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Perceptions of pre-service teachers toward Artificial Intelligence integration in education

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Abstract

This study examines the perceptions of pre-service teachers regarding the integration of Artificial Intelligence (AI) into educational practices. As AI technologies increasingly permeate educational settings, understanding the perspectives of future educators is critical for effective implementation. This research investigates pre-service teachers' readiness to adopt AI, the challenges they encounter, and the influence of demographic factors such as gender, academic discipline, and prior technological exposure on their perceptions. A sample of 60 pre-service teachers from the District Institute of Education and Training (DIET) in Guntur district, India, participated in the study. Data were collected using a validated questionnaire and analyzed through statistical methods to identify perceptual differences across groups. Results reveal significant individual variations in perceptions but no statistically significant differences based on gender, academic discipline, or technological exposure. The findings underscore the necessity for targeted AI training within teacher education curricula to prepare future educators for seamless AI integration. This research offers critical insights for policymakers and educators aiming to foster AI adoption in education.

Keywords: Pre-Service Teachers; Artificial Intelligence; Perceptions; Education Technology; Teacher Training

1. Introduction

The advent of Artificial Intelligence (AI) has revolutionized various sectors, including education, by offering innovative solutions to enhance teaching and learning processes. AI technologies, such as intelligent tutoring systems, automated grading tools, and personalized learning platforms, have the potential to transform educational delivery by catering to individual learner needs and streamlining administrative tasks (Holmes et al., 2019). However, the successful integration of AI in education hinges on the willingness and preparedness of educators, particularly pre-service teachers who are poised to shape future classrooms.

Pre-service teachers, as the next generation of educators, play a pivotal role in determining the extent to which AI is embraced in educational settings. Their perceptions of AI-encompassing their attitudes, beliefs, and readiness— significantly influence their future teaching practices. Positive perceptions can facilitate the adoption of AI tools, while negative or skeptical views may hinder their implementation. Understanding these perceptions is crucial for designing teacher education programs that equip future educators with the knowledge and skills to leverage AI effectively.

This study aims to explore the perceptions of pre-service teachers toward AI integration in education, focusing on their readiness, perceived benefits, and potential barriers. Additionally, it examines how demographic and contextual factors, such as gender, academic discipline, and prior exposure to technology, shape these perceptions. By addressing these aspects, the research seeks to provide actionable insights for enhancing teacher preparation programs and promoting AI adoption in education.

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1.1. Need for the Study

The rapid proliferation of AI in education necessitates a comprehensive understanding of how future educators perceive these technologies. Teachers are central to the effective implementation of AI tools, as their perceptions influence their willingness to adopt and integrate such technologies into their pedagogical practices (Mishra and Kumar, 2020). Negative perceptions, stemming from factors such as lack of training, ethical concerns, or misconceptions about AI, can impede its adoption, while positive perceptions can drive innovation in teaching and learning.

Despite the growing body of literature on AI in education, there is a paucity of research focusing on pre-service teachers' perceptions, particularly in the Indian context. This gap is significant, given India's diverse educational landscape and the increasing emphasis on technology-driven education. By investigating pre-service teachers' perceptions, this study aims to identify the factors that facilitate or hinder AI adoption and inform the development of targeted interventions within teacher education programs.

Moreover, understanding the influence of demographic and contextual factors on perceptions can help tailor training programs to meet the diverse needs of pre-service teachers. For instance, differences in technological exposure or academic discipline may affect how teachers perceive AI's utility in education. Addressing these factors can mitigate resistance and foster a supportive environment for AI integration, ultimately enhancing the quality of education in the digital era.

2. Review of Related Literature

The integration of AI in education has been extensively studied, with researchers highlighting both its potential and challenges. Below, we review key studies that inform the current research, focusing on pre-service teachers' perceptions and the factors influencing AI adoption.

2.1. AI in Education: Opportunities and Challenges

Holmes et al. (2019) emphasize that AI offers transformative opportunities in education, including personalized learning, real-time feedback, and enhanced administrative efficiency. However, they caution that successful integration requires addressing ethical concerns, such as data privacy and algorithmic bias, as well as ensuring teacher preparedness. Similarly, Baker and Siemens (2014) highlight the role of educational data mining and learning analytics in leveraging AI to improve student outcomes, underscoring the need for teacher training in data-driven pedagogies.

2.2. Pre-Service Teachers' Perceptions of AI

Mishra and Kumar (2020) conducted a study on pre-service teachers in India, finding that while many recognize AI's potential to enhance learning, they exhibit hesitancy due to inadequate training and concerns about dehumanizing education. The study recommends incorporating AI-focused modules in teacher education to build confidence and competence. Similarly, Reddy and Reddy (2021) explored teacher trainees' perceptions in southern India, noting that limited exposure to AI tools during training contributes to skepticism. However, hands-on experience with AI technologies was found to foster positive perceptions, suggesting the importance of practical training.

2.3. Factors Influencing Perceptions

Research indicates that demographic and contextual factors shape teachers' perceptions of technology. For instance, gender differences in technology adoption have been noted, with some studies suggesting that female teachers may exhibit lower confidence in using advanced technologies (Markauskaite, 2006). Academic discipline also plays a role, as teachers in STEM fields may be more inclined to embrace AI due to their familiarity with technology (Reddy & Reddy, 2021). Additionally, prior technological exposure, such as experience with digital tools or coding, can enhance teachers' readiness to adopt AI (Mishra & Kumar, 2020).

2.4. Gaps in the Literature

While existing studies provide valuable insights, they often focus on in-service teachers or general technology adoption, with limited attention to pre-service teachers' perceptions of AI. Moreover, few studies explore the interplay of demographic factors in the Indian context, where educational systems vary widely. This study addresses these gaps by examining pre-service teachers' perceptions in a specific regional context and analyzing the influence of gender, academic discipline, and technological exposure.

Objectives of the Study

- To examine the perceptions of pre-service teachers toward the integration of AI in educational practices.
- To investigate the influence of gender, academic discipline, and prior technological exposure on pre-service teachers' perceptions of AI integration.
- To identify the barriers and facilitators affecting pre-service teachers' readiness to adopt AI in education.

2.5. Hypotheses

- There is no significant difference in the perceptions of pre-service teachers toward AI integration in education.
- There is no significant difference in the perceptions of pre-service teachers toward AI integration in education based on gender, academic discipline, or prior technological exposure.

3. Methodology

3.1. Sample

The study was conducted in the Guntur district of Andhra Pradesh, India, where a single District Institute of Education and Training (DIET) provides a Diploma in Elementary Education (D.El.Ed.) to pre-service teachers. A random sample of 60 pre-service teachers enrolled in the D.El.Ed. program was selected. The sample comprised 35 female and 25 male participants, with diverse academic backgrounds and varying levels of prior technological exposure.

3.2. Data Collection Tool

A structured questionnaire was developed to assess pre-service teachers' perceptions of AI integration in education. The questionnaire comprised 25 items, including both positive and negative statements, rated on a three-point Likert scale (Agree, Neutral, Disagree). The items covered four dimensions: (1) perceived benefits of AI, (2) readiness to adopt AI, (3) perceived barriers, and (4) ethical concerns. The questionnaire was validated by a panel of education technology experts, and its reliability was established with a Cronbach's alpha of 0.82.

3.3. Data Collection Procedure

Data were collected in person by the researcher during regular class sessions at the DIET. Participants were briefed about the study's purpose and assured of confidentiality. The questionnaires were distributed, completed, and collected within a single session to ensure consistency.

3.4. Data Analysis

The collected data were analyzed using descriptive and inferential statistical methods. Descriptive statistics, including mean and standard deviation, were used to summarize participants' perceptions. Independent t-tests were conducted to examine differences in perceptions based on gender, academic discipline (science vs. non-science), and prior technological exposure (high vs. low, based on self-reported experience with digital tools). All analyses were performed at a 0.05 significance level using SPSS software.

4. Results and Discussion

4.1. Overall Perceptions of AI Integration

The analysis revealed significant individual differences in pre-service teachers' perceptions of AI integration, with a mean score of 52.4 and a standard deviation of 5.8. This variability suggests that while some participants were enthusiastic about AI's potential, others were more cautious or skeptical. The high standard deviation indicates diverse opinions, possibly influenced by factors such as awareness, training, or personal beliefs about technology in education.

4.2. Perceptions by Gender

The following table presents the mean, standard deviation, and t-value for perceptions based on gender

Table 1 Perceptions based on Gender

Gender	Sample	Mean	SD	't' value
Female	35	52.1	5.6	0.6123
Male	25	52.8	6.0	

The t-value (0.6123) is not significant at the 0.05 level, indicating no significant difference in perceptions between female and male pre-service teachers. This finding contrasts with some studies suggesting gender differences in technology adoption (Markauskaite, 2006) but aligns with others that report diminishing gender gaps in technology perceptions among younger populations (Reddy & Reddy, 2021).

4.3. Perceptions by Academic Discipline

The table below shows the results for perceptions based on academic discipline (science vs. non-science)

Table 2 Perceptions based on Discipline

Discipline	Sample	Mean	SD	't' value
Science	28	52.7	5.4	0.3872
Non-Science	32	52.1	6.1	

The t-value (0.3872) is not significant at the 0.05 level, suggesting no significant difference in perceptions between science and non-science students. This finding is surprising, as STEM disciplines are often associated with greater technological familiarity (Reddy & Reddy, 2021). It may reflect the limited exposure to AI-specific training across all disciplines in the D.El.Ed. program.

4.4. Perceptions by Prior Technological Exposure

The following table presents the results for perceptions based on prior technological exposure

Table 3 Perceptions based on Exposure level

Exposure level	Sample	Mean	SD	't' value
High	22	53.0	5.7	0.5241
Low	38	52.1	5.9	

The t-value (0.5241) is not significant at the 0.05 level, indicating no significant difference in perceptions between participants with high and low technological exposure. This result suggests that prior experience with general digital tools may not necessarily translate to confidence in AI-specific applications, highlighting the need for targeted AI training.

4.5. Barriers and Facilitators

Qualitative analysis of open-ended responses revealed several barriers to AI adoption, including:

- **Lack of Training**: Many participants reported limited knowledge of AI tools and their educational applications.
- **Ethical Concerns**: Some expressed worries about data privacy and the potential for AI to replace human interaction in education.
- **Resource Constraints**: Participants noted the lack of infrastructure, such as reliable internet and devices, in many Indian schools.

4.6. Facilitators included

- **Hands-On Experience**: Participants who had used AI tools (e.g., virtual assistants or educational apps) reported more positive perceptions.

- **Awareness of Benefits**: Understanding AI's potential to personalize learning and reduce administrative burdens increased enthusiasm.
- **Supportive Training Programs**: Participants emphasized the need for practical, AI-focused training in teacher education.

4.7. Findings

- There are significant individual differences in pre-service teachers' perceptions of AI integration in education, reflecting diverse attitudes and beliefs.
- No significant differences were found in perceptions based on gender, academic discipline, or prior technological exposure.
- Key barriers to AI adoption include lack of training, ethical concerns, and resource constraints, while facilitators include hands-on experience and awareness of AI's benefits.

5. Conclusion

The integration of AI in education holds immense potential to enhance teaching and learning, but its success depends on the preparedness of future educators. This study reveals that while pre-service teachers exhibit varied perceptions of AI, demographic factors such as gender, academic discipline, and technological exposure do not significantly influence their views. The findings highlight the critical need for comprehensive AI training within teacher education programs to address barriers such as lack of knowledge, ethical concerns, and resource limitations.

To foster positive perceptions and readiness, teacher education curricula should incorporate practical, hands-on experiences with AI tools, alongside modules on ethical considerations and data privacy. Policymakers and educators must also address infrastructural challenges to ensure equitable access to AI technologies in schools. By equipping pre-service teachers with the skills and confidence to integrate AI, we can pave the way for a technology-enhanced future in education.

Recommendations

- Curriculum Integration: Teacher education programs should include mandatory courses on AI in education, covering both theoretical and practical aspects.
- Professional Development: Continuous training workshops should be offered to pre-service and in-service teachers to keep pace with AI advancements.
- Infrastructure Investment: Governments and educational institutions should invest in digital infrastructure to support AI implementation in schools.
- Ethical Guidelines: Clear policies on AI use in education, addressing data privacy and algorithmic fairness, should be developed and communicated to teachers.

Compliance with ethical standards

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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