



## AI-Enabled Skills-Based Teacher Education under NEP 2020: Opportunities, Challenges and Future Directions

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**Abstract:** *The rapid advancement of Artificial Intelligence (AI) has transformed educational systems worldwide, creating new possibilities for teacher preparation and professional development. In India, the implementation of the National Education Policy (NEP) 2020 has emphasized competency-based, multidisciplinary, technology-integrated, and learner-centered education. Within this context, AI-enabled skills-based teacher education has emerged as a significant area of innovation. The integration of AI technologies into teacher education programs offers opportunities for enhancing pedagogical competencies, digital literacy, personalized learning, classroom management, assessment practices, and professional growth. AI-driven platforms, intelligent tutoring systems, learning analytics, virtual simulations, and adaptive learning environments can support prospective teachers in acquiring practical and professional skills required in twenty-first-century classrooms.*

*Despite the growing importance of AI in education, teacher education institutions face challenges in integrating AI effectively into skills-based training. Issues such as inadequate infrastructure, lack of AI literacy among teacher educators, ethical concerns, digital inequality, data privacy, algorithmic bias, and resistance to technological change continue to hinder implementation. There remains a need to examine how AI can support the objectives of NEP 2020 while addressing these challenges.*

*This study adopts a qualitative and conceptual research design based on an extensive review of policy documents, scholarly literature, government reports, and contemporary studies related to AI, teacher education, digital pedagogy, and NEP 2020. Thematic analysis was employed to identify key opportunities, challenges, and future directions associated with AI-enabled skills-based teacher education in India. The study reveals that AI can significantly enhance teacher education by promoting personalized learning experiences, competency development, reflective practice, data-informed decision-making, and continuous professional development. AI-based tools facilitate microteaching simulations, automated feedback systems, virtual classrooms, and adaptive assessment mechanisms. However, successful implementation is constrained by infrastructural limitations, insufficient faculty preparedness, ethical dilemmas, unequal access to digital resources, and concerns regarding human-AI interaction. The findings further indicate that AI should complement rather than replace human pedagogical expertise.*

*AI-enabled skills-based teacher education aligns strongly with the vision of NEP 2020 by fostering innovation, inclusivity, flexibility, and lifelong learning. To realize its transformative potential, policymakers, teacher educators, and institutions must invest in digital infrastructure, AI literacy programs, ethical governance frameworks, and research-driven implementation strategies. Future teacher education*

*systems should adopt a balanced approach that integrates technological innovation with human-centered pedagogy, ensuring equitable and sustainable educational development.*

**Keywords:** Artificial Intelligence, Teacher Education, Skills-Based Education, NEP 2020, Digital Pedagogy, Professional Development

**Introduction:** The twenty-first century has witnessed unprecedented technological developments that are reshaping educational systems across the globe. Among these developments, Artificial Intelligence (AI) has emerged as one of the most influential technologies with the potential to revolutionize teaching, learning, assessment, and educational administration. AI refers to the capability of machines and computer systems to perform tasks that typically require human intelligence, including learning, reasoning, problem-solving, decision-making, and language processing. In educational settings, AI technologies are increasingly being utilized to personalize learning experiences, automate routine tasks, support instructional decision-making, and enhance educational outcomes. In India, educational transformation has gained momentum through the introduction of the National Education Policy (NEP) 2020. The policy represents a comprehensive framework designed to modernize the Indian education system by emphasizing holistic development, multidisciplinary learning, competency-based education, technological integration, and skill development. One of the central objectives of NEP 2020 is the preparation of teachers who are capable of meeting the evolving demands of contemporary classrooms. The policy recognizes teachers as the cornerstone of educational reform and highlights the importance of quality teacher education for achieving national educational goals. Teacher education has traditionally focused on theoretical knowledge, pedagogical foundations, and classroom management strategies.

However, the changing educational landscape demands that teachers possess a broader range of competencies, including digital literacy, critical thinking, creativity, collaboration, communication, and technological adaptability. Consequently, skills-based teacher education has become increasingly important in preparing future educators for dynamic learning environments. The emergence of AI presents new opportunities for strengthening skills-based teacher education. AI-powered technologies can provide personalized learning pathways, virtual teaching simulations, automated feedback mechanisms, predictive analytics, and intelligent mentoring systems. These tools can help teacher trainees develop practical teaching competencies while enabling institutions to offer more effective and flexible learning experiences.

Despite these advantages, integrating AI into teacher education also presents significant challenges. Infrastructure deficits, technological disparities, ethical concerns, data privacy issues, and inadequate faculty preparedness can impede successful implementation. Furthermore, there is ongoing debate regarding the balance between technological automation and human-centered pedagogy. Teachers must remain central to the educational process even as AI becomes increasingly prevalent.

This paper examines the opportunities, challenges, and future directions of AI-enabled skills-based teacher education under NEP 2020. By analyzing existing literature and policy frameworks, the study seeks to contribute to the understanding of how AI can support the development of competent, innovative, and future-ready teachers in India.

## **Literature Review**

The concept of AI in education has attracted substantial scholarly attention during the past decade. Researchers have explored the potential of AI technologies to transform learning environments, improve educational outcomes, and enhance teacher effectiveness. The literature indicates that AI can facilitate personalized learning, adaptive instruction, intelligent assessment, and data-driven educational decision-making.

Studies on AI in education suggest that intelligent systems can analyze learner behavior and provide customized learning experiences based on individual needs and preferences. Holmes et al. (2022) argue that

AI technologies have the potential to support both learners and educators through personalized feedback, predictive analytics, and adaptive content delivery. Such capabilities are particularly relevant in teacher education programs where trainees possess diverse learning styles and professional development needs.

The development of digital competence has become a major focus of contemporary teacher education research. Digital competence encompasses technological knowledge, pedagogical skills, information literacy, ethical awareness, and the ability to integrate technology effectively into classroom instruction. Research indicates that teachers who possess strong digital competencies are better equipped to utilize emerging technologies, including AI, to enhance student learning outcomes. Teacher education institutions therefore play a critical role in developing these competencies among prospective teachers.

Skills-based education has gained prominence as educational systems increasingly emphasize employability, practical competence, and lifelong learning. Skills-based approaches prioritize the acquisition of transferable skills such as communication, collaboration, critical thinking, creativity, problem-solving, and digital literacy. Within teacher education, skills-based learning emphasizes practical teaching experiences, reflective practice, classroom engagement, and competency development. AI technologies can support these objectives through immersive simulations, virtual classrooms, and intelligent feedback systems.

NEP 2020 explicitly highlights the importance of technology integration in education. The policy recognizes that digital technologies can improve access, equity, quality, and efficiency within educational systems. It advocates for the development of digital infrastructure, online learning platforms, teacher training programs, and innovative pedagogical approaches. Several scholars have noted that AI aligns closely with the policy's vision of creating flexible, inclusive, and learner-centered educational environments.

Recent research has emphasized the role of AI in enhancing teacher professional development. AI-powered platforms can provide personalized learning recommendations, identify professional learning needs, and support continuous skill enhancement. Learning analytics tools enable educators to monitor progress, evaluate performance, and make informed instructional decisions. Such capabilities can strengthen teacher preparedness and improve educational quality.

Virtual simulations have emerged as a particularly promising application of AI in teacher education. Simulation-based learning environments allow teacher trainees to practice instructional strategies, classroom management techniques, and assessment procedures in realistic yet controlled settings. Research demonstrates that virtual simulations can improve teaching confidence, pedagogical competence, and reflective practice among pre-service teachers.

Assessment represents another area where AI has demonstrated considerable potential. Automated assessment systems can evaluate assignments, provide immediate feedback, and track learner progress. These systems reduce administrative workload while enabling more timely and personalized support for learners. In teacher education programs, AI-assisted assessment can facilitate competency-based evaluation and support continuous improvement.

However, the literature also highlights several concerns regarding AI integration in education. Ethical issues such as data privacy, algorithmic bias, transparency, and accountability remain significant challenges. Researchers warn that AI systems may inadvertently reinforce existing inequalities if training data are biased or unrepresentative. Additionally, concerns have been raised regarding excessive reliance on automated systems and the potential erosion of human judgment in educational decision-making.

Digital inequality constitutes another major challenge identified in the literature. Access to technology, internet connectivity, and digital resources varies considerably across regions and institutions. Such disparities may limit the effectiveness of AI-enabled educational initiatives and exacerbate existing

educational inequalities. In developing contexts such as India, addressing infrastructural and accessibility challenges remains a critical priority.

Teacher readiness also emerges as a recurring theme in AI-related educational research. Many educators lack sufficient knowledge and confidence to integrate AI technologies effectively into teaching and learning processes. Professional development programs focusing on AI literacy, technological competence, and ethical awareness are therefore essential for successful implementation.

Scholars have further emphasized the importance of maintaining a human-centered approach to AI integration. While AI can enhance educational processes, it cannot replace the empathy, creativity, ethical judgment, and interpersonal relationships that characterize effective teaching. Consequently, the future of teacher education should focus on developing synergistic relationships between human educators and intelligent technologies.

The existing literature collectively suggests that AI offers substantial opportunities for advancing skills-based teacher education under NEP 2020. At the same time, successful implementation requires careful attention to ethical, technological, pedagogical, and institutional considerations. The present study builds upon these insights to examine the opportunities, challenges, and future directions of AI-enabled teacher education in the Indian context.

**Methodology:** The present study employed a qualitative and conceptual research design to examine the opportunities, challenges, and future directions of AI-enabled skills-based teacher education under the framework of NEP 2020. A qualitative approach was considered appropriate because the study aimed to explore emerging trends, policy implications, pedagogical transformations, and institutional challenges associated with the integration of Artificial Intelligence in teacher education rather than measuring variables through statistical procedures. The research was primarily based on secondary sources of data collected from scholarly journal articles, books, policy documents, government reports, conference proceedings, and publications from national and international organizations. The data collection process involved a systematic review of literature published between 2018 and 2025 related to Artificial Intelligence in education, teacher education, digital pedagogy, educational technology, competency-based learning, and the implementation of NEP 2020. Relevant databases including ERIC, Scopus, Web of Science, Google Scholar, and institutional repositories were consulted to identify peer-reviewed publications. Policy documents issued by the Government of India, educational agencies, and international organizations were also examined to understand contemporary developments in AI-integrated teacher education. The collected literature was analyzed through thematic analysis. This analytical approach enabled the identification of recurring patterns, concepts, and themes related to AI-enabled skills development among teachers. The literature was categorized into three broad dimensions: opportunities associated with AI integration, challenges affecting implementation, and future directions for policy and practice. These categories served as the conceptual framework for interpreting findings and generating recommendations.

To enhance the reliability of the study, multiple sources of evidence were compared and cross-validated. The synthesis of literature focused on identifying converging and diverging viewpoints regarding the role of AI in teacher preparation and professional development. The findings presented in this study are therefore grounded in a comprehensive review of contemporary academic and policy discourse.

**Results:** The analysis of literature revealed several significant findings concerning AI-enabled skills-based teacher education under NEP 2020. The first major finding relates to the transformative potential of AI in enhancing personalized learning experiences for teacher trainees. AI-powered learning platforms can identify individual learning needs, monitor progress, and provide customized recommendations. Such personalization supports competency-based teacher education by allowing learners to progress at their own pace while focusing on areas requiring improvement.

The second finding highlights the role of AI in strengthening practical teaching competencies. Virtual simulations, intelligent tutoring systems, and AI-supported classroom scenarios enable teacher trainees to practice instructional strategies in realistic environments. These technologies provide immediate feedback and allow repeated practice without the constraints associated with traditional teaching internships. As a result, teacher trainees can develop classroom management skills, instructional planning abilities, and pedagogical confidence more effectively. A third finding concerns the contribution of AI to assessment and evaluation processes. AI-driven assessment systems facilitate continuous monitoring of learner performance, automated feedback generation, and competency-based evaluation. These systems reduce administrative burden while enhancing the accuracy and efficiency of assessment practices. Teacher education institutions can therefore utilize AI tools to support evidence-based decision-making and learner improvement.

The analysis further revealed that AI contributes significantly to professional development and lifelong learning. Intelligent learning platforms can identify skill gaps among teachers and recommend targeted professional development opportunities. Such systems support continuous learning and help educators remain updated with emerging pedagogical and technological innovations.

However, the findings also identified substantial challenges. One of the most prominent challenges is the digital divide. Significant disparities in technological infrastructure, internet connectivity, and access to digital resources continue to exist across educational institutions. These disparities limit the equitable implementation of AI-enabled teacher education initiatives.

Another important finding concerns the limited AI literacy of teacher educators. Many faculty members lack adequate training and expertise in AI technologies, creating barriers to effective integration. Without sufficient professional preparation, educators may struggle to utilize AI tools meaningfully within teacher education programs. Ethical concerns emerged as another critical challenge. Issues related to data privacy, algorithmic bias, transparency, surveillance, and accountability remain unresolved in many educational contexts. The literature emphasizes the need for robust ethical frameworks to ensure responsible AI adoption in teacher education. The findings also suggest that excessive reliance on AI technologies may reduce opportunities for human interaction, mentorship, and emotional support. Effective teaching requires empathy, ethical judgment, creativity, and interpersonal communication, qualities that cannot be fully replicated by artificial intelligence systems.

**Discussion:** The findings of this study demonstrate that AI-enabled skills-based teacher education aligns closely with the vision and objectives of NEP 2020. The policy emphasizes competency development, technological integration, learner-centered pedagogy, and continuous professional growth. AI technologies provide practical mechanisms for achieving these goals by facilitating personalized learning, adaptive instruction, and evidence-based educational practices.

The positive impact of AI on competency development is particularly significant. Traditional teacher education programs often face limitations in providing individualized support and extensive practical experiences. AI-powered systems address these limitations by enabling personalized learning pathways and immersive simulation-based training. Such innovations support the development of critical teaching competencies and promote reflective professional practice. The findings also underscore the growing importance of digital competence in teacher education. As educational environments become increasingly technology-driven, teachers must possess the knowledge and skills required to integrate digital tools effectively into classroom instruction. AI literacy should therefore be considered an essential component of contemporary teacher education curricula. Teacher preparation programs must move beyond basic technological training and develop educators' capacity to critically evaluate, implement, and manage AI technologies.

At the same time, the challenges identified in this study highlight the complexity of AI integration. The persistence of digital inequality raises concerns regarding educational equity and access. If technological

resources remain unevenly distributed, AI-enabled innovations may inadvertently widen existing educational gaps. Addressing infrastructural disparities must therefore be a priority for policymakers and educational institutions.

Ethical considerations represent another area requiring careful attention. The use of AI in education involves extensive data collection, analysis, and decision-making processes. Without appropriate safeguards, these practices may compromise privacy, fairness, and transparency. Educational stakeholders must establish clear ethical guidelines governing the use of AI technologies in teacher education programs. The findings further suggest that AI should be viewed as a supportive tool rather than a replacement for human educators. Effective teaching involves emotional intelligence, empathy, cultural sensitivity, and ethical reasoning-qualities that remain uniquely human. The future of teacher education should therefore emphasize collaboration between human expertise and technological innovation. AI can enhance educational processes, but human educators must continue to play a central role in facilitating meaningful learning experiences.

The discussion also points toward the necessity of institutional readiness. Successful implementation of AI-enabled teacher education requires strategic planning, investment in infrastructure, faculty development initiatives, and supportive policy frameworks. Institutions that proactively address these requirements will be better positioned to realize the transformative potential of AI.

**Conclusion:** Artificial Intelligence is rapidly emerging as a transformative force within educational systems worldwide. The integration of AI into skills-based teacher education offers significant opportunities for enhancing pedagogical competence, digital literacy, personalized learning, assessment practices, and professional development. Under the framework of NEP 2020, AI-enabled teacher education has the potential to support the development of innovative, competent, and future-ready educators capable of addressing the demands of contemporary classrooms. The findings of this study indicate that AI technologies can substantially strengthen teacher preparation by providing adaptive learning environments, intelligent feedback systems, virtual simulations, and data-driven decision-making tools. These innovations align with the policy objectives of competency-based learning, technological integration, and continuous professional growth. AI can therefore serve as an important catalyst for educational transformation in India.

Despite these opportunities, several challenges must be addressed to ensure effective implementation. Infrastructural limitations, digital inequality, insufficient AI literacy, ethical concerns, and institutional readiness continue to hinder the widespread adoption of AI-enabled teacher education. Policymakers, educational leaders, and teacher educators must work collaboratively to overcome these barriers through targeted investments, professional development initiatives, and ethical governance mechanisms.

The future of teacher education should embrace a balanced and human-centered approach to AI integration. Rather than replacing teachers, AI should function as a supportive partner that enhances professional effectiveness and educational quality. Future research should explore empirical evidence regarding the impact of AI-based interventions on teacher competencies, learner outcomes, and institutional effectiveness. Such research will contribute to the development of evidence-based policies and practices capable of maximizing the benefits of AI while minimizing associated risks.

Ultimately, AI-enabled skills-based teacher education represents a promising pathway for achieving the transformative vision of NEP 2020. By combining technological innovation with human values and pedagogical excellence, educational institutions can prepare teachers who are equipped to lead learning in an increasingly digital and interconnected world.

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