,220	148	0,826	0,31110	Not Significant/ Small Effect
	20≤age and above	67	2,78	0,33	0,216	131,452			

The independent samples t-test as shown in table 9 revealed no statistically significant difference in attitude toward artificial intelligence (AI) between younger respondents aged 18–19 years (M = 2,79, SD = 0,29) and older respondents aged 20 and above (M = 2,78, SD = 0,33). The computed t-value (t = 0,220, p = 0,826) and a small effect size (Cohen's d = 0,31) suggest minimal variation in the attitudinal orientation between the two age groups. Both means fall within the neutral range, indicating a shared cautious or undecided stance toward AI integration in education.

However, this finding diverges from previous studies. For example, [41] found that older pre-service teachers demonstrated significantly more favorable attitudes toward AI than younger ones, with a moderate effect size (Cohen's d = 0,41). They attributed this to developmental and experiential factors, citing Bandura's social cognitive theory, which emphasizes the role of self-efficacy and observational learning in shaping attitudes. Older students may feel more confident and possess greater exposure to positive models of AI use in academic contexts. Similarly, Rogers' diffusion of innovations theory suggests that older individuals may fall within the early majority of adopters due to greater life experience and maturity in evaluating innovation.

Likewise, [39] reported a statistically significant difference in attitude by age, with adults aged 20 and above (M = 2,86) scoring higher than adolescents aged 18–19 (M = 2,80). Their findings challenge common assumptions that younger individuals are automatically more receptive to technology. Instead, their analysis supports the view that age diversity can meaningfully shape openness to AI and that older pre-service teachers may hold more deliberate and informed attitudes toward AI use in education.

In contrast, the results of the current study suggest a more uniform level of neutrality across both age groups. This may be due to limited hands-on exposure to AI tools in actual teaching practice or a lack of structured orientation in teacher education programs that cuts across all year levels. It may also indicate that age alone is not a strong predictor of attitude in this specific academic and cultural context.

Overall, these findings highlight the need for teacher education institutions to avoid age-based assumptions and instead offer targeted, inclusive AI integration strategies that meet the learning needs of both younger and older pre-service teachers. Regardless of age, teacher candidates need supportive environments that foster curiosity, critical awareness, and confidence in applying AI meaningfully in the classroom.

Respondents' General Perception toward Artificial Intelligence across Age group

Table 10. Pre-service Teachers' General Perception toward toward Artificial Intelligence Age Group Difference									
Variables	Age	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
ANXIETY	18≤age≤19 years old	83	4,60	1,40	0,112	148	0,911	1,33719	Not Significant/ Large Effect
	20≤age and above	67	4,58	1,26	0,113	146,201			

The independent samples t-test conducted to assess age-based differences in general perception toward artificial intelligence as shown in table 10 reveals that younger pre-service teachers aged 18–19 (M = 2,75, SD = 0,54) had slightly more favorable perceptions of AI compared to their older counterparts aged 20 and above (M = 2,65, SD = 0,52). However, the observed difference was not statistically significant (t = 1,184, p = 0,238), although the effect size was moderate (Cohen's d = 0,53), suggesting a potentially meaningful trend that warrants attention.

This result indicates that while age may not strongly influence perception at a statistically significant level, younger teacher aspirants may exhibit a more open or optimistic view of AI's societal and educational roles. This could be attributed to their status as digital natives—individuals who have grown up with rapidly evolving technologies and are generally more immersed in digital discourse. As a result, they might be more accustomed to the idea of AI's integration into everyday life and view its expansion with curiosity and acceptance.

In contrast, the slightly lower perception scores among older respondents may reflect a more cautious stance, possibly shaped by greater awareness of AI's complexities, ethical dilemmas, or potential risks such as job displacement, surveillance, or social inequality. As general perception encompasses broad themes—including economic influence, cultural impact, automation, and governance—older students may be more critical or reflective in evaluating AI's long-term implications.

Despite the difference in mean scores, both age groups demonstrated an overall neutral perception, suggesting that across developmental stages, pre-service teachers are still in the process of forming informed, critical perspectives about AI. This neutrality may stem from limited direct experience, lack of formal instruction, or insufficient exposure to AI in their teacher education programs.

The findings underscore the importance of designing AI-related learning experiences that are age-inclusive and developmentally appropriate. Embedding discussions around AI's societal role, risks, and possibilities into the curriculum can help pre-service teachers—regardless of age—cultivate well-rounded perceptions and become more confident in understanding the evolving role of technology in education and society.

Respondents' Anxiety toward Artificial Intelligence across Age group

Table 11. Pre-service Teachers' Anxiety toward toward Artificial Intelligence Age Group Difference									
Variables	Age	N	Mean	SD	t	df	p-value	Cohen's d	Interpretation
PERC	18≤age≤19 years old	83	2,75	0,54	1,184	148	0,238	0,53327	Not Significant/ Moderate Effect
	20≤age and above	67	2,65	0,52	1,189	143,564			

The independent samples t-test as shown in table 11 revealed no statistically significant difference in AI-related anxiety between age groups. Younger pre-service teachers aged 18-19 years (M = 4,60, SD = 1,40) and those aged 20 and above (M = 4,58, SD = 1,26) reported comparable levels of anxiety (t = 0,112, p = 0,911). Despite the negligible difference in means, the large effect size (Cohen's d = 1,34) suggests notable variability within the sample.

Both age groups demonstrated moderate to high anxiety, indicating that concerns about AI—such as job replacement, ethical risks, or lack of control—are shared across developmental stages. Younger participants may feel more uncertain due to limited experience, while older ones may worry about professional disruption.

These results highlight the need for AI-integrated training and emotional support for all pre-service teachers, regardless of age, to reduce fear and build digital confidence in the classroom.

Respondents' Attitude, General Perception, and Anxiety toward Artificial Intelligence across Socioeconomic status

Table 12. Pre-service Teachers' Attitude, General Perception, and Anxiety toward Artificial Intelligence Socioeconomic Status Difference

Variables	SES	N	Mean	SD	SS	df	MS	F	p-value	η²	Interpretation
ATTITUDE	Poor: Below the poverty line	55	2,77	0,32	0,068	2	0,034	0,353	0,703	0,005	Not Significant/ Small Effect
	Low-income (but not poor): ₱10,957 to ₱21,914	85	2,78	0,31	14,260	147	0,097				
	Middle Class: ₱43,828 to ₱76,669	10	2,86	0,27	14,328	0,048					
	Total	150	2,78	0,31							
PERC	Poor: Below the poverty line	55	2,75	0,60	0,240	2	0,120	0,418	0,659	0,006	Not Significant/ Moderate Effect
	Low-income (but not poor): ₱10,957 to ₱21,914	85	2,67	0,51	42,246	147	0,287				
	Middle Class: ₱43,828 to ₱76,669	10	2,78	0,28	42,486	149					
	Total	150	2,71	0,53							
ANXIETY	Poor: Below the poverty line	55	4,92	1,25	12,828	2	6,414	3,744	0,026	0,048	Not Significant/ Large Effect
	Low-income (but not poor): ₱10,957 to ₱21,914	85	4,33	1,36		147	1,713				
	Middle Class: ₱43,828 to ₱76,669	10	4,96	1,09		149					
	Total	150	4,59	1,33							

The analysis revealed in table 12 no statistically significant difference in attitudes toward artificial intelligence across socioeconomic groups (F = 0,353, p = 0,703), with a small effect size (η² = 0,005). Although middle-class pre-service teachers recorded a slightly higher mean attitude score (M = 2,86) than those from low-income (M = 2,78) and poor (M = 2,77) backgrounds, all groups exhibited a generally neutral stance toward AI. This suggests that economic status has little bearing on how future educators perceive AI in terms of favorability or concern.

In terms of general perception, the difference among the groups was also not statistically significant (F = 0,418, p = 0,659), though the moderate effect size (η² = 0,006) hints at emerging variability. Middle-class respondents again showed the highest mean perception score (M = 2,78), followed by the poor (M = 2,75), and low-income (M = 2,67) groups. These figures indicate that across all income brackets, pre-service teachers maintain a balanced, cautious view of AI's role and implications, neither strongly optimistic nor overly skeptical.

However, a statistically significant difference was found in AI-related anxiety levels across socioeconomic groups (F = 3,744, p = 0,026), with a large effect size (η² = 0,048). The middle-class group reported the highest anxiety (M = 4,96), closely followed by the poor group (M = 4,92), while the low-income group recorded the lowest (M = 4,33). This pattern may reflect both heightened awareness and heightened stakes: those from middle-class backgrounds may feel greater pressure to adapt to technological change, while those from poor households may feel vulnerable to the disruptive consequences of AI in employment or education. The findings suggest that while attitude and perception remain stable across SES, AI-related anxiety is more sensitive to economic conditions, highlighting the need for differentiated support mechanisms in teacher education programs.

Correlation: Respondents attitude, general perception, and anxiety towards AI use

The correlation analysis as shown in table 13 revealed distinct patterns in the relationships among pre-service teachers' attitudes, perceptions, and anxiety toward artificial intelligence (AI). The relationship between attitude and perception was found to be very weak and not statistically significant (r = 0,061, p = 0,456), indicating that having a positive attitude toward AI does not necessarily translate to strong perceptions of its usefulness or impact in education. Similarly, the correlation between attitude and anxiety was weak and negative (r = -0,044, p = 0,592), suggesting that the emotional discomfort or fear associated with AI does not meaningfully affect how positively or negatively pre-service teachers feel about AI integration in the classroom.

		Attitude	Perc	Anxiety
Table 13. Relationship across Respondents attitude, general perception, and anxiety towards AI use				
Attitude	Pearson Correlation	1	0,061	-0,044
	Sig. (2-tailed)		0,456	0,592
	Sum of Squares and Cross-products	14,328	1,514	-2,714
	Covariance	0,096	0,010	-0,018
	N	150	150	150
Perc	Pearson Correlation	0,061	1	0,464[**]
	Sig. (2-tailed)	0,456		0,000
	Sum of Squares and Cross-products	1,514	42,486	49,157
	Covariance	0,010	0,285	0,330
	N	150	150	150
Anxiety	Pearson Correlation	-0,044	0,464[**]	1
	Sig. (2-tailed)	0,592	0,000	
	Sum of Squares and Cross-products	-2,714	49,157	264,659
	Covariance	-0,018	0,330	1,776
	N	150	150	150

In contrast, the correlation between perception and anxiety was moderately strong and statistically significant ($r = 0,464$, $p < 0,001$). This implies that the more pre-service teachers perceive AI as relevant or important in educational contexts, the higher their levels of anxiety about it tend to be. This could be attributed to increased awareness of the challenges AI poses such as ethical issues, job displacement, or a lack of preparedness to integrate it effectively which in turn heightens feelings of apprehension. Overall, these findings highlight that while attitude and perception appear to operate independently, perception and anxiety are more closely linked. This underscores the need for targeted training programs that not only inform pre-service teachers about the benefits and applications of AI but also address their underlying concerns and anxieties.

CONCLUSIONS

This study contributes to the ongoing discourse on AI in education by offering valuable insights into the nuanced perspectives of pre-service teachers. The findings indicate that while participants are generally optimistic about the potential of AI to enhance teaching and learning, their acceptance remains conditional. Their openness is tempered by concerns over ethical implications, job security, and the lack of adequate training and exposure to AI tools. Such concerns manifest in their attitudes, perceptions, and varying levels of anxiety toward AI integration, reflecting a cautious stance rather than full endorsement. These results align with global debates on the opportunities and risks of AI in the teaching profession, where optimism about innovation often coexists with fears of professional displacement and ethical uncertainty.

The study underscores the urgent need for teacher education programs to move beyond basic digital literacy and embed comprehensive AI-focused training that combines technical competence with ethical awareness. Equipping pre-service teachers with opportunities for hands-on engagement, reflective dialogue, and critical analysis of AI's societal and professional implications will not only reduce anxiety but also foster confidence and readiness for meaningful integration. Ultimately, as AI continues to reshape educational landscapes and pedagogical practices, it is imperative that future educators are prepared not only to use AI tools but also to apply them responsibly, ensuring that technological advancement serves to enrich rather than diminish the human dimensions of teaching and learning.

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FINANCING

CONFLICT OF INTEREST

The author declare that there is no conflict of interest.

AUTHORSHIP CONTRIBUTION

Conceptualization: Aprillette C. Devanadera.
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