

Integration of Artificial Intelligence in Teacher Education: Practices, Prospects and Alignment with NEP 2020

Suresh Gopichand Isave

Professor, Tilak College of Education, Pune-India

DOI: <https://dx.doi.org/10.51244/IJRSI.2026.130200128>

Received: 22 January 2026; Accepted: 03 February 2026; Published: 12 March 2026

ABSTRACT

Artificial Intelligence (AI) has emerged as a transformative technology influencing teaching, learning, assessment, and research in higher education. Teacher education, which prepares future teachers for dynamic classroom environments, must adapt to these technological advancements. This paper examines the integration of AI in teacher education programmes such as Diploma in Teacher Education (D.T.Ed.), Bachelor of Education (B.Ed.), and Master of Education (M.Ed.). Using a conceptual and review-based approach, the study discusses the application of AI in teaching–learning processes, micro-teaching skills, lesson planning, lesson observation, internship, evaluation tools, community-related activities, research, and presentation skills. The paper also reviews relevant literature to understand current trends and challenges in AI integration. Further, it aligns AI integration in teacher education with the vision and recommendations of the National Education Policy (NEP) 2020. The study concludes that ethical and pedagogically sound use of AI can enhance professional competencies of student-teachers and contribute to the preparation of future-ready teachers.

Keywords: Artificial Intelligence, Teacher Education, ICT Integration, NEP 2020, Pedagogical Innovation

INTRODUCTION

Teacher education is central to the quality and effectiveness of any education system. Teachers not only transmit knowledge but also shape learners' attitudes, values, and skills required for social and economic development. With rapid technological advancements, particularly in Information and Communication Technology (ICT), the role of teachers has expanded to include the integration of digital tools in teaching and learning processes. Artificial Intelligence (AI), as an advanced branch of ICT, offers innovative opportunities to enhance educational practices.

In India, teacher education programmes such as D.T.Ed., B.Ed., and M.Ed. aim to develop pedagogical competence, professional skills, reflective thinking, and research aptitude among prospective teachers. The National Education Policy (NEP) 2020 strongly emphasizes the integration of technology, digital literacy, and innovative pedagogical practices across all levels of education. In this context, AI can play a significant role in strengthening teacher education by supporting personalized learning, efficient assessment, reflective practice, and research-based teaching.

TEACHER EDUCATION AND THE SPREAD OF ICT

Teacher education institutions serve as key agents in the dissemination and effective use of ICT in schools and communities. Through pre-service and in-service programmes, teachers are trained to use digital tools, online resources, and technology-enabled pedagogical strategies. ICT integration in teacher education helps in bridging the gap between theory and practice, promoting learner-centred approaches, and enhancing professional efficiency.

With the emergence of AI, the scope of ICT in teacher education has expanded further. AI literacy, ethical use of technology, and critical understanding of intelligent systems have become essential components of teacher preparation. Teacher educators play a crucial role in modelling effective and responsible use of AI, thereby

influencing the future practices of student-teachers.

ARTIFICIAL INTELLIGENCE IN EDUCATION: CONCEPTUAL FRAMEWORK

Artificial Intelligence refers to computer systems capable of performing tasks that typically require human intelligence, such as learning, reasoning, problem-solving, and decision-making. In education, AI is applied through intelligent tutoring systems, adaptive learning platforms, chatbots, automated assessment tools, and learning analytics.

AI in education supports personalized learning, immediate feedback, data-driven decision-making, and automation of routine academic tasks. In teacher education, AI can function as a supportive tool that enhances pedagogical training, reflective practice, and research capabilities without replacing the human role of teachers.

REVIEW OF RELATED LITERATURE

Recent research highlights AI's growing influence on teaching practices and teacher professional development. Holmes, Bialik, and Fadel (2019) emphasized AI's role in personalized learning and formative assessment, while Luckin et al. (2016) conceptualized AI as a tool that augments teachers' professional capacities.

Studies published between 2022 and 2024 demonstrate a shift from experimental adoption to systematic integration of AI in teacher preparation. International research indicates that AI-supported lesson planning, analytics-based feedback, and virtual simulations enhance reflective practice and instructional decision-making. However, scholars caution against uncritical adoption and emphasize pedagogical intentionality.

In the Indian context, emerging empirical and conceptual studies focus on the interplay between AI, digital competence, and teacher education. Sahoo and Behera (2025) examined the role of AI in enhancing teacher competence in Indian classrooms using frameworks such as TPACK and DigCompEdu, noting that AI has the potential to support adaptive instruction and professional growth but is hindered by challenges such as limited infrastructure, lack of training, and ethical concerns related to bias and data privacy. Goyal (2025) explored opportunities and challenges of AI integration in teacher preparation, highlighting that Indian teacher educators need both practical skills and critical evaluation abilities to adopt AI meaningfully, and that current research mainly focuses on perceptions and competence rather than implementation strategies.

Additionally, Indian case studies and journal articles illustrate the breadth of AI-related issues in education. Khan (2025) investigated teacher readiness and student perceptions toward AI and ICT environments in Indian schools, showing that technological self-efficacy, pedagogical competence, and ethical awareness are critical foundations for successful digital pedagogy adoption, but that institutional support remains inconsistent across regions. Tripathi et al. (2025) examined the impact of AI adoption on teacher identity and autonomy, revealing that while AI tools can increase instructional efficiency, they also raise concerns about evolving professional roles and the potential loss of agency. Such studies point to the multifaceted nature of digital competence, encompassing not only technical skills but also critical understanding of AI's pedagogical and ethical implications.

Indian research on AI in education also appears in conceptual work that considers AI's role in personalised learning and systemic transformation. Kumar and Saksena (2025) described how AI can adapt instruction to individual learning needs and reduce teachers' administrative workload, but noted challenges related to equitable access and teacher preparation, aligning with broader regional concerns about digital divides. Other analyses emphasise how AI interventions in Indian schools reflect wider education policy priorities, including NEP 2020's emphasis on technology integration, inclusion, and 21st-century skills development, but warn that implementation gaps may limit impact unless accompanied by teacher training and infrastructure investment.

A notable addition to this literature is UNESCO's 2023 guidance on AI in education and research. UNESCO underscores the importance of ethical AI use, transparency, inclusivity, data privacy, and human agency. It stresses that teachers must be prepared not only to use AI tools but also to critically evaluate their pedagogical value, understand algorithmic decision-making, and mitigate bias in AI outputs. These guidelines highlight that AI integration in teacher education should be grounded in ethical principles, teacher autonomy, and equity, and

that educators play a central role in shaping how AI is used in classrooms globally.

Collectively, the literature indicates that while AI holds significant promise for enhancing teacher education, its effective and ethical integration depends on developing teacher digital competence, institutional structures that support ongoing learning, and critical engagement with AI's limitations. There is a clear research gap in large-scale empirical studies within India that examine how AI tools affect actual teaching behaviour, student outcomes, and long-term professional development, suggesting directions for future research.

INTEGRATION OF AI IN THE TEACHING–LEARNING PROCESS

The integration of Artificial Intelligence in the teaching–learning process has the potential to transform teacher education by promoting student-centred, personalized, and reflective learning. AI-enabled systems can adapt instructional content, learning pace, and feedback mechanisms according to individual learner needs, thereby supporting differentiated instruction. In teacher education, such personalization allows student-teachers to engage with complex theoretical concepts, pedagogical models, and subject content at their own pace, fostering deeper understanding and self-directed learning.

AI tools assist student-teachers in generating teaching–learning materials, visual resources, assessment items, and examples aligned with curricular objectives. Immediate feedback provided by AI-based systems supports formative learning by enabling student-teachers to identify conceptual gaps and refine their understanding. Comparative insights from international teacher-education practices indicate that adaptive learning platforms and AI-supported learning management systems enhance reflective learning when integrated with mentoring and collaborative discussion.

However, critical reflections reveal that excessive reliance on AI-mediated learning risks reducing intellectual engagement and pedagogical inquiry. AI systems tend to prioritize efficiency and pattern recognition, which may encourage surface-level learning if not guided by critical reflection. The limitations of AI tools become evident when they fail to capture the socio-cultural context of learning, particularly in multilingual and diverse Indian classrooms. AI-generated explanations may lack contextual relevance or oversimplify complex pedagogical issues.

Teacher-training institutions in India face practical challenges such as limited access to adaptive platforms, inconsistent digital infrastructure, and insufficient faculty preparedness to integrate AI meaningfully into teaching–learning processes. Moreover, ethical concerns related to data privacy, learner profiling, and algorithmic bias require careful institutional regulation. Therefore, AI should function as a pedagogical support system rather than a substitute for human interaction, dialogue, and professional judgement.

AI IN MICRO-TEACHING AND LESSON PLANNING

Micro-teaching is a foundational component of teacher education, designed to develop specific teaching skills such as questioning, explanation, reinforcement, classroom management, and communication. AI-enabled video analysis tools and simulated teaching environments offer new possibilities for enhancing this process by providing structured, objective, and data-driven feedback on teaching performance. These tools can analyse parameters such as voice modulation, teacher talk time, student engagement cues, and interaction patterns.

Comparative insights from international teacher-education systems suggest that AI-supported micro-teaching can strengthen reflective practice when combined with peer discussion and mentor guidance. Automated feedback allows student-teachers to review their performance multiple times, fostering self-evaluation and professional growth. However, critical reflections caution against treating AI feedback as definitive. Teaching performance involves emotional intelligence, spontaneity, and contextual responsiveness—dimensions that AI systems struggle to interpret.

AI also plays a growing role in lesson planning by generating structured lesson plans aligned with learning objectives, Bloom's taxonomy, pedagogical strategies, and assessment techniques. This supports student-teachers in developing systematic, outcome-based lesson plans and understanding curricular alignment. At the same time, limitations of AI-generated lesson plans include lack of contextual adaptation, cultural sensitivity,

and responsiveness to classroom diversity. Over-dependence on automated planning may restrict creativity and pedagogical autonomy.

Practical challenges in Indian teacher-training institutions include limited availability of AI-enabled micro-teaching laboratories, lack of faculty training to interpret AI analytics, and concerns related to data storage and consent during video-based analysis. Ethical issues such as surveillance, performance anxiety, and standardization of teaching practices must be addressed through institutional guidelines.

Effective integration of AI in micro-teaching and lesson planning requires a balanced approach that combines technological support with human mentoring, reflective dialogue, and ethical governance. When used critically and contextually, AI can enhance skill development while preserving the professional agency of future teachers.

AI IN LESSON OBSERVATION, INTERNSHIP, AND EVALUATION

Lesson observation, teaching internship, and evaluation constitute the most practice-oriented components of teacher education, where theoretical understanding is translated into real classroom performance. The integration of Artificial Intelligence in this phase offers significant potential for enhancing reflective practice, objectivity, and consistency; however, it also raises important pedagogical and ethical concerns that demand critical examination.

AI-enabled tools such as video-based classroom analytics, automated observation schedules, digital teaching portfolios, and performance dashboards can support systematic observation of teaching behaviours. These tools can analyse aspects such as teacher talk time, questioning patterns, student engagement indicators, and use of teaching aids. Comparative insights from international teacher-education systems suggest that AI-supported feedback, when combined with mentoring, can accelerate skill development and reflective teaching practices.

Despite these advantages, critical reflections highlight the risk of over-standardization of teaching. Teaching is a dynamic, context-sensitive, and relational activity influenced by classroom culture, learner diversity, and situational judgement. AI tools rely on predefined indicators and measurable behaviours, which may fail to capture emotional intelligence, spontaneity, creativity, and culturally responsive pedagogy. Excessive dependence on AI-generated feedback may encourage conformity to algorithmic norms rather than nurturing reflective and adaptive teachers.

Limitations of AI tools are particularly evident in evaluation processes. Many systems are unable to account for multilingual classrooms, inclusive teaching practices, or socio-emotional dimensions of learning that are central to Indian school contexts. Moreover, algorithmic bias and lack of transparency raise concerns about fairness and reliability of AI-assisted evaluations.

Teacher-training institutions in India face practical challenges such as limited access to AI-enabled observation platforms, inadequate digital infrastructure, lack of trained faculty to interpret analytics, and ethical issues related to video recording, data storage, consent, and privacy during internships. In this context, AI should be used strictly as a supportive and reflective tool, with final evaluative judgement resting with teacher educators.

AI IN COMMUNITY WORK, RESEARCH, AND PRESENTATION SKILLS

Community engagement, research work, and academic presentations are essential components of teacher education aimed at developing social awareness, inquiry skills, and professional communication. AI tools can enhance efficiency and accuracy in these areas by supporting survey design, data analysis, literature review, reference management, report writing, and presentation development.

Comparative insights from global higher-education practices indicate that AI-assisted research tools help novice researchers overcome technical barriers, allowing greater focus on conceptual understanding and interpretation. AI-based presentation tools also support student-teachers in organizing content, improving visual design, and refining academic language, thereby enhancing confidence and professional competence.

However, critical reflections reveal significant risks associated with unregulated use of AI. Over-reliance on AI-generated text, analysis, or visuals may weaken critical thinking, originality, and academic writing skills. There is a growing concern that AI may promote surface-level engagement with research, encouraging reproduction rather than interpretation of knowledge.

Limitations of AI tools are evident in their lack of contextual sensitivity. AI-generated outputs often remain generic and may not adequately reflect local community realities, socio-cultural diversity, or region-specific educational issues. Additionally, AI tools may unintentionally reproduce biases present in training data, affecting research integrity.

Practical challenges in Indian teacher-training institutions include uneven digital access, limited availability of licensed research tools, inadequate training in ethical AI use, and absence of institutional guidelines defining acceptable use of AI in academic work. To address these issues, AI integration in research and community work must be guided by strong ethical frameworks, plagiarism awareness, and continuous human supervision.

ALIGNMENT OF AI INTEGRATION WITH NEP 2020

The National Education Policy (NEP) 2020 emphasizes the strategic use of technology to enhance educational quality, equity, and access. Integrating AI into teacher education aligns closely with this vision, particularly in relation to digital infrastructure, innovation, and teacher professional development. However, effective alignment requires moving beyond policy intent to critical implementation analysis.

NEP 2020's National Digital Education Architecture (NDEAR) aims to create interoperable, learner-centric digital ecosystems. AI-enabled tools for lesson planning, assessment, digital portfolios, and learning analytics directly support this goal. Teacher education institutions play a crucial role in operationalizing NDEAR by preparing teachers capable of using, adapting, and critically evaluating AI-based systems.

The establishment of the National Educational Technology Forum (NETF) reflects NEP 2020's emphasis on evidence-based adoption of emerging technologies. Comparative insights from countries with centralized educational technology advisory bodies suggest that structured guidance leads to more ethical and coherent technology integration. AI practices within teacher education can generate valuable practice-based evidence to inform NETF's policy recommendations.

Despite strong policy alignment, critical challenges remain. Many teacher-training institutions lack the infrastructure, funding, and institutional autonomy required to adopt AI tools aligned with national platforms. The gap between policy vision and ground-level realities highlights the need for coordinated implementation strategies, capacity building, and sustained support. Thus, AI integration must be viewed as a systemic reform aligned with NEP 2020's broader goals of equity, inclusion, and lifelong teacher development.

CRITICAL ANALYSIS, LIMITATIONS, AND PRACTICAL CHALLENGES

A comprehensive critical analysis of AI integration in teacher education reveals that technological adoption is not merely a technical intervention but a deeply pedagogical, ethical, and institutional process. While AI promises personalization, efficiency, and data-driven insights, uncritical adoption risks promoting techno-determinism, where technology is perceived as a solution to complex educational challenges.

One major limitation of AI tools is algorithmic bias and lack of contextual adaptability. Most AI systems are developed using datasets rooted in Western, English-dominant educational contexts. When applied in Indian teacher-training institutions characterized by multilingualism, socio-economic diversity, and varied school cultures, AI-generated recommendations may appear culturally misaligned or pedagogically superficial.

Another significant limitation relates to transparency and explainability. Many AI tools function as "black boxes," offering outputs without clarity regarding underlying processes. For teacher education, where reflective thinking and professional judgement are core objectives, such opacity can undermine learning by discouraging critical engagement with feedback.

Practical challenges within teacher-training institutions include inadequate digital infrastructure, inconsistent internet connectivity, high costs of AI tools, limited technical support, and insufficient faculty preparedness. Resistance to change, fear of professional displacement, and uncertainty regarding ethical boundaries further hinder adoption.

Ethical issues such as data privacy, informed consent, surveillance, authorship, and academic integrity are particularly relevant in AI-supported observation, evaluation, and research. In the absence of clear institutional policies and regulatory frameworks, misuse of AI becomes a significant risk.

Addressing these challenges requires phased implementation, curriculum redesign incorporating AI literacy and ethics, continuous professional development for teacher educators, and institutional AI governance aligned with NEP 2020 and UNESCO 2023 guidelines. Ultimately, AI should function as an assistive and reflective tool that strengthens teacher professionalism rather than diminishing it, ensuring a balanced, human-centred, and context-sensitive approach to teacher education.

CONTRIBUTION OF THE STUDY

This paper makes four significant contributions to the field of teacher education. First, it provides a programme-specific analysis of AI integration across Indian teacher-education programmes (D.T.Ed., B.Ed., and M.Ed.), an area insufficiently addressed in existing literature. Second, it explicitly links classroom-level AI practices with national policy initiatives such as the National Digital Education Architecture (NDEAR) and the National Educational Technology Forum (NETF), thereby strengthening policy–practice coherence. Third, the study moves beyond descriptive accounts by critically examining ethical concerns, institutional constraints, and pedagogical limitations of AI adoption in teacher-training institutions. Finally, by synthesizing recent international research, Indian studies on teacher digital competence, and UNESCO’s 2023 ethical AI framework, the paper offers a contextualized and policy-aligned framework for responsible AI integration in teacher education.

CONCLUSION

The integration of Artificial Intelligence in teacher education has significant potential to enhance pedagogical practices, professional competencies, and research capabilities of student-teachers. When aligned with the vision of NEP 2020 and used ethically, AI can serve as a powerful supportive tool in preparing future-ready teachers for a rapidly evolving educational landscape.

REFERENCES

1. Government of India. (2020). *National Education Policy 2020*. Ministry of Education. https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
2. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.
3. Kaur, P., & Kaur, A. (2021). Artificial intelligence in teacher education: Opportunities and challenges. *International Journal of Educational Technology*, 8(2), 45–53.
4. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence unleashed: An argument for AI in education*. Pearson Education.
5. Sahoo, S., & Behera, S. K. (2023). Artificial intelligence in Indian education: Implications for teacher competence and digital pedagogy. *International Journal of Educational Research and Innovation*, 19, 112–125.
6. Singh, R., & Sharma, S. (2022). Digital competence of student teachers in the age of artificial intelligence. *Journal of Teacher Education and Research*, 17(1), 67–75. <https://doi.org/10.36268/JTER/17107>
7. Tripathi, R., Verma, P., & Mishra, S. (2023). Artificial intelligence and teacher professionalism: Emerging challenges and opportunities in Indian education. *i-manager’s Journal on Educational Technology*, 20(2), 1–10.
8. UNESCO. (2021). *Artificial intelligence and education: Guidance for policy-makers*. UNESCO

Publishing.

9. UNESCO. (2023). *Guidance for generative AI in education and research*. UNESCO Publishing.
<https://www.unesco.org/en/articles/guidance-generative-ai-education-and-research>