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Preparing Future Teachers for AI-Driven Classrooms: Transforming Pedagogical Practices in the Digital Era

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ABSTRACT

Artificial Intelligence (AI) is transforming educational practices worldwide and creating a paradigm shift in teaching–learning processes. Teacher education institutions must prepare future teachers with the competencies required to integrate AI effectively into classroom pedagogy. The present quantitative study investigates the awareness, attitudes, and preparedness of pre-service teachers toward AI-based pedagogical practices. Data were collected from 120 B.Ed. student-teachers using a structured questionnaire. Descriptive statistics and percentage analysis were used to interpret the data. The findings indicate that while most student-teachers recognize the potential of AI in improving personalized learning, assessment, and instructional design, many lack adequate training and technical skills to integrate AI tools effectively. The study highlights the urgent need to incorporate AI literacy, digital pedagogy, and ethical awareness into teacher education curricula. The research concludes that teacher education institutions must redesign pedagogical practices to align with emerging AI-driven educational environments.

Introduction

The rapid advancement of digital technologies has significantly transformed the landscape of education across the world. Among these technologies, Artificial Intelligence (AI) has emerged as one of the most influential innovations shaping the future of teaching and learning. AI refers to the development of

computer systems capable of performing tasks that normally require human intelligence, such as decision-making, problem-solving, pattern recognition, and language processing. In the educational context, AI is being used to create intelligent tutoring systems, automated grading mechanisms, adaptive learning environments, and data-driven learning analytics that enhance the effectiveness of educational processes.The integration of AI in education has introduced new possibilities for personalized learning, where instructional content and pacing can be tailored according to the individual needs and abilities of students. AI-powered systems can analyze students' learning patterns and provide customized feedback, thereby supporting differentiated instruction. This technological shift not only enhances learning outcomes but also reduces the administrative workload of teachers by automating routine tasks such as grading, attendance monitoring, and data analysis.

However, the successful implementation of AI in education largely depends on teachers' ability to understand and utilize these technologies effectively. Teachers play a crucial role in mediating the interaction between technology and learners. Therefore, teacher education programs must focus on equipping future educators with the knowledge, competencies, and ethical awareness required to integrate AI-based tools into pedagogical practices. The role of teachers is gradually shifting from being the sole source of knowledge to facilitators of learning, technology integrators, and designers of innovative learning environments.In the Indian educational context, technological integration has gained considerable importance with the introduction of the National Education Policy (NEP) 2020**,** which emphasizes the use of emerging technologies such as Artificial Intelligence, machine learning, and digital platforms in education. Initiatives such as DIKSHA, SWAYAM, NISHTHA, and PM eVidya have encouraged technology-enabled learning and teacher professional development. Despite these initiatives, many pre-service teachers still lack adequate exposure and training in AI-based educational technologies.Teacher education institutions therefore face the challenge of preparing future teachers who are technologically competent, pedagogically innovative, and ethically responsible in using AI-driven tools. Understanding the awareness, attitudes, and preparedness of pre-service teachers toward AI integration is essential for designing effective teacher education curricula. The present study attempts to examine these aspects and explore how teacher education programs can adapt to the emerging AI-driven educational ecosystem.

The integration of Artificial Intelligence (AI) in education is rapidly transforming traditional teaching practices and learning environments. AI technologies such as intelligent tutoring systems, automated assessment tools, adaptive learning platforms, and educational chat bots are increasingly used to support teaching and learning. These technologies enable personalized learning experiences, automate routine

tasks, and provide data-driven insights into student performance. With the growing use of AI in education, the role of teachers is also evolving. Instead of being merely transmitters of knowledge, teachers are expected to act as facilitators, mentors, and designers of learning experiences supported by technology. AI can assist teachers in instructional planning, evaluation, and decision-making processes. In India, the National Education Policy (NEP) 2020 emphasizes the integration of emerging technologies such as artificial intelligence to improve the quality of education and prepare learners for the digital age. Educational initiatives like DIKSHA, SWAYAM, and NISHTHA have also promoted technology-enhanced teacher training programs.Therefore, preparing future teachers to effectively integrate AI into pedagogical practices has become an important priority for teacher education institutions.

Review of Literature

Bai and Talin (2025) highlighted that AI literacy among educators includes technological competence, ethical awareness, pedagogical integration, and interdisciplinary skills. These competencies are essential for effective teaching in AI-enhanced learning environments.

Dennison et al. (2025) studied AI-supported lesson planning in government schools in Karnataka and found that AI tools helped teachers reduce workload and promoted activity-based pedagogy, although institutional challenges limited large-scale transformation.

Marcos (2025) reported that AI technologies such as adaptive learning platforms and intelligent tutoring systems improve student engagement and enable personalized learning experiences.

Tripathi, Sharma, and Singh (2025) examined teachers' perceptions regarding AI integration in schools in Delhi and found that teachers recognize the potential of AI but also express concerns about over-dependence on technology and lack of AI literacy

Shi and Choi (2024) found that AI can support teaching practices in multiple ways, including functioning as an instructional partner, assessment tool, and decision-making support system for teachers.

Holmes, Bialik, and Fadel (2019) argued that AI can significantly improve the efficiency and effectiveness of educational systems by enabling data-driven instruction and personalized learning experiences. According to the authors, AI technologies can help teachers monitor students' progress, identify learning gaps, and provide targeted support to learners.

Zawacki-Richter, Marín, Bond, and Gouverneur (2019) conducted a systematic review of Artificial Intelligence applications in higher education. Their findings revealed that AI is increasingly used in areas

such as intelligent tutoring systems, automated grading, student performance prediction, and personalized learning environments. However, the study also pointed out that the successful implementation of AI depends largely on teachers' technological competencies and institutional support.

Luckin, Holmes, Griffiths, and Forcier (2016) emphasized that Artificial Intelligence has the potential to transform education by supporting personalized learning and intelligent feedback systems. Their study suggested that AI can assist teachers in understanding students' learning patterns and designing adaptive learning environments that respond to individual differences among learners.

Tripathi, Sharma, and Singh (2025) explored teachers' perceptions of AI integration in schools in Delhi. Their findings indicated that although teachers recognized the potential benefits of AI in improving teaching practices, they also expressed concerns regarding lack of training, technical expertise, and infrastructural limitations.

These studies indicate that while AI has significant potential in education, teacher preparedness and training remain major challenges.

Objectives of the Study

1. To examine the awareness of pre-service teachers about Artificial Intelligence in education.
2. To analyze the attitude of future teachers toward AI-based teaching practices.
3. To examine the preparedness of student-teachers to integrate AI tools in classroom teaching.
4. To identify challenges faced by student-teachers in adopting AI-based pedagogical practices.

Research Hypothesis

H_0: There is no significant difference in the level of awareness and preparedness of pre-service teachers toward AI-based pedagogical practices.

Methodology

1. **Research Design**

The present study employed a quantitative survey method.

2. **Sample**

The sample consisted of 120 B.Ed. student-teachers from teacher education colleges in Uttar Pradesh selected using random sampling technique.

3. Research Tool

A structured questionnaire was developed by the researcher containing 20 statements related to AI awareness, attitudes, and pedagogical integration.

Data Analysis

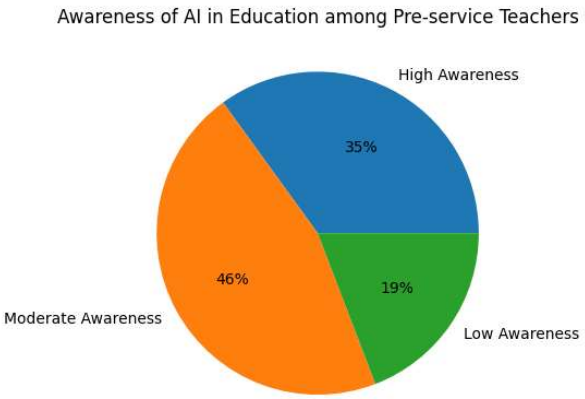
Data were analyzed using:

- Percentage analysis
- Mean score analysis

Data Analysis and Interpretation

Table 1: Awareness of AI in Education

Response	Number	Percentage
High Awareness	42	35%
Moderate Awareness	55	46%
Low Awareness	23	19%

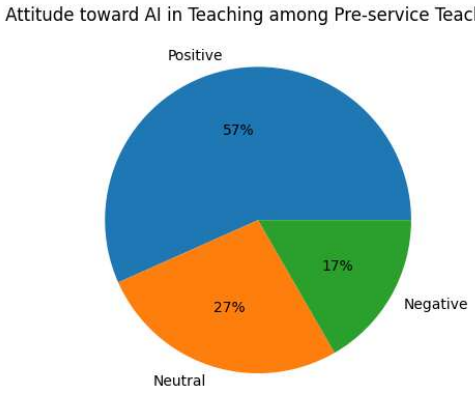


Interpretation:

Most student-teachers (46%) have moderate awareness about AI in education.

Table 2: Attitude toward AI in Teaching

Response	Number	Percentage
Positive	68	57%
Neutral	32	27%
Negative	20	16%

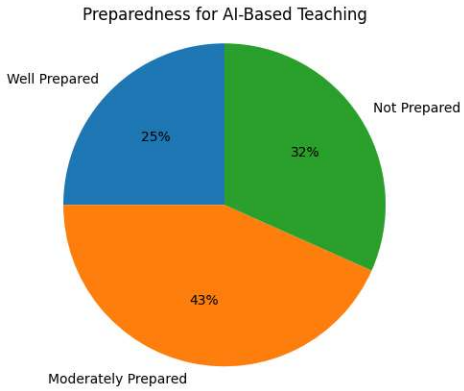


Interpretation:

A majority of future teachers (57%) show a positive attitude toward integrating AI in teaching.

Table 3: Preparedness for AI-Based Teaching

Response	Number	Percentage
Well Prepared	30	25%
Moderately Prepared	52	43%
Not Prepared	38	32%



Interpretation:

Although attitudes are positive, only 25% of student-teachers feel well prepared to integrate AI into teaching.

Major Findings

1. Most pre-service teachers possess moderate awareness of AI in education.
2. A majority of student-teachers have a positive attitude toward AI-based teaching methods.
3. Many student-teachers lack sufficient training and technical competence to implement AI tools.
4. The study indicates a gap between awareness and practical skills related to AI integration.
5. Teacher education programs need to integrate AI literacy and digital pedagogy training.

Educational Implications

The findings of this study have several important implications for teacher education institutions, policymakers, and curriculum developers.

- First, teacher education curricula must be redesigned to incorporate courses related to Artificial Intelligence in education, digital pedagogy, and educational technology integration. Such courses should focus not only on theoretical understanding but also on practical applications of AI-based tools in classroom teaching.

- Second, teacher training programs should include hands-on workshops and training sessions that allow student-teachers to experiment with AI-powered educational tools such as intelligent tutoring systems, adaptive learning platforms, and AI-assisted lesson planning tools. Practical exposure will help future teachers develop confidence and competence in using these technologies effectively.

- Third, professional development programs and continuous training opportunities should be organized for both pre-service and in-service teachers. These programs can help educators stay updated with the latest technological developments and pedagogical innovations related to AI.

- Fourth, teacher education institutions should promote interdisciplinary collaboration between education departments, computer science departments, and technology experts. Such collaborations can help develop innovative educational solutions that integrate AI effectively into teaching practices.

- Fifth, ethical considerations related to AI usage must be emphasized in teacher education programs. Teachers should be trained to use AI responsibly while protecting students' privacy, ensuring fairness in algorithmic decision-making, and promoting inclusive learning environments.

Finally, policymakers should invest in improving digital infrastructure in educational institutions to support AI-based learning environments. Without adequate technological resources and institutional support, the effective integration of AI in education may remain limited. By addressing these issues, teacher education institutions can play a crucial role in preparing future teachers who are capable of utilizing AI technologies to enhance teaching quality, improve student engagement, and foster innovative learning experiences.

- Teacher education institutions should introduce AI literacy courses.
- Practical training in AI-based educational tools and digital pedagogy should be included in B.Ed. programs.
- Workshops and professional development programs should be organized to enhance teachers' technological competence.
- Ethical and responsible use of AI should be emphasized in teacher training.

Conclusion

The findings of the present study highlight several important aspects regarding the readiness of pre-service teachers to adopt AI-based pedagogical practices. The results indicate that a significant proportion of student-teachers possess moderate awareness of Artificial Intelligence in education. This suggests that although AI is widely discussed in academic and professional circles, many pre-service teachers still lack a comprehensive understanding of its practical applications in classroom teaching.The positive attitude of the majority of respondents toward AI integration reflects the growing acceptance of technology in education. Student-teachers appear to recognize the potential of AI in enhancing personalized learning, improving assessment practices, and supporting innovative instructional strategies. This positive perception indicates that future teachers are open to adopting new technologies in their teaching practices.

Artificial Intelligence is transforming education and creating a paradigm shift in teaching practices. Future teachers must be equipped with the knowledge, skills, and attitudes required to integrate AI effectively in classrooms. The findings of this study reveal that although pre-service teachers have positive attitudes toward AI, their preparedness and technical skills remain limited. Therefore, teacher education institutions must redesign their curricula to incorporate AI literacy, digital pedagogy, and technological competencies. Preparing future teachers for AI-enhanced education will help improve teaching quality, student engagement, and overall learning outcomes.

However, the results also reveal that only a small percentage of respondents feel well prepared to implement AI tools in teaching. This gap between awareness and preparedness indicates that teacher education programs have not yet fully incorporated practical training in AI-based pedagogical practices. Many pre-service teachers may be aware of AI conceptually but lack the technical skills and pedagogical strategies required to effectively integrate AI tools into classroom instruction. Another important issue highlighted by the findings is the need for structured training programs that focus on digital pedagogy and AI literacy. Without adequate training, teachers may find it difficult to utilize AI technologies effectively or may rely on them in superficial ways that do not significantly enhance learning outcomes.

Furthermore, ethical considerations related to AI usage, such as data privacy, algorithmic bias, and responsible technology use, must also be addressed in teacher education programs. Teachers must develop critical awareness regarding the ethical implications of AI-based educational technologies to ensure that they are used in ways that promote equity and inclusivity in education.Overall, the findings suggest that while future teachers demonstrate interest and positive attitudes toward AI integration, significant efforts are required to develop their technological competencies and pedagogical skills for AI-enhanced education.

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