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ORIGINAL

Attitude, acceptability, and perceived effectiveness of artificial intelligence in education: a quantitative cross-sectional study among future teachers

Actitud, aceptabilidad y eficacia percibida de la inteligencia artificial en la educación: Un estudio cuantitativo transversal entre futuros docentes

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ABSTRACT

This study investigated the extent of prospective teachers' acceptance, attitudes, and perceived effectiveness of artificial intelligence (AI) in education. It also examined whether these perceptions varied according to gender and age group. Using a descriptive-correlational design, data were gathered from 392 teacher education students enrolled in a state-managed university in southwestern Mindanao. The results revealed that the respondents generally demonstrated moderate acceptance, favorable attitudes, and positive perceptions of AI effectiveness in the teaching and learning process. While no statistically significant differences were found between genders, moderate effect sizes suggested subtle variations worth further exploration. Significant differences were observed across age groups, with older individuals reporting higher levels of AI acceptance. Strong and significant correlations among acceptance, attitude, and perceived effectiveness affirmed the interconnected nature of belief, emotion, and evaluation in shaping readiness for AI integration. These findings support the Technology Acceptance Model and the Theory of Planned Behavior. In light of these results, it is recommended that teacher education programs integrate AI literacy and practical training, with targeted support for younger students to enhance digital confidence and preparedness.

Keywords: Attitude; Acceptability; Artificial Intelligence; Effectiveness; Education.

RESUMEN

Este estudio investigó el grado de aceptación, las actitudes y la eficacia percibida de la inteligencia artificial (IA) en la educación entre los futuros docentes. También examinó si estas percepciones variaban según el género y el grupo de edad. Utilizando un diseño descriptivo-correlacional, se recopilaron datos de 392 estudiantes de formación docente matriculados en una universidad estatal en el suroeste de Mindanao. Los resultados revelaron que los encuestados demostraron generalmente una aceptación moderada, actitudes favorables y percepciones positivas sobre la eficacia de la IA en el proceso de enseñanza y aprendizaje.

Aunque no se encontraron diferencias estadísticamente significativas entre géneros, los tamaños del efecto moderado sugirieron variaciones sutiles que merecen una mayor exploración. Se observaron diferencias significativas entre los grupos de edad, siendo los individuos de mayor edad quienes reportaron niveles más altos de aceptación de la IA. Correlaciones fuertes y significativas entre la aceptación, la actitud y la eficacia percibida afirmaron la naturaleza interconectada de la creencia, la emoción y la evaluación en la configuración de la disposición hacia la integración de la IA. Estos hallazgos respaldan el Modelo de Aceptación de la Tecnología y la Teoría del Comportamiento Planeado. A la luz de estos resultados, se recomienda que los programas de formación docente integren la alfabetización en IA y la capacitación práctica, con apoyo específico para los estudiantes más jóvenes para mejorar la confianza digital y la preparación.

Palabras clave: Actitud; Aceptabilidad; Inteligencia Artificial; Eficacia; Educación.

INTRODUCTION

The impact of artificial intelligence (AI) on our world is profound and far-reaching, touching upon various aspects of our economy and society. As this field has unprecedented growth in machine learning capabilities, it holds the potential to reshape sectors such as education, national defense, the economy, and societal functions by improving efficiency, precision, and safety.[1] The multifaceted nature of AI is evident in its applications, ranging from machine translation to intricate medical image analysis, which are constantly evolving and promising even more possibilities. Scholars define AI as a specialized branch of computer science dedicated to crafting intelligent machines capable of tasks traditionally requiring human intelligence, such as visual perception, speech recognition, decision-making, and language translation.[2,3] In pursuit of increasing education quality globally, countries are turning to modern technologies, particularly AI, as transformative forces.[4,5,6,7] This integration holds the promise of revolutionizing educational assessment systems, providing a dynamic platform for self-awareness and targeted learning. Governments worldwide are investing in technology to enhance higher education, with a focus on incorporating AI for improved educational quality.[8,9,10] In India, the integration of AI in education is seen as opening new possibilities and challenges.[11] Despite the emergence of AI, the importance of proficient educators remains crucial, as emphasized by[12,13,14], who stress the importance of educators in fostering students' affective intelligence, creativity, and communication skills.[15,16] contribute to the discourse by highlighting the potential of AI to individualize learning, offer effective learning experiences, discover students' talents, enhance creativity, and alleviate teachers' workloads.

However, it is crucial to acknowledge opposing viewpoints in this discourse. The ethical dimension of AI in education, emphasized by[17], underscores the need for a comprehensive examination of ethical implications, incorporating moral principles guiding AI research and development. This ethical framework should align with individual, organizational, and societal values, as well as expert judgments regarding the appropriateness of AI in specific contexts.[18,19] The discourse on AI has evolved beyond a simplistic transfer of teaching roles to computers, recognizing the inherent dangers in such a transition.[20] Instead, a forward-looking perspective emphasizes the need to prepare for an AI-infused educational landscape.[21] advocated for the proactive task of crafting a comprehensive teacher profile that collaborates seamlessly with evolving AI support structures. Understanding the public perceptions surrounding AI is crucial for responsible research and innovation, as it aligns the development and governance of AI systems with individual and societal needs.[22] Despite the burgeoning potential of AI, it remains a "black box" for many, necessitating further exploration and elucidation. While public attitudes are pivotal to the societal adoption of AI-enabled technologies[23], a critical gap exists in historically neglected malicious applications of AI. Investigating this gap can provide insights into the determinants influencing individual acceptance or resistance to AI.[24] This understanding is crucial for developing educational initiatives and public awareness campaigns that address concerns and misconceptions while highlighting the positive impact of AI.

While the global discourse on AI in education has expanded across technological, pedagogical, and ethical domains, the Philippine context presents a unique set of opportunities and constraints that warrant localized investigation. In the Philippines, the integration and adoption of artificial intelligence is in its nascent stage, particularly in education. Several efforts have been made to bolster the adoption of AI in teaching, learning, and administrative systems, especially within higher education institutions. However, challenges such as limited digital infrastructure, unstable internet connections, socioeconomic disparities, and a lack of AI literacy among teachers and students continue to hinder widespread implementation.[25,26] Another factor is the nature of current research, as recent studies have focused mostly on the integration of technology[27,28,29,30,31,32,33,34,35] or on specific constructs related to AI.[36,37,38,39,40,41]

Motivated by this comprehensive perspective, the current study aims to elucidate prospective teachers' attitudes, acceptability, and perceived efficacy regarding the integration of AI into education across genders

and age groups. By investigating the intricate web of perceptions and expectations surrounding AI, this research seeks to contribute to a more harmonious integration of AI technologies into the educational landscape, maximizing benefits while prudently mitigating potential risks. Furthermore, as most studies investigate a single construct of AI in education, this study investigates the relationships among three constructs—the attitudes, acceptance, and effectiveness of AI in education. This approach provides a broader perspective on how these variables correlate with one another.

Literature Review

Artificial Intelligence in Education

The integration of artificial intelligence (AI) into education has ushered in a new era of personalized learning, where algorithms analyze student data to tailor instructional content dynamically.[42,43] This adaptability accommodates varying learning styles and paces, thus fostering greater engagement and effectiveness.[44] As students engage with AI-driven platforms, these systems continuously refine their understanding of comprehension gaps and strengths, enabling targeted academic support.

Intelligent tutoring systems (ITSs) are a prominent example of this application. By leveraging machine learning, ITSs monitor student progress, identify difficulties, and provide customized interventions in real time.[42] Such systems enhance traditional instruction by offering responsive, individualized tutoring that adapts to learner needs.

AI also contributes to administrative efficiency within educational institutions. Automating tasks such as grading and scheduling lightens educators' workloads, affording more time for pedagogical matters.[21,45] Furthermore, predictive analytics enable institutions to anticipate enrollment trends and optimize resource allocation [46], promoting strategic and data-informed decision-making.

In addition, AI-powered chatbots and virtual assistants embedded in learning management systems offer 24/7 support for students, such as answering queries, clarifying deadlines, and guiding coursework.[47] Research indicates that these tools enhance student satisfaction, engagement, and retention, especially in online and blended learning environments.

These applications underscore the multifaceted role of AI in enhancing both instructional delivery and institutional operations. From personalized learning and adaptive tutoring to administrative automation and student support, the literature reflects a growing consensus on the transformative potential of AI in education. This evolving landscape reinforces the importance of understanding how learners perceive and interact with AI technologies, particularly as these tools become increasingly embedded in educational practice.

Prospective teachers' attitudes toward Artificial Intelligence

Studies consistently indicate a positive inclination among students toward the incorporation of AI in education. Several studies report a generally positive disposition among students regarding the integration of AI into learning environments.[48] noted that students recognize the potential advantages of AI technologies, particularly in enhancing personalized learning. Positive perceptions are often linked to AI's ability to support individual learning styles and deliver immediate feedback.[49]

Students also value the efficiency and accessibility of AI-driven tools. Applications such as intelligent tutoring systems and adaptive learning platforms are appreciated for complementing traditional instruction and supporting self-directed learning.[50] These technologies are seen as practical enhancements to the educational experience.

Nevertheless, student perspectives are not without reservations. Concerns around data privacy, the ethical use of personal information, and the diminishing role of human interaction in education are frequently reported.[51,52] Ethical uncertainty, particularly in how personal data are collected and applied, continues to shape student apprehensions.

The fear of job displacement also emerges as a significant concern. Students, especially at the tertiary level, express anxiety over the potential for AI to automate roles and render specific job skills obsolete.[53] These concerns highlight the importance of ethical implementation and open dialogue about AI's broader implications in the academic and professional spheres.

Several factors influence student attitudes toward AI. Perceived usefulness and ease of use, as outlined in the Technology Acceptance Model[54], remain central to acceptance. Students are more likely to adopt AI technologies when they are viewed as both beneficial and user friendly. Other contributing factors include students' technological exposure, academic discipline, and demographic background.[55]

Findings on the impact of AI on student academic performance remain mixed. While studies such as[48] report improvements associated with AI-based interventions, others call for a more measured interpretation. The effectiveness of AI depends on how well the technology aligns with instructional goals and on the specific tools implemented within educational settings.

The reviewed studies indicate that while students tend to view the integration of AI in education positively,

their acceptance is influenced by specific conditions such as perceived usefulness, ease of use, and ethical considerations. This layered perspective underscores the need to move beyond measuring acceptance alone and instead examining the underlying factors that inform students' dispositions toward AI.

Prospective teachers' acceptance of Artificial Intelligence

The rapid proliferation of artificial intelligence (AI) in education demands a rigorous examination of its acceptance, especially in culturally and economically diverse settings. While AI holds significant potential teaching, learning, and administrative systems, its adoption is often met with substantial barriers in the context of the Philippines.[26,36]

Globally, scholars emphasize the necessity of examining AI acceptance due to challenges emerging alongside its integration. These include ethical risks related to privacy and security stemming from the use of big data, the potential alienation of learners through algorithm-driven recommendations, increasing educational inequality caused by the digital divide, and the oversimplification of instructional processes.[56,57,58] Additionally, difficulties in embedding AI within existing educational cultures and communication norms present further obstacles, particularly when insights drawn from educational data fail to translate effectively into teaching practices.[59,60]

In the Philippine context, these global concerns are magnified by local realities, such as persistent infrastructure gaps, inconsistent faculty training, and unequal digital literacy among students.[61,62] The digital divide continues to disadvantage rural and low-income students, whereas institutional limitations in data governance, algorithmic transparency, and policy readiness raise further ethical and practical challenges.[63]

The examination of AI acceptance is often framed through established theoretical lenses such as the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Unified Theory of Acceptance and Use of Technology (UTAUT), which highlight constructs such as perceived usefulness, ease of use, and social influence.[54,64,65] Recent models such as the KIAM and the AI acceptance model for higher education extend these frameworks by incorporating emotional and ethical dimensions, including trust, fairness, and fear of automation.[66]

These perspectives suggest that AI acceptance in Philippine higher education is shaped by a complex interaction of structural, psychological, ethical, and contextual factors. While established acceptance models offer a strong foundation for understanding user behavior, emerging frameworks underscore the growing relevance of affective and moral concerns in AI integration.

Prospective teachers' sense of efficacy

Scholarly works consistently indicate that students generally hold favorable views regarding the effectiveness of AI in enhancing learning. Studies by[36,39,67] reveal that learners often regard AI technologies as effective tools for improving their educational experience. These positive perceptions are closely tied to AI's capacity to adapt to individual learning preferences, deliver personalized content, and provide timely feedback, which are the factors that contribute significantly to students' sense of efficacy.[68]

Beyond personalization, the perceived effectiveness of AI also encompasses its role in supporting academic achievement. Intelligent tutoring systems, adaptive platforms, and AI-powered learning applications are valued for complementing traditional instruction and offering learners additional avenues for understanding course content.[69] Many students express confidence in AI's ability to enhance learning outcomes and facilitate deeper engagement with subject matter.

However, despite the generally positive perceptions, concerns persist regarding privacy, ethics, and the long-term impact of AI on human roles in education and employment.[70] These concerns present challenges to the sustained perception of effectiveness, highlighting the need for transparent and ethical implementation of AI systems.

Students' prior exposure to AI technologies further influences their perception of their effectiveness. Those with limited experience tend to report lower confidence in AI's contribution to their academic success, suggesting that increasing familiarity is essential for broader acceptance.[71] Perceived usefulness and ease of use are the central tenets of the Technology Acceptance Model[54], where they remain key predictors of trust in AI tools, particularly when students find them both beneficial and accessible.[72]

The alignment of AI applications with pedagogical goals is another important factor. When students experience direct improvements in learning, such as more personalized support, clearer feedback, or enhanced skill development, they are more likely to perceive AI as an effective educational aid.[73] These experiences strengthen confidence in AI's role in addressing practical educational needs.

The literature suggests that students' perceptions of AI effectiveness are shaped by both functional attributes such as adaptability and performance support and experiential factors, including prior exposure, trust, and pedagogical alignment. While most students recognize the promise of AI in enhancing education, concerns related to ethics, privacy, and relevance remain critical in sustaining positive perceptions. These insights reinforce the importance of evaluating perceived effectiveness not only as a technical outcome but also as a

dynamic construct influenced by students' experiences, expectations, and broader educational environment.

Artificial Intelligence in Education across Genders and Age Groups

Sociodemographic factors such as gender, and age, play pivotal roles in shaping students' attitudes, acceptance, and perceived effectiveness of artificial intelligence (AI) in education. Research suggests that gender influences how students engage with technology. Male students often exhibit greater confidence in their technical skills, which contributes to greater perceived ease of use, whereas female students are more inclined to consider the ethical, emotional, and human-centered aspects of AI use.[74,75] In the context of the Philippines, Ramirez et al.[76] reported that while male students demonstrated greater confidence in using AI, they expressed lower levels of trust in data privacy, whereas female students expressed heightened concerns for fairness, emotional impact, and responsible AI use.

Age also emerges as a determining factor in AI adoption. Younger students, typically aged 16-21 years and considered digital natives, are more likely to have favorable attitudes toward AI, shaped by their familiarity with algorithm-driven platforms such as ChatGPT, TikTok, and Google Classroom.[77,78] In contrast, older students, particularly those above 22 years of age and enrolled in graduate-level programs, tend to be more cautious. Their attitudes are influenced by heightened awareness of system transparency, data governance, and long-term reliability.[38]

These findings underscore that attitudes, acceptance, and perceived efficiency toward AI in education are not monolithic but are shaped by the intersection of gender and age. While male, younger, and technically oriented students tend to embrace AI for its functional benefits, female, older, and education-focused students raise valid concerns about ethical implications and the erosion of human-centered learning. These sociodemographic distinctions highlight the importance of contextualized implementation strategies that are sensitive to diverse learner needs, ensuring that AI integration in education remains equitable, inclusive, and pedagogically sound.

Research Questions

1. What is the extent of prospective teachers' attitudes toward AI, acceptability of its use, and perceptions of its effectiveness in education?
2. Do prospective teachers' attitudes toward AI, acceptability of its use, and perceptions of its effectiveness in education significantly differ based on gender and age group?
3. Is there a significant relationship between the extent of prospective teachers' acceptance, attitudes and perceived effectiveness in the teaching and learning process?

METHOD

This study used a quantitative, non-experimental cross-sectional survey to examine prospective teachers' attitudes, acceptance, and perceived effectiveness of AI integration in education. Conducted at a single point in time, it followed Stockemer's[79] cross-sectional approach and aimed to describe participants' views through coded numerical data. The method was appropriate for gathering quantifiable responses, which were statistically analyzed following the guidelines of Leedy and Ormrod.[80]

Respondent of the Study

The respondents of the study were aspiring teachers enrolled in education degree programs at a state-managed university in southwestern Mindanao. The gender distribution reveals that the majority were female, accounting for 80,1 % of the sample. This finding is consistent with the female dominance commonly observed in teacher education programs.[81,82,83,84] Moreover, male respondents accounted for 19,9 % of the sample. In terms of age, 42,3 % of the participants were within the adolescent bracket of 18-19 years old, whereas a larger proportion, 57,7 %, fell under the adult category aged 20 years and above.

Sampling Technique

Researchers have employed Slovin's formula to determine the sample size. Out of a total population of 1303 prospective teachers from different year levels and programs, 306 respondents were initially suggested. However, since the data collection instrument was an online survey created via Google Forms, 397 individuals accessed the link. Among them, 5 respondents declined to participate, and a few responses were considered spoiled for reasons such as incomplete responses or lack of demographic entry.

Research Tool

Three questionnaires on prospective teachers' acceptance of artificial intelligence, attitudes toward artificial intelligence, and effectiveness of artificial intelligence in education, along with questions about respondents' demographic profiles, were the research instruments of this study. The Acceptance of Artificial Intelligence Scale has 27 items and is classified into eight parts: Perceived Usefulness (PU) (4 items), Perceived Ease of Use

(PEOU) (4 items), Artificial Intelligence Self-Efficacy (AISE) (4 items), AI Anxiety (3 items), Perceived Enjoyment (PE) (3 items), Subjective Norm (SN) (2 items), Job Relevance (JR) (3 items), and Behavioral Intention (BI) (2 items) developed by Zhang et al.[71] The attitude questionnaire (General Attitudes toward Artificial Intelligence Scale (GAAIS) was developed by Schepman and Roadway[85] and consists of 20 items. The questionnaire on the effectiveness of artificial intelligence in education was developed by Kraishan[86] and consists of 27 items with three parts: educational aspects (9 items), teachers (items), and educational strategies (9 items). All the instruments use a five-point Likert scale ranging from 5 = strongly agree to 4 = agree, 3 = neutral, 2 = disagree, and 1 = strongly disagree. For the purpose of capturing the independent variables relevant to this study, the scale was modified to include a demographic section, with questions about gender and age.

Before the questionnaire was deployed, the researchers conducted a comprehensive pilot test involving prospective teachers pursuing an education degree not only within their own institution but also among those enrolled in other institutions across the region. This meticulous approach aimed to ensure the broader applicability and effectiveness of the questionnaire. The collected data were subsequently analyzed via Cronbach's alpha, which revealed that all the sections of the questionnaire presented a Cronbach's alpha value exceeding 0,60. This outcome unequivocally confirms that the research instruments demonstrated "acceptable" internal consistency, reinforcing the credibility and reliability of the questionnaire for the broader cohort of education degree-seeking individuals in the region.

Table 1. Cronbach's Alpha Values for Constructs Measuring Attitudes, Acceptance, and Perceived Effectiveness of Artificial Intelligence in Education

Instrument	Cronbach Alpha
General Attitudes Toward Artificial Intelligence Scale (GAAIS)	0,767
Acceptance of Artificial Intelligence Scale	0,942
Perceived Usefulness (PU)	0,888
Perceived Ease of Use (PEOU)	0,855
Ai Self-Efficacy (AISE)	0,967
Ai Anxiety (AI)	0,935
Perceived Enjoyment (PE)	0,774
Subjective Norm (SN)	0,775
Job Relevance (JR)	0,902
Behavioral Intention (BI)	0,604
Effectiveness of Artificial Intelligence in Education Scale	0,848
Educational Aspect (EA)	0,801
Teacher (T)	0,866
Educational Strategies (ES)	0,878

Data Analysis Procedure and Statistical Treatment

The data collected and tabulated were analyzed via both descriptive and inferential statistics to address the research questions. To test the reliability of the instrument, the researchers employed Cronbach's alpha on a sample of 30 individuals who were not part of the main study.

To answer Problem 1, descriptive statistics such as weighted means and frequency counts were used. For Problem 2, which examined the test of differences in the level of AI acceptability, attitudes, and perceived efficiency on the basis of gender and age, the independent samples t test was applied.

To address Problem 3, which investigated the relationships between (a) prospective teachers' level of acceptability and attitudes toward AI use in education, (b) acceptability and perceived efficiency, and (c) attitudes and perceived efficiency, the Pearson product–moment correlation coefficient was utilized.

RESULTS AND DISCUSSION

The Attitudes of Prospective Teachers Toward AI Use in Education

The results show that respondents hold a generally neutral view of artificial intelligence (AI) in education. For the positively worded statements, the overall weighted mean is 3,16, which indicates a neutral attitude. While some items stood out with higher agreement, such as "I am impressed by what artificial intelligence can do" (M=4,17) and "There are many beneficial applications of AI" (M=3,62), most responses reflect a more cautious or undecided stance. Statements such as "I am interested in using AI in my daily life" (M=3,11) and "I would like to use AI in my own job" (M=2,93) were rated closer to the midpoint, suggesting that many

respondents are still unsure about AI's personal and professional relevance. Notably, the idea that AI could replace humans in routine jobs (M=2,47) received the lowest support, pointing to skepticism about AI's role in the workplace.

Table 2. Frequency Distribution of the Attitudes of Prospective Teachers Toward AI Use in Education

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Weighted Mean	Interpretation
Positive	1	2	3	4	5		
1. For routine transactions, I would rather interact with an artificially intelligent system than with a human.	93	123	134	32	10	2,34	NA
2. Artificial Intelligence can provide new economic opportunities for this country.	17	47	146	133	49	3,38	NuA
4. Artificially intelligent systems can help people feel happier.	23	62	188	102	17	3,07	NuA
5. I am impressed by what Artificial Intelligence can do.	12	9	47	158	166	4,17	PA
7. I am interested in using artificially intelligent systems in my daily life.	14	71	181	110	16	3,11	NuA
11. Artificial Intelligence can have positive impacts on people's wellbeing.	6	31	156	154	45	3,51	PA
12. Artificial Intelligence is exciting.	6	32	142	169	43	3,54	PA
13. An artificially intelligent agent would be better than an employee in many routine jobs.	75	134	123	45	15	2,47	NA
14. There are many beneficial applications of Artificial Intelligence.	5	21	144	170	52	3,62	PA
16. Artificially intelligent systems can perform better than humans.	60	93	162	60	17	2,70	NuA
17. Much of society will benefit from a future full of Artificial Intelligence	16	65	185	104	22	3,13	NuA
18. I would like to use Artificial Intelligence in my own job.	28	85	177	92	10	2,93	NuA
Total	7,55 %	16,43 %	37,95 %	28,25 %	9,82 %	3,16	NuA
Negative (Reversed Coded)	1	2	3	4	5	Weighted Mean	Interpretation
3. Organizations use Artificial Intelligence unethically.	17	69	208	79	19	3,04	NuA
6. I think artificially intelligent systems make many errors.	30	109	199	44	10	2,73	NuA
8. I find Artificial Intelligence sinister.	15	63	246	56	12	2,97	NuA
9. Artificial Intelligence might take control of people.	93	160	93	36	10	2,26	NA
10. I think Artificial Intelligence is dangerous.	67	110	158	49	8	2,54	NA
15. I shiver with discomfort when I think about future uses of Artificial Intelligence.	59	100	154	66	13	2,68	NuA
19. People like me will suffer if Artificial Intelligence is used more and more.	73	89	155	60	15	2,63	NuA
20. Artificial Intelligence is used to spy people.	108	174	62	24	24	2,19	NA
Total	14,73 %	27,87 %	40,66 %	13,20 %	3,54 %	2,63	NuA

On the other hand, responses to the negatively worded items also leaned toward neutrality, with an overall

weighted mean of 2,63. Although there were some concerns, particularly concerning privacy and control, these concerns did not dominate the responses. Items such as "AI might take control of people" (M=2,26) and "AI is used to spy on people" (M=2,19) were rated low, suggesting that while such fears exist, they are not strongly felt across the group. Other items, such as concerns about AI making errors or being dangerous, hovered around the midpoint.

Taken together, the results suggest that prospective teachers are open to the possibilities of AI but are not fully convinced of its benefits or comfortable with its risks. Their views appear shaped by a mix of curiosity, limited exposure, and concern about broader social implications. These findings highlight the need for more structured discussions, practical exposure, and ethical awareness of AI in teacher education programs to help future educators engage with the technology more critically and confidently. Furthermore, this study provides valuable insights into prospective teachers' attitudes toward AI in education. Positive attitudes indicate potential openness, but neutral and negative sentiments suggest the need for targeted educational initiatives and addressing ethical concerns. Integrating AI responsibly into education requires a balance between highlighting benefits and addressing apprehensions.

The Acceptance of Prospective Teachers Toward AI Use in Education

Table 3. Frequency Distribution of the Acceptability of Prospective Teachers toward AI Use in Education

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Weighted Mean**	**Interpretation**
Perceived Usefulness	1	2	3	4	5		
Using AI-based systems increases my productivity.	23	84	134	128	23	3,11	MoA
Using AI-based systems improves my effectiveness.	16	72	159	126	19	3,15	MoA
I find the use of AI-based systems to be useful for me.	4	31	113	205	39	3,62	MA
The use of AI-based systems supports me in fulfilling my tasks.	8	33	131	184	36	3,53	MA
Total	3,25 %	14,03 %	34,25 %	41,01 %	7,46 %	3,35	MoA
Perceived Ease of Use	1	2	3	4	5	Weighted Mean	Interpretation
I find AI-based systems to be user-friendly.	7	31	158	167	29	3,46	MA
Operating an AI-based system does not require a lot of mental effort.	8	56	145	142	41	3,39	MoA
I find it easy to implement what I want to do with AI-based systems.	6	43	162	150	31	3,40	MA
The operation of an AI- based system is clear and understandable.	7	32	170	154	29	3,42	MA
Total	1,79 %	10,33 %	40,50 %	39,09 %	8,29 %	3,42	MA
AI Self-Efficacy	1	2	3	4	5	Weighted Mean	Interpretation
I can use AI-based systems without any problems, even if no one told me what I had to do.	10	67	161	124	30	3,25	MoA
I can use AI-based systems without any problems, even if I only had an integrated help function.	9	52	200	109	22	3,21	MoA
I can use AI-based systems without any problems, even if no one has shown me to use the AI-based system.	8	58	182	120	24	3,24	MoA
I can use AI-based systems without any problems, even if I have not/ have not already use similar AI-based systems.	10	58	199	106	19	3,17	MoA
Total	2,36 %	14,99 %	47,32 %	29,27 %	6,06 %	3,22	MoA
AI Anxiety	1	2	3	4	5	Weighted Mean	Interpretation
Dealing with AI-based system makes me nervous.	26	80	164	97	25	3,04	MoA
AI-based systems make me feel uneasy.	23	83	156	101	29	3,08	MoA
AI-based systems make me tense.	18	83	164	98	29	3,09	MoA

Total	5,70 %	20,92 %	41,16 %	25, 17 %	7,06 %	3,07	MoA
Perceived Enjoyment	1	2	3	4	5	Weighted Mean	Interpretation
I enjoy using AI-based systems.	13	25	194	129	31	3,36	MoA
The current preparation of AI-based system is pleasant.	7	35	216	112	22	3,27	MoA
I enjoy learning with the help of AI-based systems.	10	32	162	150	38	3,44	LA
Total	2,55 %	7,82 %	48,64 %	33,25 %	7,74 %	3,36	MoA
Subjective Norm	1	2	3	4	5	Weighted Mean	Interpretation
People who influence me think that I should use AI-based systems.	16	62	192	97	25	3,14	MoA
People who are important to me think that I should use AI-based systems.	29	79	192	74	18	2,93	MoA
Total	5, 74 %	17,98 %	48,98 %	21,81 %	5,48 %	3,03	MoA
Job Relevance	1	2	3	4	5	Weighted Mean	Interpretation
Using AI-based systems will be important for my future career.	17	50	179	121	25	3,22	MoA
The use of AI-based systems is relevant for prospective teachers.	15	47	181	124	25	3,25	MoA
The use of an AI-based system is useful for introducing the diverse tasks of a teacher.	17	30	167	154	24	3,35	MoA
Total	4, 17 %	10,80 %	44,81 %	33,93 %	6,29 %	3,27	MoA
Behavioral Intention	1	2	3	4	5	Weighted Mean	Interpretation
If I had access to AI-based systems, I would use them too.	13	20	159	165	35	3,48	MA
I plan to use an AI-based system this semester or next.	21	46	193	113	19	3,16	MoA
Total	4,34 %	8,42 %	44,90 %	35,46 %	6,89 %	3,32	MoA

The analysis of responses across all the constructs reveals a generally moderate level of agreement toward the use of AI-based systems among prospective teachers. For perceived usefulness, the overall weighted mean is 3, 35, interpreted as moderate agreement (MoA). The respondents believe that AI-based systems help improve productivity and effectiveness, although the level of agreement is not consistently strong. The item "I find the use of AI-based systems to be useful for me" (M=3,62) garnered the highest rating within this construct, reflecting a clearer recognition of AI's utility in academic or professional tasks.

In terms of perceived ease of use, the average weighted mean is 3,42, indicating moderate to high agreement. Most items in this section were interpreted as moderate agreement, although respondents found AI systems to be relatively user friendly and easy to operate. The responses suggest functional comfort with AI tools but not fully confident mastery. Similarly, AI self-efficacy scored an overall mean of 3,22, showing that while respondents can navigate AI systems independently to some extent, there is still a level of hesitancy when support is limited.

The construct of AI anxiety resulted in a weighted mean of 3,07, which was also under moderate agreement, indicating that respondents experienced mild anxiety or unease when dealing with AI systems. Although not extreme, this level of anxiety may affect their comfort and willingness to engage fully with such technologies. For perceived enjoyment, the mean is 3,36, showing that while respondents generally enjoy using AI-based systems, enjoyment is not consistently strong across all items. The highest-rated item, "I enjoy learning with the help of AI-based systems" (M = 3,44), suggests that the learning context contributes positively to the user experience.

With respect to subjective norms, the overall mean is 3,03, which is also interpreted as moderate agreement. This implies that while respondents feel some social influence in the use of AI, the pressure or encouragement from peers and significant others is not particularly strong. Job relevance has an average mean of 3,27, indicating that respondents recognize the potential value of AI for their future teaching roles but may not view it as essential. Finally, Behavioral Intention yielded a mean of 3,32, suggesting a moderate likelihood that respondents would use AI-based systems if given the opportunity. While the intention to adopt AI is present, it is not yet firm or widespread.

Taken together, these findings suggest that prospective teachers exhibit moderate acceptance and cautious optimism toward AI integration in education. Their responses reflect general agreement with the benefits of

AI in terms of usefulness, usability, and relevance to teaching. However, the presence of mild anxiety, limited social influence, and modest behavioral intentions points to the need for greater exposure, targeted training, and institutional support to build confidence and strengthen actual adoption. Addressing these areas may enhance prospective teachers' readiness to integrate AI meaningfully into their professional practice.

Perceived Efficiency of Prospective Teachers toward AI Use in Education

Table 4. Frequency Distribution of the Perceived Efficiency of Prospective Teachers toward AI Use in Education

	Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**	**Weighted Mean**	**Interpretation**
Educational Aspect	1	2	3	4	5		
Artificial intelligence gives a more accurate definition of education than traditional teaching.	87	112	136	44	13	2,45	ME
The educational content can be programmed using AI applications.	21	48	152	147	24	3,27	MoE
AI enhances the concept of digital education.	10	25	102	201	54	3,67	SE
AI works on improving the educational curricula presented to learners.	13	36	158	154	31	3,39	MoE
AI presents solutions to different educational problems.	16	27	158	163	28	3,41	SE
AI enhances skill processes of the educational curriculum.	18	55	170	127	22	3,20	MoE
AI enhances cognitive processes of the educational curriculum.	26	70	166	110	20	3,07	MoE
AI increases the skills incorporated in the educational curriculum.	20	56	181	113	22	3,16	MoE
All methods and equipment necessary to ensure efficacy and effectiveness in using AI applications are available.	13	68	207	88	16	3,07	MoE
Total	6,35 %	14,09 %	40,53 %	32,51 %	6,52 %	3,19	MoE
Teacher	1	2	3	4	5	Weighted Mean	Interpretation
AI applications are suitable to the teacher and their educational expertise.	23	86	184	89	10	2,94	MoE
AI applications suit students' educational expertise.	17	75	182	104	14	3,06	MoE
AI applications increase students' learning ability.	23	56	147	144	22	3,22	MoE
AI applications increase students' skill level.	26	74	164	106	22	3,06	MoE
AI applications increase students' cognitive level	28	74	180	96	14	2,98	MoE
Through AI applications, students' skill aspects can be analyzed.	26	78	173	101	14	3,00	MoE
Through AI applications, students' cognitive aspects can be analyzed.	25	77	170	107	13	3,02	MoE
Through AI applications, students' emotional aspects can be analyzed.	61	107	146	68	10	2,64	MoE
AI applications take into account individual differences among students.	34	80	181	81	16	2,91	MoE

Total	7,45 %	20,04 %	43,28 %	25,40 %	3,83 %	2,98	MoE
Educational Strategies	1	2	3	4	5	Weighted Mean	Interpretation
AI applications are suitable to the educational strategies used.	21	60	182	108	21	3,12	MoE
Through AI applications, the educational strategies can be related to the expertise of teacher and learner.	21	42	167	137	25	3,26	MoE
AI applications increase the efficacy and effectiveness of learning strategies.	18	39	166	148	21	3,29	MoE
Through AI applications, the best teaching methods that suit the learner's ability and expertise can be selected.	16	62	176	118	20	3,16	MoE
AI applications increase the teacher's ability to achieve the objectives of educational strategies.	14	50	180	127	21	3,23	MoE
AI applications work on improving the teacher's ability to select the appropriate strategy that suits learners' individual differences.	18	59	163	135	17	3,19	MoE
AI applications help improve the spirit of cooperation between learners.	23	95	169	89	16	2,95	MoE
AI applications help improve the sense of responsibility in learners.	39	110	168	62	13	2,74	MoE
AI applications work on achieving all the educational objectives effectively and efficiently.	28	61	193	96	14	3,02	MoE
Total	5,61 %	16,38 %	44,33 %	28,91 %	4,76 %	3,11	MoE

The overall results indicate that prospective teachers perceive artificial intelligence (AI) as moderately efficient in supporting various aspects of education, as reflected by the overall weighted means across three core domains: educational aspects (M=3,19), teacher-related functions (M=2,98), and educational strategies (M=3,11). These values fall within the interpretation range of moderate extent (MoE), suggesting a cautiously optimistic stance toward the efficiency of AI in education. Among the three domains, the educational aspect yielded the highest mean, highlighting that prospective teachers see AI as particularly efficient in enhancing digital education (M=3,67) and offering solutions to instructional challenges (M=3,41). However, skepticism remains regarding AI's ability to redefine the concept of education, as indicated by a lower rating (M=2,45).

In the teacher domain, the responses suggest that while AI is seen as somewhat effective in enhancing students' cognitive and skill development (M=3,22 for learning ability), there is less confidence in its ability to address emotional aspects (M=2,64) or individual learner differences (M = 2,91). These lower scores imply that prospective teachers are still hesitant to rely on AI for personalized or affective components of teaching, areas traditionally considered central to the teacher's role.

Similarly, in the educational strategies domain, the data show moderate agreement on the usefulness of AI in improving instructional planning and implementation. The respondents acknowledged that AI could help align strategies with learners' abilities (M=3,26) and improve the effectiveness of teaching methods (M=3,29). Nonetheless, items related to the development of learners' social behaviors, such as cooperation (M=2,95) and responsibility (M=2,74), were rated lower, reflecting reservations about AI's role in fostering interpersonal and affective learning outcomes.

These findings suggest that prospective teachers perceive AI as moderately efficient, particularly in supporting the technical, cognitive, and content-driven dimensions of education. However, doubts remain regarding its efficiency in addressing emotional, social, and individual learning needs. This calls for the inclusion of AI literacy and pedagogical integration in teacher education programs, emphasizing not only functionality but also ethical, relational, and inclusive applications of AI in the classroom.

Significant differences in the extent of prospective teachers' attitudes toward, acceptance of and perceived effectiveness of AI in education when the data are grouped according to gender

Table 5. Independent sample t test for significant differences in the extent of prospective teachers' acceptance, attitudes and perceived effectiveness of AI in education when the data are grouped according to gender

Variables	Gender	N	Mean	SD	t	df	p value	Cohen's d	Interpretation
ACCEPTANCE	Female	314	3,21	0,56	-1,664	390	0,097	0,56	Not Significant
	Male	78	3,33	0,58	-1,629	115,258			Medium Effect
ATTITUDE	Female	314	3,22	0,41	-1,908	390	0,057	0,41	Not Significant
	Male	78	3,32	0,41	-1,893	117,114			Medium Effect
EFFECTIVENESS	Female	314	3,06	0,67	-1,657	390	0,098	0,66	Not Significant
	Male	78	3,20	0,63	-1,731	125,068			Medium Effect

An independent-samples t test was conducted to compare the extent of AI acceptance of AI in education between female and male prospective teachers. The results revealed no statistically significant difference, t (390) = -1,664, p > ,05. The me an acceptance score of the female participants (M = 3,21, SD = 0,56) was not significantly different from that of the male participants (M = 3,33, SD = 0,58). The effect size, calculated via Cohen's d = 0,56, indicates a moderate magnitude of difference, even though it did not reach statistical significance. This outcome aligns with previous findings by Venkatesh and Morris [87] who reported that while gender may influence technology use patterns in some contexts, its influence diminishes in more digitally immersed environments. The relatively balanced scores suggest a convergence in technology acceptance across genders, possibly driven by shared educational exposures, curriculum content, and institutional efforts to promote digital literacy among all learners. Moreover, this finding resonates with Gefen and Straub[88], who noted that differences in acceptance tend to equalize when both genders perceive the technology as useful and easy to use—two key components of the Technology Acceptance Model (TAM) by Davis.[54]

In terms of attitude, no significant difference was observed between female (M = 3,22, SD = 0,41) and male (M = 3,32, SD = 0,41) participants, t (390) = -1,908, p > 0,05. The calculated Cohen's d = 0,41 suggests a moderate effect size, which again highlights a meaningful, although not statistically significant, variation in the attitudinal orientation toward AI in education. This result corroborates Teo's[89] findings on preservice teachers' technology attitudes, where gender was not a consistent predictor. It may also reflect changing gender dynamics in digital education contexts, where access and exposure are increasingly equitable. The moderate effect size may hint at underlying sociocultural or cognitive variations in how male and female teachers perceive AI's potential but is not strong enough to affect the overall attitudinal stance. Furthermore, Ajzen's[64] theory of planned behavior explains that attitudes are shaped by perceived behavioral control and subjective norms—factors that may be influenced more by training and environmental factors than by gender alone in teacher education programs.

Finally, with respect to perceived effectiveness, female participants (M = 3,06, SD = 0,67) and male participants (M = 3,20, SD = 0,63) also did not differ significantly, t (390) = -1,657, p > 0,05. The effect size, however, was moderate at Cohen's d = 0,66. This finding aligns with the position of Selwyn[90] who emphasized that gender differences in perceptions of educational technology effectiveness have become less pronounced in recent years because of universal exposure to digital tools in higher education. The moderate effect size may suggest nuanced differences in perception, perhaps influenced by confidence, prior experience, or differential engagement with AI, but these differences do not appear robust enough to produce statistically significant group differences. Additionally, according to Bandura's[92] social cognitive theory, individual beliefs in the efficacy of tools such as AI are shaped more by self-efficacy and vicarious learning than by demographic variables such as gender. The present results may indicate that both male and female prospective teachers draw upon similar social and academic learning contexts that shape a relatively unified view of AI effectiveness.

Significant differences in the extent of prospective teachers' acceptance, attitudes and perceived effectiveness of AI in education when the data are grouped according to age group

Table 6. Independent samples t test for significant differences in the extent of prospective teachers' acceptance, attitudes and perceived effectiveness of AI in education when the data are grouped according to age group

Variables	Age Group	N	Mean	SD	t	df	p value	d	Interpretation
ACCEPTANCE	18≤age≤19 years old	166	3,17	0,48	-2,043	390	0,034	0,56	Significant
	20≤age and above	226	3,29	0,62	-2,125	389,155			Medium Effect
ATTITUDE	18≤age≤19 years old	166	3,19	0,33	-2,135	390	0,025	0,41	Significant
	20≤age and above	226	3,28	0,46	-2,243	389,803			Medium Effect

EFFECTIVENESS	18≤age≤19 years old	166	3,02	0,64	-1,854	390	0,064	0,66	Not Significant
	20≤age and above	226	3,15	0,68	-1,871	366,821			Medium Effect

An independent-samples t test was conducted to examine whether there were differences in the acceptance of AI in education between younger prospective teachers (18–19 years old) and their older counterparts (20 years old and above). The results revealed a statistically significant difference, t(390) = -2,043, p < .05. The younger group reported a lower mean acceptance score (M = 3,17, SD = 0,48) than did the older group (M = 3,29, SD = 0,62). The effect size, as indicated by Cohen's d = 0,56, denotes a moderate effect. This result suggests that age is a meaningful differentiator of AI acceptance, potentially reflecting maturational differences in exposure, confidence, or educational preparedness. According to the Technology Acceptance Model (TAM) by Davis[54], acceptance is influenced by perceptions of usefulness and ease of use, which may be more deeply developed in older students due to greater academic experience and familiarity with technology-integrated environments. Consistent with the findings of Teo[89] and Venkatesh et al.[65], age has been observed to positively correlate with digital maturity and strategic engagement with educational technologies. Older students may also have encountered more opportunities to reflect on the pedagogical value of AI through internships, higher-level coursework, or peer teaching, influencing their higher acceptance levels.

An independent-samples t test was also employed to compare attitudes toward AI in education between the two age groups. A significant difference was found, t(390) = -2,135, p < 0,05. Younger participants reported a lower mean attitude score (M = 3,19, SD = 0,33) than older participants did (M = 3,28, SD = 0,46). Cohen's d = 0,41 suggests a moderate effect size. The observed difference may stem from developmental and experiential disparities. Bandura's [92] social cognitive theory posits that attitudes are shaped by self-efficacy and observational learning. Older students might possess a greater sense of technological self-efficacy and more opportunities to model or observe positive uses of AI in educational settings. Moreover, Rogers' [93] diffusion of innovations theory highlights how age and maturity often influence the categorization of adopters—from early to late. Older students may be more likely to belong to early or early majority adopters of AI-based technologies in education, whereas younger students may still be navigating uncertainty and forming stable attitudes.

In contrast, the comparison of perceived effectiveness between age groups yielded no statistically significant difference, t(390) = -1,854, p > 0,05. The younger group (M = 3,02, SD = 0,64) and the older group (M = 3,15, SD = 0,68) had similar evaluations of AI effectiveness in the teaching and learning process. However, the effect size, Cohen's d = 0,66, was moderate, suggesting that while the difference is not statistically significant, it may be educationally meaningful. This finding may imply that both groups recognize the functional capabilities of AI in supporting learning processes, but younger learners may be less confident in its application or impact, thus slightly skewing their perceived effectiveness. In line with Selwyn [90] and Ng [94], students' perceptions of technological effectiveness are influenced not only by age but also by their depth of interaction, autonomy, and context of use. The moderate effect size, despite the nonsignificant p value, indicates a potential latent trend worth exploring further in longitudinal or mixed-methods studies. It is plausible that as younger students gain more academic exposure and AI-related traini dng, the perceived gap in effectiveness may narrow.

Significant relationships between the extent of prospective teachers' acceptance, attitudes and perceived effectiveness of AI in education

Table 7. Pearson's r test of the significant relationships between the extent of prospective teachers' acceptance, attitudes and perceived effectiveness of AI in education

Variables	Correlation Coefficient	ACCEPTANCE	ATTITUDE	EFFECTIVENESS
ACCEPTANCE	Pearson Correlation	1	0,642**	0,756**
	Sig. (2-tailed)		0,000	0,000
	N	392	392	392
ATTITUDE	Pearson Correlation	0,642**	1	0,575**
	Sig. (2-tailed)	0,000		0,000
	N	392	392	392
EFFECTIVENESS	Pearson Correlation	0,756**	0,575**	1
	Sig. (2-tailed)	0,000	0,000	
	N	392	392	392

Note: **. Correlation is significant at the 0,01 level (2-tailed).

The table shows that all correlations were statistically significant at the 0,01 level (2-tailed), underscoring meaningful and robust relationships among prospective teachers' acceptance, attitudes, and perceived

effectiveness of AI in education. These findings affirm the intertwined nature of the affective and cognitive factors in technology adoption models and emphasize the importance of fostering both positive attitudes and acceptance to enhance the perceived effectiveness and eventual utilization of AI in teaching.

In terms of acceptance and attitude, a moderately strong positive correlation was found between acceptance and attitude, $r(390) = 0,642$, $p < 0,001$. This finding indicates a significant linear relationship whereby greater acceptance of AI corresponds with more favorable attitudes toward its integration in the teaching and learning process. This finding aligns with the theoretical framework of the Technology Acceptance Model (TAM) proposed by Davis[54] which posits that acceptance of technology is strongly influenced by users' attitudes. Prior empirical studies also support this link; for example, Teo[89] reported that teachers' positive attitudes toward educational technology strongly predict their acceptance and intention to use such tools.

For acceptance and perceived effectiveness, a strong positive correlation was observed between acceptance and perceived effectiveness, $r (390) = 0,756$, $p < 0,001$, indicating that as prospective teachers' acceptance of AI increases, so does their perception of its effectiveness in enhancing the teaching and learning process. This relationship echoes findings by Venkatesh et al.[65] and subsequent research, which demonstrate that perceived usefulness (akin to perceived effectiveness) is a principal determinant of acceptance and adoption of educational technologies. The stronger correlation suggests that prospective teachers who believe that AI tools are effective are more likely to embrace and integrate these technologies into their pedagogical practice. This is also consistent with Bandura's[92] social cognitive theory, where efficacy beliefs influence behavioral intentions and actions.

With respect to attitudes and perceived effectiveness, a moderate positive correlation was also found between attitudes and perceived effectiveness, $r (390) = 0,575$, $p < 0,001$, implying that more positive attitudes toward AI are associated with greater perceptions of its effectiveness. This connection supports the argument that affective components—such as attitudes—influence cognitive evaluations of technology effectiveness Ajzen.[95]

CONCLUSIONS

The findings of this study underscore that prospective teachers generally acknowledge the value of AI in education, as reflected in their moderate acceptance, positive attitudes, and favorable perceptions of its effectiveness. Although gender did not yield statistically significant differences, the moderate effect sizes suggest subtle variations in perceptions that may influence classroom practices. Age emerged as a meaningful factor, with older participants demonstrating significantly higher levels of acceptance and more favorable attitudes, likely shaped by greater academic experience and digital exposure.

Teacher education institutions are encouraged to integrate AI-related content and hands-on activities into their curricula, promoting equitable access to digital learning regardless of their demographic background. Younger teacher aspirants, in particular, may benefit from structured opportunities to build digital confidence and familiarity with AI tools. Ongoing professional development and cross-disciplinary training can further enhance educators' understanding of AI's role in diverse instructional settings. The strong interrelationships among acceptance, attitudes, and perceived effectiveness also highlight the need to cultivate both cognitive and affective readiness for AI use in education. Future research may adopt longitudinal or qualitative designs to explore how these perceptions evolve and influence classroom integration over time.

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