



REIMAGINING TEACHER EDUCATION FOR THE AGE OF ARTIFICIAL INTELLIGENCE AND HUMAN-CENTRED PEDAGOGY

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Article DOI: <https://doi.org/10.36713/epra31279>

DOI No: 10.36713/epra31279

ABSTRACT

Artificial Intelligence (AI) is rapidly transforming educational practices and challenging conventional understandings of teaching, learning and teacher professionalism. The emergence of generative AI, intelligent tutoring systems, adaptive learning platforms and AI-supported assessment has created new possibilities for improving educational efficiency, personalisation and accessibility, while simultaneously raising concerns related to accuracy, bias, privacy, academic integrity, professional autonomy and human agency. Against this backdrop, the present study explores how teacher education can be reimagined for an AI-intensive educational environment through a human-centred pedagogical perspective. The study adopts a qualitative, review-based approach, drawing upon scholarly literature, systematic reviews, international frameworks and Indian educational policy documents. The findings indicate that teacher education in the AI era requires a broader conception of teacher competence encompassing AI literacy, pedagogical integration, ethical and critical judgement, human-AI collaboration and continuous professional learning. The study further identifies the need to integrate AI across teacher education curricula rather than treating it as an isolated technological component. Based on the synthesis of the reviewed literature, a Human-Centred AI-Integrated Teacher Education Framework is proposed, comprising six interconnected dimensions: human purpose, AI literacy, AI pedagogical integration, ethical governance, professional agency and continuous professional learning. The study argues that AI should augment rather than replace teachers' professional judgement, creativity, relational capacities and ethical responsibility. Reimagining teacher education through this framework can support the development of reflective, technologically capable, ethically responsible and human-centred teachers prepared to navigate the evolving educational landscape.

KEYWORDS: Artificial Intelligence, Teacher Education, Human-Centred Pedagogy, AI Literacy, AI Competency, Teacher Professionalism, Ethical AI, Human-AI Collaboration

1. INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming the social, economic, cultural and educational landscape. In education, AI is no longer limited to experimental applications such as intelligent tutoring systems or automated assessment; generative AI, learning analytics, adaptive platforms, conversational agents and AI-supported content creation are increasingly becoming part of everyday teaching and learning. This transformation has significant implications for teacher education because teachers are no longer working only within a teacher-student relationship. They are increasingly operating within a more complex teacher-AI-student ecosystem in which technological systems can generate content, provide feedback, analyse learning data, personalise learning pathways and support administrative tasks. UNESCO (2024) consequently argues that the emergence of AI requires a reconsideration of the knowledge, skills and values expected of teachers.

The rapid development of generative AI has further intensified this transformation. Large language models can support lesson planning, question generation, formative feedback, differentiation, translation, brainstorming and professional learning. At the same time, they create concerns regarding misinformation, algorithmic bias, privacy, academic integrity, intellectual property, overdependence on automated

systems and the possible weakening of human judgement (Kasneci et al., 2023). AI therefore cannot simply be introduced into teacher education as another technological tool. Its educational value depends on how teachers understand, evaluate, contextualise and ethically employ it.

Teacher education has traditionally sought to develop pedagogical knowledge, subject knowledge, professional identity, classroom management skills, assessment competencies and reflective practice. The technological transformation of education requires these dimensions to be reconsidered rather than discarded. Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) framework demonstrates that effective technology integration requires an interaction among content, pedagogy and technology rather than isolated technological competence. In the AI era, this interaction must be expanded to include AI literacy, ethical reasoning, data awareness, critical evaluation and human-AI collaboration.

The present review-based qualitative study therefore explores how teacher education can be reimagined for an AI-intensive educational environment while retaining human-centred pedagogical values. The central argument is that AI should augment, rather than replace, teachers' professional judgement, relational capacities, creativity and ethical



responsibility. A human-centred approach places human agency, dignity, inclusion, cultural diversity, social-emotional development and learner autonomy at the centre of technological innovation. UNESCO's (2023) guidance similarly stresses that generative AI should be governed and used through an ethical, safe, equitable and meaningful human-centred vision rather than being treated as a technological solution to all educational problems.

Thus, reimagining teacher education does not mean preparing teachers merely to operate AI applications. It means preparing reflective professionals who can determine when AI is educationally appropriate, when human intervention is indispensable, how AI-generated outputs should be evaluated, and how technology can be employed to promote deeper, more inclusive and more humane learning.

2. CONCEPTUAL FRAMEWORK OF THE STUDY

The conceptual framework of the present study is based on the proposition that teacher education in the AI era should be understood as a Human-Centred AI-Integrated Teacher Education Framework. The framework brings together five interconnected dimensions: AI literacy, pedagogical transformation, ethical and critical competence, human agency and continuous professional learning. These dimensions are informed by established theories of teacher knowledge and contemporary international frameworks concerning AI in education.

2.1 AI Literacy as a Foundational Teacher Competence

The first component is AI literacy. In conventional technology-integrated teacher education, digital literacy generally refers to the ability to access, evaluate and use digital information and tools. AI literacy is broader. It requires teachers to understand the basic principles of AI, machine learning, generative AI, data processing, algorithmic decision-making and the limitations of AI-generated outputs. Teachers need not become computer scientists, but they should possess sufficient conceptual knowledge to understand what AI systems can and cannot do.

UNESCO's (2024) AI Competency Framework for Teachers identifies AI foundations and applications as one of five major competency dimensions. The framework describes 15 competencies across human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning, with progression from "Acquire" to "Deepen" and "Create." This progression suggests that teacher education should not treat AI competence as a one-time training programme. Teachers should gradually move from basic understanding to critical application and ultimately to creative and transformative use.

2.2 Pedagogical Transformation

The second dimension is pedagogical transformation. AI becomes educationally meaningful only when integrated with appropriate pedagogical purposes. Mishra and Koehler's (2006) TPACK framework provides an important foundation because it conceptualises effective technology integration as a complex interaction among technological, pedagogical and content knowledge.

In an AI-integrated context, teachers need to determine how AI can support inquiry-based learning, collaborative

learning, project-based learning, differentiated instruction, formative assessment and creative knowledge construction. AI should not simply automate existing teacher-centred practices. Instead, it can create opportunities for teachers to redesign learning experiences around questioning, exploration, feedback, collaboration and problem-solving.

UNESCO's teacher framework similarly emphasises AI pedagogy and AI-enhanced pedagogical innovation. It encourages teachers to critically examine how AI can influence teaching, learning and assessment while protecting human rights, learner autonomy, independent thinking and social relationships.

2.3 Ethical and Critical AI Competence

The third dimension concerns ethics and criticality. AI systems are not neutral. They are developed from datasets, algorithms, institutional priorities and social assumptions. Consequently, AI-generated outputs may reproduce bias, misinformation or cultural stereotypes. Teachers must therefore be able to question the accuracy, fairness, relevance and appropriateness of AI outputs.

Ethical competence includes awareness of privacy, data protection, intellectual property, transparency, accountability, authorship and academic integrity. UNESCO (2023) highlights data privacy, age-appropriate use, ethical validation and pedagogical design as essential elements of responsible generative AI use.

Critical AI competence also involves recognising automation bias—the tendency to accept computer-generated information without adequate verification. Teacher education should therefore train future teachers to compare AI outputs with reliable sources, identify hallucinations and inaccuracies, recognise biased representations and make informed professional decisions.

2.4 Human Agency and Human-Centred Pedagogy

The fourth and central dimension is human agency. The purpose of teacher education is not merely to produce technically competent operators but reflective professionals capable of making pedagogical and ethical judgements. AI should therefore function as an assistant, resource or co-design partner rather than an autonomous replacement for the teacher.

A human-centred approach gives priority to relationships, empathy, care, dialogue, creativity, moral reasoning, cultural responsiveness and learner autonomy. These dimensions are particularly important because teaching is inherently relational. Selwyn (2019) questions simplistic assumptions that automated systems can reproduce the social, emotional, cognitive and ethical qualities of human teachers. The issue is therefore not whether AI can perform certain teaching tasks, but what educational values should govern the delegation of those tasks to machines.

2.5 Continuous Professional Learning

The fifth dimension is lifelong professional learning. AI technologies evolve rapidly, making static teacher-training models inadequate. Teacher education should therefore establish a continuum extending from pre-service preparation to induction, mentoring, continuing professional development and professional learning communities.

UNESCO (2024) explicitly identifies AI for professional learning as a core teacher competency. AI can



support teachers in reflective practice, resource development, professional inquiry and collaborative learning, provided that teachers remain responsible for evaluating and contextualising its outputs.

2.6 Integrated Conceptual Model

The framework can therefore be represented as:

AI Literacy → AI Pedagogical Knowledge → Ethical-Critical Judgement → Human-AI Collaboration → Reflective Professional Practice → Human-Centred Learning Outcomes

These components are not linear. They operate cyclically. Teachers acquire AI knowledge, apply it pedagogically, evaluate its ethical implications, reflect on learner outcomes and continuously modify their practice. The desired outcome is not technological sophistication alone but AI-empowered, ethically responsible, reflective and human-centred teachers.

This framework also aligns with India's National Education Policy (NEP) 2020, which emphasises educational technology, learner-centred and collaborative learning, teacher preparation and professional development. NEP 2020 envisages technological interventions for improving teaching-learning, assessment, access and teacher professional development while also emphasising Indian languages, inclusion and accessibility.

3. REVIEW OF RELATED LITERATURES

Research on AI in education has expanded considerably during the last decade. Early scholarship primarily examined intelligent tutoring systems, adaptive learning and automated assessment. More recent research has broadened the discussion to include generative AI, learning analytics, teacher decision-making, AI literacy and ethical governance.

Holmes et al. (2019) presented AI as a potentially transformative force in education while simultaneously highlighting substantial pedagogical, technical and ethical challenges. Their work suggests that AI should be understood in relation to curriculum, learning sciences and social values rather than as a purely technological innovation.

Celik et al. (2022), in a systematic review of AI research concerning teachers, identified opportunities for AI to support planning, implementation and assessment. AI can help teachers understand learner needs, provide feedback and assist assessment processes. However, the review also demonstrates that teachers have important roles in evaluating and shaping AI systems rather than merely consuming their outputs.

The emergence of generative AI has considerably expanded the debate. Kasneci et al. (2023) examined the opportunities and challenges associated with large language models in education. Their analysis points to possibilities for personalised support, content generation, feedback and innovative educational applications but also identifies concerns involving accuracy, bias, academic integrity and equitable access.

UNESCO's (2023) guidance on generative AI places human capacity and collective educational action above technological determinism. It argues that GenAI should not be treated as a universal solution to fundamental educational challenges and emphasises ethical, safe, equitable and meaningful use.

UNESCO's (2024) AI Competency Framework for Teachers represents an important development because it shifts

the conversation from generic digital skills to clearly articulated AI competencies. Its five dimensions—human-centred mindset, ethics of AI, AI foundations and applications, AI pedagogy, and AI for professional learning—provide a strong foundation for restructuring teacher education.

Recent systematic research also indicates that teacher education itself requires transformation. A 2026 systematic review of GenAI-specific technological pedagogical knowledge identified gaps in teacher educators' preparation and argued that AI literacy should be embedded in teacher education programmes rather than provided as an isolated technical module. Another recent systematic review of AI-integrated professional development found that effective AI preparation should extend beyond technical skills and should cultivate adaptable, innovative and ethically mindful teacher identities.

In the Indian context, NEP 2020 provides a policy foundation for technology-integrated and learner-centred teacher education. It calls for teacher education to incorporate educational technology, collaborative learning and contemporary pedagogical approaches. Nevertheless, the literature indicates a need to move from general educational technology integration towards AI-specific teacher competencies.

Overall, the literature establishes the potential of AI but simultaneously highlights the limitations of technological determinism. A significant gap remains in conceptualising teacher education as a human-centred AI ecosystem in which technical competence, pedagogy, ethics, professional identity and human relationships are integrated.

4. RATIONALE OF THE STUDY

The rationale for the present study emerges from the growing mismatch between the rapid development of AI technologies and the relatively slower transformation of teacher education programmes. Teacher education institutions continue to prepare teachers primarily around established pedagogical knowledge, content knowledge, classroom practice and conventional educational technologies. Although these remain essential, they are insufficient for a context in which AI can generate lesson plans, create assessment items, translate educational materials, provide feedback, analyse learning data and participate in instructional decision-making.

The first rationale is the changing nature of teacher competence. Teachers require more than operational digital skills. They need AI literacy, prompt and interaction skills, data awareness, critical evaluation, ethical judgement and the capacity to integrate AI with subject-specific pedagogy. UNESCO's AI Competency Framework for Teachers confirms that contemporary teacher competence must encompass human-centred thinking, ethics, AI foundations, AI pedagogy and professional learning.

Second, the study is justified by the risk of technological determinism. There is a tendency to assume that introducing AI automatically improves educational quality. However, technology cannot independently resolve problems such as inequity, poor pedagogy, weak teacher preparation or inadequate infrastructure. UNESCO (2023) explicitly cautions against treating GenAI as a solution to education's fundamental problems. Therefore, the educational question should not be



“How can teachers use more AI?” but “How can teachers use AI appropriately to achieve meaningful educational purposes?”

Third, there is a need to protect human agency and professional identity. If teachers become dependent on automated lesson planning, assessment and decision-making, their professional autonomy may gradually weaken. Teacher education should instead prepare teachers to collaborate with AI while retaining responsibility for pedagogical decisions.

Fourth, ethical and social considerations justify the study. AI raises concerns regarding privacy, bias, misinformation, intellectual property, surveillance, unequal access and academic integrity. Future teachers must be prepared to identify these risks and establish responsible practices.

Fifth, the Indian policy context provides strong justification. NEP 2020 emphasises educational technology, learner-centred pedagogy, teacher preparation and professional development. It also recognises the importance of overcoming the digital divide and strengthening teachers' capacity to function effectively in technology-mediated environments.

Finally, the study is needed because teacher education should prepare teachers not simply for the current technological environment but for an uncertain future. AI systems will continue to change. Hence, the most sustainable approach is to develop teachers who can continuously learn, critically evaluate emerging technologies and preserve the human purposes of education.

5. RESEARCH OBJECTIVES OF THE STUDY

The present study aims to critically examine how teacher education can be reconstructed in response to the growing influence of Artificial Intelligence while preserving human-centred pedagogical values. Since the study is qualitative and review-based, the objectives focus on conceptual synthesis, identification of competencies, examination of pedagogical possibilities and formulation of a human-centred framework.

- To examine the changing role and competencies of teachers in the age of Artificial Intelligence.
- To analyse the possibilities of integrating AI into teacher education pedagogy and professional preparation.
- To examine the ethical, social and pedagogical challenges associated with AI integration in teacher education.
- To develop a human-centred conceptual framework for reimagining teacher education in the AI era.

6. RESEARCH QUESTIONS OF THE STUDY

In accordance with the above objectives, the study seeks to address the following research questions:

- What changes in teachers' roles and competencies are necessitated by the emergence of Artificial Intelligence in education?
- How can AI be meaningfully integrated into teacher education pedagogy and professional preparation?
- What major ethical, social and pedagogical challenges arise from the integration of AI into teacher education?
- What human-centred conceptual framework can guide the reimagining of teacher education for an AI-driven educational future?

7. METHODOLOGY OF THE STUDY

The present study adopted a qualitative, review-based research design. It relied exclusively on secondary sources, including peer-reviewed research articles, systematic reviews, scholarly books, policy documents and authoritative reports concerning AI in education, teacher education, AI literacy, educational technology and human-centred pedagogy. Particular attention was given to UNESCO's AI Competency Framework for Teachers, UNESCO's guidance on generative AI, India's National Education Policy 2020, established technology-integration literature and recent systematic reviews concerning AI-integrated teacher education.

The retrieved literature was analysed through qualitative thematic analysis. Relevant literature was examined, compared and synthesised under five broad themes: changing teacher competencies, AI-integrated pedagogy, human-AI collaboration, ethical and social concerns, and continuous professional learning. The analysis did not seek statistical aggregation or meta-analytic effect estimation. Instead, it aimed to identify recurring conceptual patterns, areas of convergence and unresolved concerns in the literature. Findings were subsequently organised according to the four research objectives, and an integrated human-centred framework was developed through conceptual synthesis.

8. OBJECTIVE-WISE FINDINGS OF THE STUDY

Objective 1: To examine the changing role and competencies of teachers in the age of Artificial Intelligence

The review indicates that AI is fundamentally changing the professional role of teachers. In traditional educational settings, teachers have generally been positioned as primary sources of information, instructional designers, classroom facilitators and assessors. The increasing availability of AI changes this configuration because students can now access conversational systems capable of generating explanations, examples, summaries, questions, translations and feedback. Consequently, the teacher's role is gradually shifting from information transmission towards learning design, critical mediation, mentoring, interpretation and ethical guidance.

Celik et al. (2022) demonstrate that AI can support teachers in planning, implementation and assessment. AI can potentially identify learner needs, generate instructional resources and provide rapid feedback. However, these capabilities do not eliminate the need for teachers. Rather, they increase the importance of teachers' capacity to evaluate machine-generated information and determine its educational appropriateness.

The review identifies AI literacy as a foundational competency. Future teachers need to understand the basic characteristics of AI systems, including data dependence, pattern recognition, probabilistic outputs and the limitations of generative models. Without such knowledge, teachers may either overestimate AI capabilities or reject potentially useful applications because of misconceptions.

A second competency is AI pedagogical competence. Teachers need to know not merely how an AI system works but how it can support particular learning outcomes. UNESCO (2024) places AI pedagogy at the centre of its teacher competency framework and emphasises AI-assisted teaching and AI-enhanced pedagogical innovation. Thus, teacher



education should prepare candidates to align AI applications with curriculum objectives, learner characteristics, assessment principles and disciplinary contexts.

A third competency is critical judgement. AI-generated content can be inaccurate, biased or contextually inappropriate. Teachers therefore need verification skills and source-evaluation capabilities. The ability to question AI outputs becomes as important as the ability to generate them.

A fourth competency is ethical competence. Teachers must understand privacy, intellectual property, academic integrity, transparency, algorithmic bias and responsible data use. UNESCO (2024) places ethics of AI alongside AI foundations and pedagogy, reinforcing the argument that technical knowledge cannot be separated from moral responsibility.

A fifth competency concerns human and social-emotional capacities. AI may automate routine tasks, but empathy, encouragement, conflict resolution, moral guidance, relationship building and contextual understanding remain fundamentally human-centred dimensions of teaching. Selwyn (2019) highlights the difficulty of reproducing these qualities through technological systems.

The review therefore finds that the future teacher should be conceptualised as an AI-literate pedagogical designer, ethical decision-maker, learning facilitator, mentor, critical evaluator and human–AI collaborator. The central shift is from “teacher versus AI” to “teacher with AI,” while maintaining teacher accountability for educational decisions.

Objective 2: To analyse the possibilities of integrating AI into teacher education pedagogy and professional preparation

The second objective reveals substantial possibilities for incorporating AI throughout pre-service and in-service teacher education. AI can support teacher candidates before, during and after teaching practice. However, integration should be pedagogically purposeful rather than technology-driven.

One important application is AI-supported lesson planning. Teacher candidates can use AI systems to generate preliminary lesson structures, learning activities, examples and differentiated resources. The pedagogical value lies not in accepting these outputs directly but in critically reviewing, modifying and contextualising them. Such activities can transform lesson planning into a reflective exercise in which teacher candidates learn to evaluate curriculum alignment, learner appropriateness and instructional quality.

A second possibility is differentiated instruction. AI can help generate multiple versions of activities, explanations and learning materials for learners with different levels of prior knowledge. It can also assist teachers in adapting language complexity and providing alternative representations. NEP 2020's emphasis on learner-centred and collaborative learning creates a supportive policy environment for such innovations.

A third possibility is AI-supported assessment. Teachers can use AI to generate question banks, formative assessment prompts, rubrics and feedback suggestions. However, assessment decisions should remain under teacher supervision because AI-generated assessment may contain inaccuracies or inappropriate assumptions.

A fourth area is microteaching and simulation. Teacher candidates can interact with AI systems that simulate learners with different learning needs or classroom situations. Such

simulations can create opportunities for practising questioning, explanation, feedback and classroom decision-making before entering real classrooms.

A fifth possibility is reflective professional learning. Teacher candidates can use AI as a reflective dialogue partner by asking it to critique lesson plans, suggest alternative strategies or identify potential weaknesses. The teacher candidate should then evaluate these suggestions and articulate a professional rationale for accepting or rejecting them.

A sixth area is research and academic writing. AI can assist teacher educators and students in brainstorming, organising ideas, identifying keywords and improving language. Nevertheless, teacher education programmes should establish clear expectations concerning authorship, citation, disclosure and academic integrity. Kasneci et al. (2023) highlight both the productive possibilities and risks associated with large language models in educational contexts.

AI can also support inclusive education through translation, speech-to-text, text simplification and alternative representations. NEP 2020 specifically recognises technology's potential for overcoming language barriers and improving access for learners with disabilities.

The review suggests that AI integration should therefore be embedded across the teacher education curriculum rather than confined to a single “AI in Education” paper. AI should appear in educational psychology, pedagogy, assessment, curriculum studies, educational technology, inclusive education, research methodology and teaching practice.

The most important finding is that AI should be introduced through co-design and critical reflection. Teacher candidates should experience cycles of planning with AI, testing ideas, evaluating outputs, reflecting on consequences and revising practice. Recent research on teacher–AI co-design similarly indicates growing interest in collaboration between teachers and AI for learning-task design.

Thus, AI can become a pedagogical partner in teacher education when it expands teachers' capacity for creativity, differentiation, inquiry and reflection rather than replacing professional judgement.

Objective 3: To examine the ethical, social and pedagogical challenges associated with AI integration in teacher education

The third objective reveals that AI integration produces substantial challenges that teacher education must explicitly address. The first challenge is accuracy and reliability. Generative AI systems can produce convincing but incorrect information. If teacher candidates accept AI-generated responses uncritically, misinformation may enter instructional materials. Therefore, verification and source triangulation must become essential professional practices.

The second challenge is algorithmic bias. AI systems are trained on data that may contain social, linguistic, cultural or gender biases. Consequently, AI-generated examples, recommendations or assessments may unintentionally privilege certain groups or reproduce stereotypes. Teacher education should prepare future teachers to recognise such biases.

The third challenge is privacy and data protection. AI-based educational platforms may process student information, behavioural data or personal interactions. UNESCO (2023) identifies data privacy as a major concern and recommends a



human-centred regulatory approach. Teachers must therefore understand what data are collected, how they are stored, who can access them and what risks may arise.

The fourth challenge is academic integrity. Generative AI can produce essays, assignments, lesson plans and other academic outputs. This complicates traditional assessment because a completed product may not accurately represent the learner's own knowledge. Teacher education must therefore prepare future teachers to redesign assessment around process, oral defence, reflection, project work, authentic performance and evidence of learning.

The fifth challenge is digital inequality. AI access is uneven. Differences in devices, connectivity, paid subscriptions, language support and institutional infrastructure may create new forms of educational inequality. NEP 2020 recognises that technological benefits cannot be fully realised without addressing the digital divide and strengthening teacher capacity.

The sixth challenge is overdependence and deskilling. Excessive reliance on AI may reduce teachers' engagement with lesson planning, assessment design and independent reasoning. If teachers routinely accept AI-generated solutions, professional knowledge may become increasingly dependent on external systems.

The seventh challenge is teacher identity and autonomy. The introduction of AI can generate anxiety about professional displacement. A human-centred model should therefore frame AI as an augmentation technology rather than a replacement mechanism. Selwyn (2019) argues for careful consideration of the values and choices surrounding technological integration rather than assuming that automation is inherently desirable.

The eighth challenge is cultural and linguistic relevance. AI-generated content may privilege dominant languages and cultural perspectives. In multilingual contexts such as India, teacher education must emphasise contextualisation and validation of AI-generated materials.

Finally, there is the challenge of ethical ambiguity. Not every technically possible use of AI is educationally desirable. Teachers need professional frameworks for deciding when AI should be used, when it should be limited and when human interaction should remain central.

The review therefore finds that responsible AI integration requires an explicit ethical architecture involving privacy protection, transparency, accountability, fairness, human oversight, accessibility and professional autonomy.

Objective 4: To develop a human-centred conceptual framework for reimagining teacher education in the AI era

The fourth objective synthesises the preceding findings into a human-centred framework. The review suggests that effective teacher education for the AI era should operate through six interconnected layers: Human Purpose, AI Literacy, Pedagogical Integration, Ethical Governance, Professional Agency and Continuous Learning.

The first layer, Human Purpose, establishes the foundation. Every AI application should be evaluated according to educational values such as learner development, inclusion, dignity, autonomy, creativity, social-emotional growth and democratic participation. Technology is therefore subordinate to educational purpose.

The second layer is AI Literacy. Teacher candidates need foundational knowledge of AI, generative AI, data, algorithms and system limitations. This provides the cognitive foundation for informed use.

The third layer is AI Pedagogical Integration. Teacher candidates should learn to integrate AI into lesson planning, differentiated instruction, assessment, inquiry, project-based learning, collaborative learning and feedback. This layer extends the logic of TPACK by placing AI within a broader pedagogical context. Mishra and Koehler (2006) emphasise the situated interaction among technology, pedagogy and content; the AI era requires this interaction to be complemented by ethical and human-centred judgement.

The fourth layer is Ethical Governance. Teacher education institutions should establish principles concerning privacy, academic integrity, transparency, bias, authorship, accessibility and responsible use. Teachers should be able to identify ethical dilemmas and justify decisions.

The fifth layer is Professional Agency. Teachers must remain responsible for instructional decisions. AI may provide suggestions, but the teacher decides whether those suggestions are educationally appropriate. This principle preserves professional autonomy and prevents automation from becoming the dominant logic of education.

The sixth layer is Continuous Professional Learning. Because AI is continuously evolving, teacher education must become a lifelong process. Pre-service teachers should develop habits of experimentation, reflection, peer learning and professional updating.

The proposed framework can therefore be conceptualised as:

Human Purpose → AI Literacy → AI Pedagogical Integration → Ethical Governance → Professional Agency → Continuous Professional Learning → Improved Human-Centred Learning

The cycle is iterative. Professional learning continuously enriches AI literacy; AI literacy improves pedagogical integration; pedagogical experiences generate ethical questions; ethical reflection strengthens professional agency; and professional agency ensures that human purposes remain central.

This framework is consistent with UNESCO's five-dimensional AI competency model and its progression from acquiring foundational knowledge to deepening competence and creating new practices. It also corresponds with India's policy emphasis on educational technology, teacher preparation, professional development and learner-centred pedagogy.

The framework ultimately proposes a new professional identity: the human-centred AI educator. Such a teacher is technologically capable but not technologically dependent; innovative but ethically cautious; data-informed but context-sensitive; efficient but relational; and open to AI while firmly committed to human dignity and educational purpose.

9. DISCUSSION OF THE STUDY

The findings demonstrate that the future of teacher education should not be framed as a competition between human teachers and artificial intelligence. Instead, the central issue is the design of an appropriate relationship between teachers, learners and AI systems. The emergence of AI



changes what teachers need to know, but it does not eliminate the fundamental purposes of teaching.

The first major implication concerns the redefinition of teacher knowledge. TPACK established that meaningful technology integration depends upon the interaction of content, pedagogy and technology. AI requires this model to become more critically oriented because AI systems do not simply deliver technology; they generate information, make recommendations and participate in knowledge production. Teachers must therefore evaluate not only whether a technology works but also whether its output is accurate, ethical and educationally appropriate.

Second, the findings support a shift from tool-centred to pedagogy-centred AI integration. AI should not be incorporated merely because it is innovative. Its use should be justified by learning outcomes. For example, AI-generated content is useful only when it contributes to deeper understanding, creativity, inquiry or accessibility. UNESCO's human-centred guidance strongly supports this principle by placing human capacity and educational values above technological enthusiasm.

Third, the findings emphasise the importance of professional judgement. AI can generate options but cannot fully understand the social and emotional context of a classroom. Teachers interpret learner behaviour, recognise emotional needs, understand community contexts and negotiate interpersonal relationships. These dimensions make teachers indispensable even when AI becomes highly capable.

Fourth, teacher education must move towards ethical AI literacy. Technical training without ethical reasoning could produce highly efficient but irresponsible users. UNESCO's framework's inclusion of human-centred mindset and ethics alongside technical and pedagogical competencies is therefore particularly significant.

Fifth, the study has implications for curriculum restructuring. AI should not be restricted to a separate technology paper. Its principles should permeate pedagogy, assessment, curriculum studies, educational psychology, inclusive education, research and teaching practice. Teacher candidates should repeatedly encounter AI-related ethical and pedagogical questions across the programme.

Sixth, the findings support a new model of assessment in teacher education. If AI can produce polished written assignments, teacher educators need greater emphasis on authentic assessment. Lesson demonstrations, reflective journals, oral presentations, classroom simulations, project work, teaching portfolios and viva-based assessment can provide stronger evidence of professional competence.

Seventh, the findings highlight the importance of teacher educators. Teacher educators themselves need AI competencies. Recent systematic research indicates that teacher education programmes require stronger GenAI-specific technological pedagogical knowledge and institutional support. Therefore, institutional AI readiness should accompany student-teacher preparation.

Finally, the study suggests that India's NEP 2020 provides an enabling policy foundation. Its emphasis on educational technology, teacher development, learner-centred pedagogy, digital infrastructure and inclusive access is compatible with a human-centred AI strategy. However, implementation requires institutional investment, teacher

preparation, ethical guidelines, infrastructure and continuous evaluation.

Overall, the discussion indicates that AI should be understood as a professional augmentation technology. Its greatest educational contribution may not be replacing teacher functions but freeing teachers from selected routine tasks so that greater attention can be devoted to mentoring, creativity, inquiry, inclusion, dialogue and human development.

10. CONCLUSION

Artificial Intelligence is redefining the conditions under which teaching and teacher education take place. Its ability to generate content, analyse information, provide feedback, personalise learning and support professional tasks creates significant opportunities for teacher education. However, these opportunities cannot be realised through technological adoption alone. They require a fundamental reconsideration of what it means to prepare a teacher for an AI-mediated educational environment.

The present qualitative review demonstrates that future teachers require a combination of AI literacy, pedagogical competence, ethical awareness, critical judgement, professional agency and lifelong learning capacity. AI should be integrated into teacher education not as an isolated technological subject but across curriculum, pedagogy, assessment, teaching practice and professional development. The teacher's role should evolve from information provider towards learning designer, facilitator, mentor, critical evaluator, ethical decision-maker and human-AI collaborator.

The study further establishes that a human-centred approach must remain the normative foundation of AI integration. Human agency, dignity, inclusion, creativity, cultural diversity, social-emotional development and learner autonomy should not be compromised in the pursuit of technological efficiency. UNESCO's AI competency framework reinforces this orientation by placing human-centred mindset and ethics alongside AI foundations, pedagogy and professional learning.

The proposed Human-Centred AI-Integrated Teacher Education Framework consequently places human purpose at the centre and AI capability around it. Such an approach rejects both technological rejection and technological determinism. It recognises AI as a powerful educational resource while retaining teachers as responsible professionals.

The future teacher, therefore, should not be imagined as a competitor to AI but as an AI-literate, ethically grounded and human-centred professional who knows when, why and how to collaborate with intelligent technologies. Reimagining teacher education in this way can enable education systems to benefit from AI without losing the relational, moral and developmental purposes that make education fundamentally human.

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