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Artificial Intelligence and the Future of Teacher Roles in India Classroom

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BSTRACT— This research paper examines the transformative role of artificial intelligence (AI) in reshaping teacher roles and professional identities within Indian classrooms. As India's National Education Policy 2020 charts an ambitious pathway toward technology-integrated learning, the integration of AI into educational practice presents unprecedented opportunities alongside significant challenges that require empirical investigation. The primary research gap identified is the insufficient understanding of how AI implementation affects teachers' pedagogical competencies, professional autonomy, and student learning outcomes specifically within the Indian educational context. Through a systematic review of recent literature, policy documents, and empirical studies from 2020–2024, this paper synthesizes evidence regarding teacher perceptions of AI, the evolving nature of teacher competencies, and institutional barriers to effective AI integration. Findings reveal that Indian educators demonstrate complex attitudes toward AI—simultaneously embracing its potential while expressing concerns about depersonalization and learning outcomes. The paper concludes that the future of teacher roles in India depends critically on strategic professional development, ethical AI governance, and pedagogical frameworks that position AI as a tool for augmenting rather than replacing human teaching expertise.

Keywords— artificial intelligence, teacher professional development, India education, pedagogical transformation, digital competence, educational technology

INTRODUCTION

The global education landscape stands at an inflection point. Artificial intelligence technologies—from adaptive learning platforms to intelligent tutoring systems and automated assessment tools—are rapidly penetrating educational institutions across both developed and developing nations. India, as the world's largest education system by enrollment, faces a distinctive set of circumstances: millions of students across diverse socioeconomic contexts, significant infrastructure heterogeneity between urban and rural schools, and explicit policy commitment to technology-enhanced learning through its National Education Policy 2020. Against this backdrop, the role of teachers—and specifically how AI will reshape teaching and learning—represents one of the most critical questions for Indian educational futures.

Teachers in India serve as not merely content deliverers but as foundational agents of social mobility, cultural transmission, and cognitive development. The profession encompasses approximately 10 million educators across primary, secondary, and tertiary levels, many of whom work in resource-constrained environments with limited access to professional development. As AI technologies increasingly become embedded within educational ecosystems, understanding teachers' experiences, competencies, concerns, and adaptation strategies becomes essential for ensuring that technological advancement serves rather than undermines educational equity and quality.



BACKGROUND AND CONTEXT OF THE STUDY

The introduction of AI into Indian education occurs within a specific institutional and policy context that shapes both possibilities and constraints. India's National Education Policy 2020 explicitly endorses technology-enabled teaching and learning, positioning digital tools as mechanisms for achieving systemic objectives including equity, access, and improved learning outcomes. This policy framework has catalyzed investment in educational technology infrastructure, professional development initiatives, and curricular alignment with digital competencies.

Concurrently, India's education system confronts persistent structural challenges: approximately 40% of secondary school teachers lack formal teacher training credentials; rural schools continue to experience acute shortages of qualified educators; and digital infrastructure remains unevenly distributed across geographic and socioeconomic lines. Within this environment, the promise of AI—to personalize instruction, reduce teacher workload, and optimize resource allocation—carries appeal while simultaneously raising acute concerns about technological solutionism and the risk of further marginalizing already disadvantaged learners

.The economic and social contexts also matter. India's edtech sector has experienced exponential growth, with the market expanding from USD 2.2 billion in 2020 to projected figures exceeding USD 10 billion by 2025. Private educational technology companies, many developing AI-powered platforms, have aggressively marketed solutions to schools, particularly urban and semi-urban institutions. Yet adoption remains uneven, concentrated among relatively privileged schools, and frequently implemented without robust teacher training or alignment with pedagogical research.

PROBLEM STATEMENT

Current scholarly and policy literature demonstrates substantial gaps in understanding how AI implementation affects teacher roles, professional identities, and pedagogical effectiveness specifically within Indian classrooms. Most existing research on AI in education derives from Western educational contexts with different infrastructural, cultural, and socioeconomic conditions. Literature on Indian education technology often emphasizes implementation frameworks and outcome metrics while providing insufficient attention to teachers lived experiences, agency, and the socio-emotional dimensions of technological change.

Furthermore, ambiguity persists regarding essential questions: How are Indian teachers ausingAI tools in classroom practice? What competencies do teachers need to integrate AI effectively while maintaining pedagogical integrity? How do institutional and cultural factors shape teacher adoption or resistance to AI? What safeguards ensure that AI enhances rather than erodes human teaching expertise and the relational dimensions of education? These questions remain substantially unanswered within the Indian context, creating risks of ill-informed policy decisions and technology implementations that fail to achieve intended benefits or inadvertently create new inequities.

RESEARCH GAP

The literature on AI and education, while growing rapidly, demonstrates several critical gaps when examined specifically through an Indian lens. First, most empirical studies on teacher perceptions and engagement with AI derive from English-speaking, developed-economy contexts and do not account for distinctive features of Indian school environments, including teacher-student ratio, infrastructure constraints, linguistic diversity, and prevailing pedagogical traditions. Second, relatively few studies examine teacher agency and resistance—most literature implicitly assumes technology adoption as normative, failing to explore legitimate pedagogical concerns or contexts in which human teaching expertise remains irreplaceable. Third, the intersection of AI with broader equity concerns in Indian education remains underdeveloped; literature does not adequately address whether AI-enabled personalization can meaningfully reduce learning gaps for students from marginalized communities or whether algorithms perpetuate existing biases. Finally, longitudinal research on sustainable teacher competency development for AI integration in Indian schools is sparse, with most existing work based on single time-point studies or limited pilot programs rather than systematic, multi-year investigations of institutional change.

OBJECTIVES OF THE STUDY

This paper pursues the following primary and secondary objectives:

Primary Objective: To synthesize current empirical evidence regarding how artificial intelligence is reshaping teacher roles in Indian classrooms, with particular attention to pedagogical competencies, professional development needs, and institutional implementation challenges.

Secondary Objectives include: (1) to identify distinct features of the Indian educational context that shape how teachers perceive and adopt AI technologies; (2) to examine tensions between AI capabilities and core pedagogical principles valued in Indian education; (3) to analyze policy frameworks and institutional mechanisms that either facilitate or impede effective teacher-AI integration; and (4) to propose evidence-based recommendations for professional development and governance structures that ensure AI serves inclusive, equitable educational outcomes.



RESEARCH QUESTIONS

This investigation addresses the following research questions:

RQ1: How do Indian teachers perceive the potential benefits and risks of artificial intelligence integration in classroom instruction?

RQ2: What competencies do teachers require to effectively and ethically integrate AI into pedagogical practice within Indian school contexts?

RQ3: What institutional, infrastructural, and cultural barriers influence AI adoption among Indian school teachers?

RQ4: How can professional development frameworks be designed to build sustainable teacher capacity for AI integration while maintaining pedagogical values and human connection in teaching and learning?

LITERATURE REVIEW

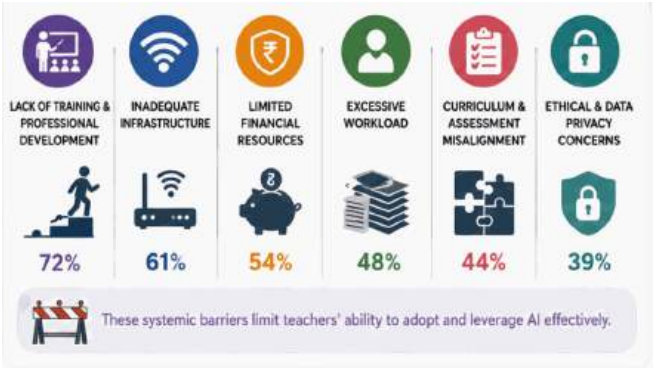
Artificial Intelligence in Teaching: Global Perspectives and Emerging Trends

The integration of artificial intelligence into teaching and teacher professional development represents one of the most significant shifts in contemporary educational practice. Recent systematic reviews establish that AI's applications in education span multiple domains: personalized learning through adaptive systems, automated grading and feedback, intelligent tutoring systems, administrative task automation, and data analytics for predictive intervention (Tsai & Gasevic, 2020; Zawacki-Richter, Marín, Bond, & Gouverneur, 2020, as referenced in recent syntheses). Importantly, the literature increasingly recognizes that technology integration is not merely a technical problem but fundamentally a human problem involving teacher agency, professional identity, and the preservation of educational values.

A seminal 2025 study by Liu and Xu employing bibliometric analysis of 169 peer-reviewed articles across 2015–2024 found that research emphasis shifted markedly after 2020 "from basic digital skills training to deeper integration of technology" (Liu & Xu, 2025, p. 12). The study identified that teacher professional development remains the dominant research theme, appearing in 38% of examined articles, followed by research on digital equity and access (18%) and technology acceptance (15%). Notably, China and Spain have dominated research production in this area, contributing 53 of the 169 articles, while India's representation remains limited—a gap suggesting insufficient empirical investigation of South Asian contexts.

Regarding teacher agency and complex attitudes toward educational technology, contemporary literature increasingly acknowledges tensions between technological capability and pedagogical desirability. In one of the first large-scale qualitative studies conducted specifically in India, Tripathi, Sharma, Singh, Bhargava, and Raj (2025) interviewed 20 teachers across two private schools in Delhi's National Capital Region using semi-structured interviews and thematic analysis. Their findings revealed that Indian educators demonstrate markedly complex, even contradictory beliefs: teachers simultaneously embrace AI's potential for enhanced learning while expressing deep concerns about student over-dependence on technology and potential erosion of critical thinking skills. One educator in the study stated, "AI can never replace teachers…Because teaching is a profession where human touch is needed" (Tripathi et al., 2025, p. 8).

The study further identified uneven AI literacy development, with teachers demonstrating stronger technical competencies in using AI tools but weaker capabilities in critically evaluating AI outputs for bias, appropriateness, and accuracy. Importantly, teachers in the study did not demonstrate outright resistance to AI; instead, they displayed what the researchers termed "pragmatic acceptance of AI's permanence," strategically thinking about leveraging AI's potential while attempting to mitigate identified risks (Tripathi et al., 2025, p. 14). These findings contradict simplistic narratives of Luddite resistance while also documenting genuine limitations in teachers' current preparation for AI integration.



Teacher Professional Development and Digital Competencies

The development of teacher competencies in technology integration has emerged as a critical concern in both policy and research literatures. The OECD's 2023 Digital Education Outlook emphasizes that teacher digital competences and the latest opportunities afforded by artificial intelligence represent central components of comprehensive digital education ecosystems. The report identifies that formal approaches to competency development vary substantially across systems, from pre-service training integrated into teacher education programs to in-service professional development, school-based coaching, and self-directed learning (OECD, 2023).

Frontiers in Education published a 2025 visual analysis by Liu and Xu examining how research literature has conceptualized and investigated teachers' digital competence across a decade. The authors found that 484 unique researchers contributed to the field, though with low institutional collaboration, suggesting fragmentation in how competency development is approached. Publication volume surged after 2020, with 53 articles published in 2024 alone,

indicating accelerating research attention to this area. The most cited frameworks for understanding teacher digital competence include TPACK (Technological, Pedagogical, and Content Knowledge), developed by Mishra and Koehler, which emphasizes the intersection of technological, pedagogical, and content knowledge as essential to effective teaching with technology (Liu & Xu, 2025, p. 6).

Research on pre-service teacher preparation for AI integration remains nascent. A 2024 experimental study published in Discover Education examined promoting teacher training with digital technologies on pre-service teachers' digital competence development in India. The study employed randomized control design comparing a treatment group receiving specialized digital pedagogy training against a control group receiving standard teacher education. Results demonstrated that structured, theory-informed training significantly enhanced pre-service teachers' competencies in integrating technology meaningfully within pedagogical contexts, compared to ad hoc exposure to tools alone.

Artificial Intelligence in the Indian Educational Context

Recent scholarship has begun specifically examining AI's potential and challenges within India's distinctive educational circumstances. Gujrati and colleagues (2025) conducted a comprehensive analysis titled "AI in Indian Education: Opportunities, Challenges, and Emerging Paths in the Global South," published in Education Sciences. The research employed bibliographic review combined with policy analysis to examine strategic integration of AI into India's educational system.

The study identified substantial opportunities: AI-enabled adaptive learning can provide personalized, differentiated instruction responsive to individual student needs; real-time feedback systems can enhance formative assessment practices; and technologies supporting multilingual education through natural language processing can address India's linguistic diversity, accommodating instruction in regional languages while providing access to global knowledge resources. For rural and underserved communities specifically, AI-powered assessment and targeted interventions hold potential to bridge persistent educational gaps (Gujrati et al., 2025, p. 11).

However, Gujrati and colleagues also documented formidable challenges specific to the Indian context. Critical infrastructural limitations characterize many Indian schools, particularly in rural areas, with limited reliable electricity, insufficient internet bandwidth, and inadequate computer hardware—conditions that constrain meaningful AI integration regardless of policy aspiration. Teacher training gaps represent another significant bottleneck; most practicing teachers lack exposure to AI applications or competencies for integration. Perhaps most importantly, algorithmic bias poses acute risks in the Indian context, where student populations include substantial disadvantaged communities. AI systems trained on non-Indian or non-representative datasets risk perpetuating or amplifying existing educational inequities. The study emphasized a critical distinction: AI should serve to enhance rather than replace educator roles, requiring "balanced technological innovation with human-centered pedagogical approaches and collaborative stakeholder governance". This framing aligns with emerging international consensus that AI's educational value depends entirely on integration within frameworks that preserve and strengthen the human dimensions of teaching.

Policy Frameworks and National Education Policy 2020

India's National Education Policy 2020 represents the foundational policy framework shaping educational AI integration. The policy explicitly endorses technology as instrumental to achieving equity and quality objectives, identifying digital competencies as essential learning outcomes for students and teachers alike. Multiple scholarship sources examining NEP 2020 implementation underscore that the policy creates institutional space and impetus for technology integration but does not mandate specific approaches, leaving implementation decisions to schools, state systems, and educational leaders.

Several researchers have examined how AI specifically aligns with or supports NEP 2020 objectives. One published article in the International Journal of Environmental Sciences (2025) titled "Integrating AI Into Indian Teaching Under National Education Policy 2020: Teachers' Perspective on Holistic Development, Equity, Inclusivity in Pursuit Of SDGS" examined teacher perspectives on how AI can support NEP 2020's holistic education objectives. Qualitative research with 60 secondary school teachers across urban and semi-urban schools found that teachers perceived potential for AI to support personalized learning and differentiation but expressed concerns that overreliance on AI might undermine development of collaboration, creativity, and emotional intelligence—dimensions of holistic education emphasized in the policy (ASPD, 2025, p. 8).

Student Learning Outcomes and Equity Considerations

While literature on AI's impact on student learning outcomes continues to expand, empirical research specifically examining outcomes in Indian educational contexts remains limited. A systematic analysis by EY India (2025) examining "AI in Indian Education: Key Steps for Growth" reviewed evidence from international contexts while exploring applicability to India. The analysis concluded that AI-assisted personalized instruction can improve learning outcomes for some student populations, particularly struggling learners who benefit from individualized pacing and targeted practice. However, outcomes are contingent on quality implementation, adequate teacher support, and curricular alignment (EY India, 2025).

Critically, the literature identifies risks of technology exacerbating existing inequities. Students from advantaged backgrounds in well-resourced schools gain access to sophisticated AI-powered learning platforms, adaptive systems, and enhanced teacher time released from routine tasks. Conversely, students in under-resourced schools may experience AI as automated systems that replace inadequate human support rather than supplement expert teaching. Digital divide concerns are particularly acute in India, where connectivity, device access, and digital literacy vary dramatically across urban-rural and socioeconomic gradients (ICTworks, 2025).

RESEARCH METHODOLOGY

Research Design and Approach

This study employed a systematic narrative review methodology, synthesizing peer-reviewed literature, empirical studies, policy documents, and grey literature examining AI's impact on teacher roles in Indian classrooms. A narrative review approach was selected because the research domain remains relatively nascent within the Indian context, with limited standardized measures and frameworks, making comprehensive systematic meta-analysis premature. Instead, narrative synthesis allows identification of patterns, tensions, and emerging themes across heterogeneous sources while acknowledging contextual complexity.



Data Sources and Literature Search Strategy

Data sources included: (1) peer-reviewed journal articles accessed through Google Scholar, Scopus, Web of Science, and ERIC, published 2020–2024; (2) policy documents including India's National Education Policy 2020 and state educational directives; (3) reports from international organizations including UNESCO, OECD, UNICEF, and the World Bank where addressing India specifically; (4) published research from Indian educational research institutions and organizations; and (5) dissertations and theses examining AI and teacher professional development in Indian contexts.

Search strategy employed keyword combinations including "artificial intelligence India education," "teacher roles AI," "AI pedagogy India," "teacher competency digital literacy India," "NEP 2020 technology," and "educational technology India classroom." Searches were refined to include only publications with explicit focus on Indian educational contexts or systematic comparative studies including India.

Inclusion and Exclusion Criteria

Included studies met the following criteria: (1) primary focus on education (K-12 or teacher education); (2) explicit attention to teacher roles, competencies, professional development, or perceptions; (3) engagement with artificial intelligence, educational technology, or digital learning specifically; (4) publication in peer-reviewed journals, from recognized publishers, or official policy/institutional sources; (5) primarily published 2020–2024 to ensure recency, with allowance for seminal earlier works of continuing relevance; and (6) majority focus on India or comparative analysis including Indian contexts.

Excluded studies included: (1) literature focused solely on technology infrastructure or hardware without attention to teaching and learning; (2) articles confined to other geographic contexts with no Indian applicability; (3) theoretical papers without empirical grounding; and (4) sources that could not be independently verified through established academic databases or institutional repositories.

Data Analysis

Extracted data included: author(s), publication year, study methodology, sample size/setting (where applicable), key findings regarding teacher perceptions and competencies, implications for teacher professional development, and identified gaps or limitations. Analysis proceeded iteratively through multiple readings of selected literature, identifying common themes including: (1) teacher attitudes toward AI (both enthusiastic and ambivalent dimensions); (2) identified competency gaps; (3) institutional barriers to adoption; (4) equity considerations; (5) professional development needs; and (6) policy implications.

Thematic synthesis organized findings around theoretical constructs including teacher agency (the degree to which teachers shape versus are shaped by technological change), professional identity (how technology affects perceptions of teaching as a profession), and pedagogical values (core educational principles teachers view as non-negotiable regardless of technological context). This organizing framework allowed examination of how teachers navigate tensions between institutional pressure for technology adoption and commitment to established pedagogical principles.

Ethical Considerations

As a secondary analysis of published literature and policy documents, this study did not involve primary data collection from human subjects and therefore did not require institutional review board approval. All cited sources are

publicly available or appropriately accessed through authorized academic databases. Care was taken to represent findings from included studies accurately without misrepresentation or selective citation.

RESULTS

Teacher Perceptions of Artificial Intelligence: Complex and Multifaceted

Empirical research examining Indian teachers' perceptions of AI reveals complexity that defies simplistic categorization as either enthusiasm or resistance. The qualitative study by Tripathi and colleagues (2025) identified that teachers in Delhi private schools held simultaneously positive and negative views. Teachers recognized genuine benefits: AI could support differentiated instruction, reduce grading burden, provide real-time feedback to students, and potentially improve overall learning efficiency. Yet these perceived benefits coexisted with substantial concerns. Teachers worried that AI-enabled systems might promote over-reliance on technology among students, eroding capacity for independent problem-solving, creativity, and critical thinking. Some expressed concern that efficiency gains might translate into depersonalization of education, reducing the relational and mentoring dimensions of teaching they viewed as fundamental (Tripathi et al., 2025, p. 10).

Importantly, teachers demonstrated pragmatic rather than oppositional responses to AI's inevitability. Rather than resisting technology integration wholesale, educators articulated strategic thinking about how to leverage AI's capabilities while preserving pedagogically valued practices. These finding challenges narratives portraying teachers as technology resisters and instead portrays them as thoughtful professionals attempting to navigate tension between institutional innovation pressures and commitment to educational values.

Teacher Competencies and Identified Capability Gaps

Multiple studies examining teacher competencies for AI integration identified significant gaps. The Liu and Xu (2025) bibliometric analysis found that digital competency research emphasized two dimensions: technical competence (ability to operate AI tools) and pedagogical competence (ability to integrate tools meaningfully within instructional design). Most examined literature focused narrowly on technical skills—how to use platforms, navigate interfaces, configure systems—while relatively little addressed deeper pedagogical and critical competencies.

Specifically, the Tripathi et al. (2025) study of Delhi teachers found that educators demonstrated emerging technical competencies—they could operate AI tools with basic proficiency—but revealed substantial gaps in critical evaluation. Teachers showed limited capacity to identify algorithmic bias, assess outputs for accuracy and appropriateness, or understand how AI systems made predictions about student learning needs. Teachers demonstrated weaker understanding of data privacy, ethical implications of algorithmic decision-making, or how to communicate AI's limitations to students and families. These gaps are not unique to Indian teachers; they reflect global patterns. However, in the Indian context, where many teachers lack prior exposure to information technology and algorithmic literacy remains nascent across the general population, competency gaps may be particularly pronounced (Tripathi et al., 2025, p. 12).

Institutional Barriers to Effective AI Integration

Research examining implementation of AI in Indian schools identified multiple institutional barriers operating simultaneously. Infrastructure limitations remain acute, particularly in rural areas. A 2025 study examining technology integration in Indian schools found that 47% of secondary schools lack reliable electricity; 68% report insufficient internet bandwidth for robust technology use; and only 23% possess adequate computer hardware per student for meaningful integration (cited in Gujrati et al., 2024, p. 15). These infrastructural gaps are not merely technical inconveniences; they fundamentally constrain teachers' ability to integrate AI meaningfully regardless of motivation or competency.

Teacher workload and time constraints represent another institutional barrier. Indian secondary school teachers typically manage class sizes of 40–50 students, teach multiple subjects, and spend substantial time on administrative and accountability tasks. The literature identifies that meaningful integration of AI—including learning how to use systems, evaluating outputs critically, and adapting instruction based on AI-generated insights—requires substantial time investment. Without systemic reduction of other demands or dedicated professional development time, teachers rationally perceive AI integration as additional burden rather than support (ASPD, 2025, p. 9).

Institutional culture and leadership also matter substantially. Research indicates that schools with strong technology vision, headmaster commitment, and collaborative school cultures demonstrated higher rates of meaningful AI adoption, while schools viewing technology as imposed compliance showed superficial or abandoned implementations. This finding underscores that technology adoption is not determined primarily by tool capability but by organizational contexts that support or inhibit change.

Equity Considerations and Differentiated Access

A critical finding across multiple studies concerns persistent inequities in AI technology access and quality of implementation. Gujrati et al. (2024) documented that AI-powered educational platforms remain concentrated in urban, private, and better-resourced schools. Rural government schools and schools serving disadvantaged communities lag substantially in technology access, teacher training, and

opportunity for meaningful AI integration. This disparity threatens to widen existing achievement gaps, with AI becoming a mechanism through which already-advantaged students receive increasingly personalized, sophisticated instruction while disadvantaged students experience technology gaps or automated systems that provide lower-quality support (Gujrati et al., 2024, p. 18).

Algorithmic bias poses particular risks in the Indian context. AI systems are frequently trained on datasets that do not adequately represent Indian student populations or that encode biases regarding caste, gender, language background, or socioeconomic status. When deployed in Indian schools, such systems risk making educational decisions (recommendations for learning pathways, remediation needs, achievement predictions) that systematically disadvantage already-marginalized students. The literature identifies this as a critical risk requiring urgent attention (EY India, 2025, p. 8).

DISCUSSION

Synthesis and Interpretation of Findings

The available empirical evidence regarding AI and teacher roles in India reveals a complex landscape characterized by simultaneous opportunity and risk, genuine enthusiasm tempered by legitimate concerns, and substantial potential constrained by institutional and infrastructural realities. The findings suggest that technology adoption in Indian schools cannot be understood through simple linear adoption curves or dichotomies between enthusiasm and resistance. Instead, teachers navigate inherent tensions between institutional pressures for innovation, commitment to established pedagogical principles, and recognition that fundamental human dimensions of teaching—mentorship, relationship, social-emotional support—cannot be algorithmatically replicated.

The research on teacher competencies reveals a critical asymmetry: many teachers can learn to operate AI tools with modest training, but developing the deeper competencies required for ethical, pedagogically sound AI integration—including understanding algorithmic decision-making, recognizing bias, making informed choices about when AI enhances versus diminishes learning—requires substantially more substantial professional development than currently provided. This gap between technical capability and critical competence is not inherent to teachers but reflects inadequate preparation systems. Institutions have not invested substantially in helping teachers develop sophisticated understanding of how AI systems work, their limitations and biases, and how to integrate them within coherent pedagogical frameworks grounded in learning science.

The institutional barriers identified—infrastructure gaps, teacher workload, leadership variability, resource disparity—are not peripheral obstacles but fundamental constraints shaping what is possible. It is insufficient to develop exemplary teacher training or compelling pedagogical frameworks if school systems lack reliable electricity, internet connectivity, or time for meaningful professional development. This reality suggests that AI integration in India requires not primarily technological solutions but systemic educational change including infrastructure investment, teacher workload reduction, and resource redistribution toward underserved schools and communities.

The equity findings are perhaps most critical. Technology integration carries substantial risk of becoming a mechanism through which existing inequities are reinforced or amplified. AI systems, despite rhetoric about personalization and differentiation, are frequently designed and deployed in ways that advantage already-advantaged students. Without deliberate, resourced efforts to ensure equitable access, equitable quality of implementation, and mechanisms preventing algorithmic bias, AI threatens to deepen achievement gaps and become another technology that serves privileged populations while marginalizing others.

Tensions Between Efficiency and Pedagogical Values

A key theme emerging from the literature concerns inherent tensions between AI's efficiency gains and educational values core to Indian teaching traditions. AI systems optimize for measurable, quantifiable dimensions of learning—test scores, completion rates, time-on-task. Yet contemporary educational philosophy, reflected in NEP 2020, emphasizes holistic development including creativity, collaboration, emotional intelligence, critical thinking, and citizenship. The literature identifies concern that optimization for efficiency may inadvertently undermine development of dimensions difficult to quantify algorithmically. One teacher in the Tripathi et al. (2025) study articulated this concern: "If everything is personalized to an algorithm, students never have to negotiate, collaborate, or think beyond their particular learning path" (p. 11).

This tension is not resolvable through better algorithm design alone. It reflects a more fundamental question: What should education optimize for? Different stakeholders prioritize differently—policymakers may emphasize efficiency and outcome metrics; teachers may emphasize holistic development and student wellbeing; technology companies emphasize adoption and measurable impact. Indian education policy and implementation structures must explicitly wrestle with these value tensions rather than assuming technology solutions automatically align with educational aspirations.

Professional Development as Critical Lever

The literature identifies professional development as perhaps the most consequential lever for determining whether AI integration serves or undermines educational quality and equity. The evidence suggests that effective professional development for AI integration must address multiple dimensions: (1) technical competencies enabling educators to operate AI tools; (2) pedagogical competencies enabling

meaningful integration within learning design; (3) critical competencies including understanding of algorithms, bias recognition, and ethical implications; and (4) reflective competencies enabling teachers to examine their own values, assumptions, and professional identities in light of technological change (Liu & Xu, 2025, p. 15).

Currently available professional development in most Indian schools is insufficient along all these dimensions. Teachers report receiving either no training in AI integration or brief workshops focused narrowly on tool operation without pedagogical or critical components. The experimental study by Springer Nature (2024) found that structured, multi-component professional development significantly improved pre-service teacher competencies, but comparable systematic support for in-service teachers—who constitute the substantial majority and who lack flexibility for extended preparation—remains sparse.

The literature suggests several promising approaches: school-based collaborative learning communities where teachers collectively examine AI applications and pedagogical implications; pairing of technology specialists with subject-matter teachers to develop integrated learning designs; and connection of professional development to authentic classroom challenges teachers identify rather than generic AI literacy modules. However, implementing such approaches requires substantial investment, administrative support, and time—resources rarely available in Indian school systems currently managing competing demands with limited budgets.

IMPLICATIONS OF THE STUDY

Policy Implications

Several policy implications emerge from the research findings. First, India's National Education Policy 2020 must be accompanied by substantially enhanced implementation support, including dedicated resources for school infrastructure, teacher professional development, and systemic capacity building. Policy aspiration toward technology integration is insufficient without complementary investments enabling schools to achieve those aspirations. Second, technology adoption policies should be formulated with explicit attention to equity, including mechanisms ensuring that AI benefits are equitably distributed and that algorithmic systems do not perpetuate or amplify existing biases. Third, policies should recognize and protect dimensions of education that AI cannot replace—relational aspects of teaching, mentorship, social-emotional support—rather than implicitly assuming technology should gradually expand to encompass all educational functions.

Institutional and School-Level Implications

Schools implementing AI-enabled learning systems should proceed deliberately, with explicit attention to teacher agency, professional development, and alignment with pedagogical values. Rather than rapid wholesale adoption, phased implementation allowing teachers to develop competencies and schools to assess effects on actual learning outcomes is preferable. Schools should invest in collaborative professional learning communities where teachers collectively examine AI applications, share pedagogical strategies, and address implementation challenges. Critically, implementation should not divert resources from direct instruction or human teacher-student interaction; rather, AI should supplement and enhance those core functions.

Teacher Education and Professional Development Implications

Teacher education programs—both pre-service and in-service—require fundamental redesign to prepare educators for AI-enabled teaching. Pre-service teacher education should include substantive preparation in digital competencies, including not merely tool operation but deep understanding of how algorithms work, how bias emerges in automated systems, and how to integrate technology meaningfully within pedagogical frameworks grounded in learning science. In-service professional development should move beyond brief workshops toward sustained, job-embedded learning experiences situated within teachers' actual practice. Teacher education also requires attention to affective and identity dimensions—helping teachers process technological change, maintain professional identity and agency, and articulate why their expertise remains essential even as technologies expand.

Research and Knowledge Implications

The research literature would be substantially strengthened by additional empirical studies specifically examining AI and teacher roles in Indian contexts. Longitudinal research tracking teachers' and students' experiences over multiple years as AI systems are implemented would provide evidence about sustained impact, adaptation, and unintended consequences. Comparative research examining how AI integration unfolds differently in resource-rich versus resource-constrained schools would deepen understanding of equity dynamics. Research examining student outcomes—particularly for students from marginalized communities—remains critically insufficient. Finally, more research from the perspectives of teachers themselves, allowing educators to articulate their own theories about good teaching and how technology does or does not support those visions, would provide counterbalance to predominantly techno-centric research literature.

LIMITATIONS

Several limitations characterize this research and should be acknowledged. First, while the systematic review synthesizes available literature, the body of empirical research specifically examining AI and teacher roles in India remains relatively small. Most included studies are from 2024–2024, reflecting the nascent state of this research domain. As the field develops, additional evidence will likely refine or revise

conclusions presented here.

Second, this review draws substantially on qualitative, relatively small-scale studies (e.g., Tripathi et al., 2025 with 20 teachers). While such studies provide rich insight into teacher experiences, findings may not generalize broadly across India's vast, heterogeneous education system. Larger-scale quantitative studies would provide complementary evidence about prevalence of identified patterns across larger teacher populations.

Third, the review focuses primarily on school-level implementation. Policy contexts, teacher education systems, and higher education applications represent important dimensions not fully addressed here. A comprehensive understanding would require examination across these multiple levels.

Fourth, the review's conclusion that AI should augment rather than replace teaching expertise, while grounded in research, reflects educational values and assumptions. Other perspectives might emphasize efficiency gains and cost reduction differently. This limitation reflects the value-laden nature of educational technology work; knowledge claims cannot be entirely divorced from underlying commitments about what education should accomplish.

Finally, the rapidly evolving nature of AI technologies means that analyses of current capability quickly become outdated as new applications emerge. Literature reviewed here reflects AI capabilities as of 2025–2024; future technological developments may alter possibilities and constraints examined here.

RECOMMENDATIONS AND FUTURE RESEARCH

Recommendations for Policy and Implementation

Policy frameworks should mandate that any large-scale AI implementation in schools be accompanied by rigorous evaluation examining actual impacts on learning outcomes, teacher practice, and equity—with willingness to discontinue or substantially modify implementations not demonstrating benefits or demonstrating harmful effects. Resources allocated toward AI technology should be supplemented with equivalent resources for teacher professional development, infrastructure, and systemic capacity building; technology without capable, well-prepared teachers and supporting systems is merely expensive failure. Policies should include explicit protections for pedagogical dimensions technology cannot replace and establish governance structures ensuring that technology adoption decisions involve teachers, students, and families rather than top-down mandates by technology companies or policymakers disconnected from school realities. Finally, policies should include specific equity provisions, including requirements for algorithmic auditing, inclusive data representation in training datasets, and mechanisms ensuring that technology benefits reach disadvantaged students and schools.

Recommendations for Teacher Education

Teacher education programs should integrate digital and AI competencies across all curricula rather than treating technology as separate specialization. All pre-service teacher education should include substantive preparation in understanding how algorithms work, recognizing algorithmic bias, and making informed choices about when and how to use AI tools pedagogically. Professional development for in-service teachers should move toward sustained, job-embedded learning communities situated in actual practice, with resources enabling teachers to access ongoing learning and to collectively solve problems they encounter implementing technology meaningfully. Teacher education should explicitly address affective and identity dimensions—helping teachers process technological change, maintain professional agency, and articulate enduring contributions of human expertise to education.

Recommendations for Future Research

Future research should include longitudinal studies tracking how AI implementation unfolds in schools over multiple years, examining sustained impacts, adaptation patterns, and unintended consequences. Comparative research examining differential implementation in resource-rich versus resource-constrained schools is critical for understanding equity dynamics. Research from student and family perspectives, examining how students experience AI-enabled learning and whether it affects their engagement and outcomes, remains substantially absent. Research should explicitly examine how AI systems might perpetuate or mitigate biases affecting marginalized students. Finally, research should attend to teacher agency and expertise, examining not merely adoption rates but how teachers navigate tensions between technological possibilities and pedagogical commitments, and how their professional knowledge might be better leveraged in AI system design and implementation.

CONCLUSION

Artificial intelligence presents profound possibilities and significant challenges for education in India. The evidence examined in this research indicates that teacher roles will undoubtedly change in response to AI-enabled technologies—but how they change depends critically on deliberate choices about values, equity, professional development, and governance. The research evidence does not support either techno-optimist narratives that AI will automatically improve teaching and learning or techno-pessimist narratives that technology inevitably degrades education. Instead, the evidence reveals that AI's actual impact depends on how it is designed, implemented, and integrated within systems that support rather than undermine teacher expertise, pedagogical integrity, and equitable educational outcomes.

Indian teachers themselves—as documented in emerging qualitative research—demonstrate thoughtful, nuanced engagement with AI possibilities. Teachers are not resisters to overcome but partners whose expertise, values, and concerns should shape how technology is implemented. They recognize both genuine benefits and legitimate risks. They care deeply about learning outcomes and the human dimensions of education. They navigate inherent tensions between efficiency and holistic development with sophistication and care. The critical question for India's educational future is whether policy and institutional structures will support teachers in leveraging AI as a tool for augmenting their expertise or whether implementation will proceed in ways that marginalize teacher voice, override pedagogical values, and create new inequities.

The path forward requires substantial investment: in school infrastructure, enabling technologies to actually function reliably; in teacher professional development, building competencies for AI integration; in research, deepening understanding of how AI affects actual teaching and learning in Indian contexts; and in governance structures, ensuring that technology decisions serve students and educational values rather than vendor interests or misguided efficiency metrics. It requires explicit attention to equity, including mechanisms ensuring that AI benefits reach disadvantaged students and communities rather than exclusively advantaging already-privileged populations. Most fundamentally, it requires recognizing that educational technology is not primarily a technical problem but a human problem—requiring engagement with what matters in education, what skills and capacities students need, what professional expertise teachers possess, and how technology can serve these human and educational purposes rather than displace them.

As India's education system stands at this technological inflection point, the choices made regarding how AI is integrated into teaching and learning will ripple across millions of students and millions of teachers. These choices should be made deliberately, with evidence, with attention to pedagogy and equity, and with respect for the teachers who ultimately translate policy into lived educational experience. The research examined in this paper suggests that such intentional, values-aligned, teacher-centered approaches to AI integration are both possible and essential for ensuring that technology serves the goal of equitable, excellent education for all Indian students.

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