Artificial Intelligence And The Future Of Teacher Education In India: Opportunities, Challenges, And Strategic Imperatives.

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Abstract:

This detailed research article explores how Teacher Education and AI work together to change the way education is implemented in India and to show how AI can be effectively implemented to address India's critical structural issues, particularly the growing crisis of teacher shortages [7][8] and the ambitious education reforms called for by the National Education Policy 2020. This research article compiles and summarizes recent empirical evidence from multiple sources, including national surveys and government studies, to chart the increasing but inconsistent rate of AI adoption in Indian Higher Education Institutions (HEIs) and K-12 schools, where AI is rapidly being integrated into students' and teachers' daily lives [4]. In addition, results show that while more than 50 percent of Indian HEIs have adopted AI policies at the institutional level [8], the process of integrating AI has presented numerous difficulties, such as long-standing technology and infrastructure barriers [7], ethical considerations related to data use and algorithmic bias [9], and a significant lag in comprehensive teacher training and professional development [3][4]. Utilizing UTAUT, the paper states that the success of integrating AI into teacher training in India is contingent on implementing an integrated approach, rather than simply putting the technology into place. The integrated approach must provide student learning solutions that take into account the local context and vernacular language, employ ethical capabilities through technology literacy at all levels, and create an effective and comprehensive policy framework that supports India's social and economic realities as well as its vision to prepare a future workforce. The paper finishes with actions based on evidence and suggestions regarding the creation of a multi-participant approach to leveraging artificial intelligence for supporting and creating equal, resilient and prepared teacher populations in India.

Keywords: AI, teacher education, NEP 2020, India, teacher shortages, AI ethics, personalized learning, digital divide, UTAUT model.

1.Introduction: The Indian education system is at a pivotal moment - a time of change and challenges due to the past constraints and the future promises of advanced technologies. On one hand, there is a teacher shortage, as states such as Bihar, Karnataka and Rajasthan continue to experience tens of thousands of teacher vacancies creating pupil/teacher ratios that routinely exceed forty students to one teacher, which is significantly higher than the thirty students to one teacher that is prescribed by the NEP 2020 [2][8]. At the same time, approximately fifty-seven percent of schools have access to working computer labs and there is also a continuing gap in literacy rates between women (69.4%) compared to men (84.7%) [8].

Artificial Intelligence (AI) will be a game changer in the near future. As identified by many, 2025 is going to see AI evolve from a project to something we can't avoid and something we use every day in all aspects of our academic lives at Canadian Colleges and Universities [1].top-down policy intervention will have an enormous impact on this transition, particularly as we see significant changes that have originated from the National Educators Association of Canada (NEP 2020) and the NEP decision to implement AI and computational thinking into our Grade 3 curriculum, starting with the 2026/27 academic year [5].As of May 2022, more than 56 per cent of Indian Higher Education Institutions (HEIs) currently have developed University/College specific AI policies, and 60 per cent have allowed students to use generative AI tools [7].

The current study will further develop the argument that systemic constraints and disruptive technology will shape the future of teacher training programmes in India. More specifically, this article addresses the question, how do we use AI technology in a socially just and productive way for teachers in India? It is necessary to move beyond thinking of AI simply as a means of enhancing productivity, and instead see it as an agent of systemic change—a way to close the teacher gap, to transition from an emphasis on rote learning to competency-based education, and to create individualized pathways for all learners in India. This article presents a thorough examination of these trends, including underlying conceptual frameworks surrounding the development and use of AI technology in teacher training, current rates of adoption, identified opportunities and challenges associated with implementation, and strategic policy considerations for placing AI technology at the core of teacher education.

2. Conceptual and Theoretical Framework:

It is important to understand how AI will impact Indian Teacher Education Systems, which requires investigating both the overarching technological and sociocultural contexts that influence the use of technology across the globe as well as how this impacts the specific educational ecosystem within India. In this regard, the Unified Theory of Acceptance and Use of Technology (UTAUT) offer us an excellent model for analysing the many factors that influence a teacher's decision to adopt AI technology. UTAUT has been applied in prior research concerning the adoption of AI by Indian Teachers as demonstrated in Previous India-specific research that applies UTAUT has shown that teachers who perceive that AI will positively impact their teaching by increasing their productivity (performance expectancy) and ease of use (effort expectancy) are likely to have higher behavioural intentions to adopt AI in their classrooms [4]. This supports the notion that for successful integration of AI into classrooms, it is necessary to provide evidence of how, in these specific contexts, AI can improve classroom operations and make it easier for teachers to use in their classrooms.

In order to implement this model within the context of India, we must recognise and account for several important contextual layers, including the overarching framework as established by the National Education Policy (NEP) of 2020. The NEP promotes an inclusive approach to teaching and learning through inquiry-based methods that integrate a multidisciplinary focus. This aligns well with the capabilities offered by AI

to support differentiated and personalised styles of learning. Additionally, AI-based systems are treating as facilitators to support the goal of continuous assessment and foundational literacy and providing a pathway to competency-based education (CBE).

The second principle focuses on providing equitable and linguistically inclusive access to education. What works in an English-medium urban institution may not be effective for a rural Marathi-medium school. The success of projects such as 'Hack the Classroom', which is an AI-based tool designed specifically for use by teachers in rural public schools and built in the Marathi language, illustrates that the effectiveness of any innovative program is related to the ability of that program to resonate both linguistically and culturally with users [6]. Thus, the contextual factors associated with a school must take precedence over the use of pre-existing or 'imported' solutions when designing new ways to improve learning outcomes.

The Third imperative requires that AI be developed and used ethically and responsibly. As AI becomes widespread throughout all aspects of Education, ethical frameworks for AI such as those developed by UNESCO will be increasingly important. There are some unique challenges that India must face when it comes to implementing ethical frameworks, including addressing the issue of algorithmic bias based on different languages/dialects, socio-economic class, etc., ensuring that teachers have the tools they need to teach students how to use generative AI responsibly (to avoid copying/plagiarism), and ensuring sufficient data privacy in a rapidly accumulating digital environment where laws governing digital data still lag behind technology development.

Table 1: Conceptual Framework for AI in Indian Teacher Education

Conceptual Foundation	Core Concepts	Indian Contextualization
Technology Acceptance (UTAUT)	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions [4].	Determines teacher willingness to adopt AI; highlights need for relevant, easy-to-use tools and institutional support.
Policy Vision (NEP 2020)	Holistic education, Competency-based learning, Multidisciplinary approach, Foundational skills.	AI as an enabler for policy goals; tools must align with shifting pedagogical aims, not just automate old methods.
Social & Linguistic Context	Equity, Digital Divide, Multilingualism, Rural-Urban disparity [6][8].	Mandates development of vernacular AI tools and strategies for resource-constrained settings.
Ethical Governance	Fairness, Accountability, Transparency, Privacy [9].	Requires curriculum on AI ethics for teachers, robust data policies, and bias audits for algorithms used in Indian classrooms.

This multi-layered framework guides our analysis, insisting that the technological, pedagogical, social, and ethical dimensions must be addressed concurrently for sustainable and equitable integration.

3. Review of Related Literature:

The literature on AI in Indian education reveals a landscape of vigorous policy ambition and rapidly evolving, yet uneven, ground-level adoption. The discourse is broadly divided between macro-level policy analyses and emerging micro-level studies on adoption and impact.

At the policy level & global level of adoption, the prevailing outcome is one of increased assimilation. A report by EY-Parthenon & FICCI provides an important snapshot indicating nearly half (53%) of respondents have institutions of higher education using generative artificial intelligence (AI) to develop learning materials, with 40% utilizing AI-enabled tutoring software as well.[7] Institutional usage is reflected by widespread usage among students in using AI to assist in doing their homework, revising, & obtaining research assistance. Additionally, the government has made a concerted effort to create an official AI curriculum for Grades 3 through 12 in order to foster national AI literacy and prepare the future workforce for the challenges ahead. [5] Various commentaries have connected these events with overarching economic agendas such as "Viksit Bharat 2047" as well as the potential job displacement created by an increase in job displacements, potentially due to the automation of AI related operations and processes.

There is an emerging body of academic literature that examines the relationship between the crisis of teacher shortage and the rise of interest in AI. The most dramatic illustrations of the problem include recent reports documenting the paradox of increased literacy rates coupled with a decline in the number of available teachers due to a crisis of teacher vacancies in central systems like Kendriya Vidyalayas and widespread use of unqualified contractual teachers. The education literature presents AI as a "tool" that can help ease the burden of many responsibilities placed upon teachers rather than a competitor. For instance, several studies document multiple applications of AI that can relieve teachers of time-consuming responsibilities such as grading, tracking attendance, and analysing data so they can concentrate on forming personal connections with students through less formalized forms of mentoring and instruction.

Nonetheless, this review highlights considerable deficiencies within the existing body of literature regarding AI and education. The lack of long-term, robust, and comprehensive research examining the effects of AI tools upon students' academic achievement and on teachers' professional development in an Indian context has created a great void in our understanding of how AI can improve education in this country. Furthermore, while numerous ethical considerations have been discussed (e.g., equity of access, privacy, academic integrity), very little has been published regarding how schools in India currently deploy ethical standards when using AIs, or the readiness of Teacher Education Institutions (TEIs) to incorporate ethical discussions into teacher training programs. Finally, while there are numerous studies documenting the experience of High-Educational Institutions (HEIs) and elite private primary/high schools with AI tools, comparatively fewer studies have documented the creative grassroots work taking place in low-resource settings in India, such as that seen in projects like Hack the Classroom, which could provide tremendously valuable insights into the possibilities of using AI tools to enhance educational equity in India.

4. Research Objectives and Questions:

This study is guided by the following objectives and corresponding research questions, designed to navigate the opportunities and complexities identified in the literature:

Research Objectives:

1. Describe AI adoption in India and its drivers related to teacher education & professional development
2. Assess how AI can be used to address the many systemic issues related to Teacher shortages, as well as the need for individualized instruction, faced by Indian schools today.

3. Identify the main barriers to the equitable and effective use of AI in Teacher Education, including Infrastructure, Socio-Cultural, and Ethical barriers.
4. Propose a policy, Curriculum development framework, and Institutional Capacity Building framework to support the effective and responsible use of AI in the Training of Future Teachers.

Research Questions:

1. How are preservice training institutions/initiatives (TEI) adopting and using AI, and what factors (based on UTAUT) most significantly influence how TEI influence the adoption of AI for both preservice and Inservice teacher professional development [4][7]?
2. How can AI specifically be utilized to address the need for more teachers, as well as support the large pupil-teacher ratio (under a teacher-pupil ratio of 1:30), experienced in various areas of India. In what ways could AI limitations affect this illustration of need [2][8]?
3. How could AI be used to support NEP 2020's vision by helping create the necessary pedagogical changes required for competency-based, continuous, and holistic assessment?
4. What ethical risks associated with the growth of AI in Indian classrooms (algorithmic bias, data privacy, erosion of academic integrity) are considered as the most significant, and what support or programmatic strategies can TEIs provide to assist educators navigate these risks [9]?
5. Through public private partnerships and the development of unorthodox vernacular AI solutions (e.g., 'Hack the Classroom'), how could partnerships create equitable and contextually appropriate solutions in order to address the diverse educational landscape in India [6]?

6.Methodology:

Through qualitative synthesis methodology (qualitative synthesis), this research examines and combines several recent articles (secondary sources) which will develop a holistic account of the landscape of AI and teacher education in India. This multi-method approach has been developed to provide an insight into the complexity of the issue.

Data Sources: The study draws on four key categories of sources:

- **National Survey and Industry Reports:**

The 2025 EY-Parthenon & FICCI report on AI in Indian Higher Education Institutions is the source of the primary data, which has been sourced from the FICCI-EY-Parthenon AI Adoption Survey 2025, which contains empirical evidence about institutional readiness, adoption trends and use cases of AI in Indian higher education [7].

- **Government Policy Documents and Statements:**

The critical analysis of the data will be included in the analysis of data from the national educational policy 2020, the announcement of the new AI curriculum from the Ministry of Education [5], and the parliamentary reports/work on teacher shortages [8].

- **Academic and Research Literature:**

The analysis also includes insights from the peer-reviewed study of the UTAUT (Unified Theory of Acceptance and Use of Technology) model and its application to the adoption of AI by Indian higher education teachers [4] as well as the analysis of the CIET-NCERT institutional training programme "Empowering Teachers with AI" [3].

- **Case Studies and Journalistic Reports**

Ground-level reality and innovation have been documented through in-depth case studies and investigations, including the 'Hack the Classroom' project in Maharashtra [6], as well as reports/investigatory work showing the challenges of teacher shortages and literacy challenges [2].

Analytical Framework:

The data collected from various different sources are synthesised thematically. The findings have been organised according to the main elements of the theoretical framework (drivers of technology adoption, compatibility with policy, contextual barriers to adoption, including infrastructure, language and equity, and the ethical governance of technology). The analyses aim to highlight areas of convergence as well as important discrepancies, such as a high level of ambition at the high policy level compared to the low level of resources that exist at the grass roots level, and provide examples of successful practices.

Limitations:

Because the research relies on secondary sources, it is limited by the scope and focus of the reports and other literature that exist. Second, there have been few large sample, quantitative studies of the use of AI in teacher education specific to schools. Additionally, AI technologies and AI policies continue to evolve rapidly, therefore this analysis can be considered a snapshot of a fluid, rapidly changing field.

6.The Role of AI in Indian Teacher Education: Opportunities and Applications

AI offers a range of revolutionary applications for teacher education in India, each of which addresses particular systemic issues and gives teachers new tools.

1.Teacher as Facilitator and Mentor (Addressing Shortage & Personalisation):
AI has the potential to transform classrooms into environments where teachers become facilitators of individualized instruction rather than mere transmitters of information. Learning platforms utilizing adaptive learning technologies have the ability to evaluate students' academic performance based on their individual records (data) and adjust the level of academic rigor associated with the content. In addition to providing the capacity to adjust content difficulty based on individual student performance, many of the same technologies offer a variety of options for students to interact with their work and receive feedback for improvement. For example, Hack the Classroom is an example of a company that uses technology to enable AI to identify, evaluate, and provide students with written feedback on their responses in written form using a teacher's native language so that students can develop a personalized instructional plan/curriculum that meets their unique educational needs, while learning in the classroom with all grade levels taught by a single educator. Instructor-level AI represents a scalable opportunity for teachers to provide personalized instructional support to their students, especially in circumstances where student-teacher ratios make it extraordinarily challenging for teachers to meet the unique needs of each student.

2.Augmenting Administrative and Assessment Efficiency:

In India, teacher burnout results from the burden of routine (non-teaching administrative) responsibilities and grading assignments for a large class size. Use of AI technology will allow for automating time-consuming tasks such as grading multiple-choice tests, tracking students' attendance, generating student performance reports, etc. The use of AI will also support the move from traditional one-point terminal examinations to continuous and holistic assessment as outlined in the National Education Policy (NEP) 2020. By employing AI systems, educators will be able to track student development longitudinally, identify

student learning difficulties in a timely manner and provide analytical data to aid teachers in transitioning from a terminal exam method to a formative assessment approach.

3. Enabling Continuous Professional Development (CPD):

Millions of in-service teachers across India can access personalized CPD driven by the power of AI. Rather than providing a one-size-fits-all solution for every teacher, AI provides a unique opportunity for teachers to identify their specific areas of need (for instance, how to teach a particular mathematics topic) and provide them with the appropriate microlearning modules to meet those needs. As evidenced by initiatives such as NCERT's "Empowering Teachers with AI" YouTube series, which aims to make the process of improving teachers' professional development scalable and universally accessible, the use of AI will allow for continuous adaptations based upon teacher interactions and feedback [3].

5.Curriculum Co-Creator and Resource Generator:

Teachers who work in remote regions of the country often have difficulty obtaining diverse and engaging teaching resources. The use of Generative AI can assist teachers in rapidly generating lesson plans, multilingual worksheets, interactive quizzes, and contextualized stories for their students. The use of these digital resources will reduce the time teachers spend preparing lesson plans and increase the outcome quality and relevancy of the instruction provided by the teacher in the classroom, as well as support the transition to experiential and multidisciplinary learning outlined in the NEP2020.

Table 2: AI Applications Addressing Key Indian Educational Challenges

Educational Challenge	Educational Challenge	Expected Impact & Example
High Pupil-Teacher Ratio [2][8]	Adaptive Learning Platforms & AI Tutors	Provides individualised practice and feedback, allowing teacher to focus on students needing most help.
Burden of Administrative Tasks	Automation of Grading, Attendance, Reporting	Frees up significant teacher time for instruction and student interaction.
Shift to Competency-Based Assessment (NEP 2020)	Learning Analytics & Continuous Evaluation Tools	Tracks competency development over time, provides data for holistic progress cards.
Lack of Personalised Teacher PD	AI-Powered, Adaptive Professional Development Platforms	Offers customised training modules based on individual

		teacher's classroom needs and gaps [3].
Resource Scarcity in Vernacular Mediums	Vernacular LLMs for Content Creation (e.g., 'Hack the Classroom' [6])	Enables generation of relevant teaching/learning materials in local languages, promoting equity.

7. Challenges and Ethical Concerns:

There are many significant obstacles to the integration of AI into Indian teacher education, which, if left unchecked, could worsen already-existing disparities.

1. The Infrastructure and Digital Divide:

The most significant hindrance to equitable access is a lack of resources and structural supports, with approximately 57% of schools nationwide having functioning computer labs; however, due to significant urban and rural differences in both connectivity (internet) and electricity, many schools do not have adequate infrastructure to use AI tools [8]. The lack of access to infrastructure, both physical and virtual, creates two systems (an elite system comprised of wealthy institutions that can afford to utilize AI technology) and includes resentment between AI users from these types of institutions and their counterparts from poorer, rural and/or remote schools that are unable to take advantage of AI technology and the advancements it provides.

2. The Preparedness and Mindset of Teacher Educators:

Teachers' confidence and critical use of AI is important for the success of AI in the classroom, and there is currently a large gap in this area. While AI policies exist at 56% of HEI's, faculty preparedness varies greatly across the country [7]; many teacher educators are digital immigrants who are also unable to effectively model or teach how to effectively use and integrate AI into their courses. If there is not a huge amount of effective skill development and growth for teachers (not just through workshops, but by providing deep, continual support to the teacher), then AI tools will either be widely underused or incorrectly used.

3. Ethical and Socio-Cultural Risks:

- **Algorithmic Bias:** AI tutors trained on biased data that come primarily from the English language and the urban middle-class (e.g., native English-speaking urban middle-class) will not only perpetuate bias towards marginalized dialects, socio-economically disadvantaged groups, and geographically isolated communities, but may also fail to incorporate contextual knowledge for a rural child who uses non-standard linguistic forms [6][9].
- **Data Privacy and Surveillance:** The collection of large amounts of data for implementing personalized learning represents a significant risk to the students' data due to the infancy of the country's data protection law. There is a particular concern for the protection of students' personal information from inappropriate use or commercial exploitation [9].

- **Erosion of Academic Integrity and Critical Thinking:** The increased accessibility of Generative AI technology to do assignments has brought forth an urgent need for educators to receive training in detecting AI-generated work and creating assessments that require critical thinking rather than memorization or simple reproduction [9]

- **De-professionalisation and Deskilling:** Educators who rely heavily on artificial intelligence AI to do things such as develop lessons, create assessments, and even interact with their students will lose the very essence of what makes them great. The goal of integrating AI in the classroom should not be to eliminate the job of a teacher; rather, it should be to enhance the capabilities of a teacher by providing support for their professional judgment and creativity when it comes to teaching.

5. **Linguistic and Cultural Hegemony:** India's flourishing linguistic variety is threatened by the overwhelming preponderance of English in the expanding field of Global Artificial Intelligence. Cutting-edge technology is predominantly built using the English language, with some exceptions (e.g. Hack the Classroom for the Marathi language) that illustrate this point [6]. Unless a concentrated national effort is pursued to cultivate a strong and viable form of AI designated for the languages of India, this technology is unlikely to connect with the bulk of educators or students in this nation.

8. Future Directions and Policy Implications:

India needs to take a calculated, multifaceted approach in order to use AI for fair and revolutionary teacher education. The following suggestions offer legislators, TEIs, and ed-tech partners a road map.

- **Develop a National Framework for AI in Teacher Education:** In addition to the announcement regarding the curriculum for schools, educators require a structured approach to prepare them to teach effectively. This structure requires educators to gain AI Literacy prior to entering the profession through their B.Ed. or D.El.Ed. and as part of their ongoing continued professional development (CPD). The NCTE, in partnership with the NCERT and industry stakeholders, will create this structure. This structure will outline competencies related to AI Literacy, ethical considerations, and give educators access to standardised resources and toolkits.

- **Prioritise Vernacular AI and Public Digital Infrastructure:** The main objective of public investment is to create the following two areas: a) Making available multilingual, open-source AI education software and datasets. b) Ensuring that all TEI's and partner schools have the necessary resources (e.g. a stable internet connection, hardware and auxiliary power source) to operate effectively using AI as a part of their curriculum. Governments should also encourage private-sector companies to establish partnerships with them in order to provide solutions for government schools, not exclusively private schools. This is the concept behind 'hack the classroom'. The HTH approach will be adapted to greater use through state-based partnerships [6].

- **Teacher Professional Development:** CPD should change from isolated workshops and seminars to continuous learning through community practice using AI technologies as enablers of that learning. For instance, DIKSHA will need to change its offerings to include AI coached personalised learning pathways for teachers on its platform. Additionally, training must include strong emphasis on critical AI literacy—this means teaching educators to critically analyse the algorithmic bias, secure student data and use AI to enhance creativity rather than limit it [3][9].

- **Establish Robust Governance and Ethical Audits:** Educational institutions that utilize artificial intelligence technology must have developed clear policies on Data Privacy, Acceptable Use and Academic Integrity. Regulatory Agencies should place an obligation on education providers to conduct Algorithmic Impact Assessments to assess various characteristics (including but not limited to: bias and fairness) of educational AI products. All stakeholders, such as teachers, students, parents, etc., should be involved in these processes [9].

- **Foster Research and Indian-Centric Innovation:** Funding the long-term studies of the effects of AI technology on education would be of great importance, especially within India. To advance the field, Teacher Education Institutes (TCIs) need to create "AI in Indian Classrooms" research centres that produce knowledge based on local needs instead of Western research. Priority areas should include technology for teaching across grade levels, in areas with limited internet access, and for inclusive education [6].

9.Conclusion:

The future of teacher education in India can only be enhanced by incorporating artificial intelligence thoughtfully and strategically. Utilizing AI will create a significant toolset to address currently some of the greatest challenges facing India's teachers; specifically, large-scale shortages of teachers, the necessity for personalized learning across many students and classrooms, and administrative overloads that prevent teachers from exercising professional judgment and providing quality education to all students. NEP 2020 and the direction given in AI Curriculum Mandate support this direction for AI in Teacher Education [5].

Nonetheless, this article emphasizes that the mere infusion of technology does not equate with resolving every educational challenge. The convergence of digital divides, entrenched cultural and linguistic bias, and diminished value of humanistic education is a real and current challenge through the… [6][8][9].The most critical element of change in Indian teacher education institutions will be the evolution and growth of these institutions to be incubators of innovation and critical thought and to produce teachers who are not simply consumers of AI tools but ethically and effectively navigating the use of technology. Achieving this transformation will take a significant national commitment through a coordinated approach that combines strategic policy, significant investment in permanent infrastructure for equity and vernacular solutions, and a continued commitment to empowering teachers.

In India, the way forward for the teaching profession will involve AI making use of human abilities, not machines replacing human teachers. With the right approach, India can show others—its size and diversity, (as well, developing) nations—that technology can aid in educational advancements and the creation of a new form of education in the 21st century that provides both equity and wisdom.

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