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INTEGRATING ARTIFICIAL INTELLIGENCE IN TEACHER EDUCATION: A STUDY ON PEDAGOGICAL APPLICATIONS AND PSYCHOLOGICAL WELL-BEING IN THE CONTEXT OF NEP 2020

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Abstract:
Artificial Intelligence advancements are reshaping teacher education worldwide by introducing intelligent digital tools for instruction, assessment, and professional development. In India, where educational reform increasingly emphasizes technology integration, this study investigates how emerging digital technologies are being incorporated into teacher education institutions and how their adoption influences teaching practices, professional roles, and the psychological experiences of individuals involved in teacher preparation. By examining both instructional outcomes and psychological responses, the study seeks to understand the benefits of technological integration alongside potential concerns related to stress, performance expectations, and adaptation challenges. This perspective recognizes that innovation in education must be evaluated not only in terms of efficiency and learning outcomes but also in relation to the well-being of educators and learners. The study further examines how institutional practices correspond with national policy goals while identifying barriers that affect responsible implementation.

The research pursued three primary objectives: to identify patterns and extent of technology use in teacher education institutions, to examine perceived instructional advantages and implementation difficulties, and to analyze psychological responses among different stakeholder groups. A mixed-methods research design was adopted. The sample consisted of 120 participants drawn from selected teacher education institutions, including 50 teacher educators, 50 student teachers, and 20 administrators. Participants were selected through purposive stratified sampling to ensure representation across institutional roles. Quantitative data were collected using a structured questionnaire measuring usage patterns, perceived effectiveness, psychological well-being, and policy alignment. Qualitative insights were obtained through semi-structured interviews exploring training experiences, ethical considerations, and perceptions of technology integration.

The findings reveal that a large proportion of participants reported regular use of digital tools for lesson preparation, assessment processes, and feedback delivery, with many respondents perceiving improvements in instructional efficiency. Psychological responses were varied: some participants reported reduced workload and stress, while others indicated increased anxiety associated with monitoring and performance expectations. Major implementation challenges included limited access to systematic training opportunities and concerns regarding data protection and ethical responsibility. Despite these issues, most participants perceived general alignment between institutional practices and national reform priorities, although gaps in implementation remain evident.

The study concludes that AI integration can strengthen teacher preparation by enhancing efficiency and feedback processes. However, meaningful and sustainable adoption requires structured professional development, clear ethical safeguards, and consistent institutional support. Policy initiatives should therefore focus on capacity development, protection of data privacy, and collaborative participation of educators and learners in decision-making processes.

Keywords: Artificial Intelligence, Teacher Preparation, Instructional Effectiveness, Psychological Well-Being

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I. INTRODUCTION

The rapid advancement of artificial intelligence is reshaping how knowledge is delivered, assessed, and managed in education globally. International bodies note that AI can expand access, personalise learning, automate routine assessment tasks, and support data-driven decision-making, while also raising ethical, privacy, and governance questions that require policy attention (UNESCO).In the context of India, national policy explicitly promotes the wider use of digital technologies across the education system and identifies technology-enabled learning, assessment, and administration as strategic priorities — a direction set out by the National Education Policy 2020 (National Education Policy 2020). The policy calls for strengthening teacher preparation so educators develop the digital competencies and ethical awareness needed to implement these tools responsibly.

The growing presence of Artificial Intelligence (AI) in education has initiated significant changes in how teaching, learning, and professional preparation are organized across the world. Intelligent digital systems are increasingly used to support instructional design, automate assessment processes, personalize learning pathways, and generate real-time feedback for both educators and learners. These developments signal a transition from technology as a supplementary aid to technology as an active partner in educational processes. Within teacher education, this shift is especially significant because it influences not only how future teachers learn but also how they conceptualize teaching, assessment, and professional responsibility.

In India, educational transformation is closely linked to national efforts aimed at expanding access, improving quality, and promoting equity through digital innovation. The National Education Policy 2020 identifies technology integration as a strategic priority for strengthening teacher preparation programmes and preparing educators for rapidly evolving learning environments. The policy framework emphasizes the development of digital competencies, ethical awareness, and adaptive professional skills among educators, while also acknowledging the importance of holistic development and professional well-being. As teacher education institutions respond to these policy directions, AI-enabled tools are gradually being incorporated into teaching practice, training modules, and institutional administration.

AI applications in teacher education now include adaptive learning platforms that tailor content to learner needs, automated evaluation systems that assist in assessment and feedback, virtual teaching simulations that provide practice-based learning environments, and generative content tools that support lesson planning and instructional material development. These technologies offer clear pedagogical advantages. They can enhance instructional efficiency, support differentiated learning, provide timely feedback, and reduce routine administrative workload. By facilitating data-informed decision-making, AI systems also enable teacher educators and student teachers to monitor learning progress more systematically and refine teaching strategies based on evidence.

However, alongside these pedagogical opportunities, AI integration introduces new psychological and professional dynamics within teacher preparation contexts. The increasing use of data-driven monitoring systems, algorithmic evaluation mechanisms, and continuous performance tracking may reshape perceptions of accountability, autonomy, and professional competence. While some educators experience relief from repetitive tasks and greater instructional support, others report heightened performance pressure, uncertainty regarding ethical use of technology, and concerns related to data privacy and surveillance. These experiences suggest that technological adoption is not merely a technical process but also a human and institutional transformation that influences motivation, confidence, and well-being.

Existing scholarship on educational technology has largely focused on the effectiveness of digital tools or on educators' attitudes toward technology adoption. Comparatively fewer studies have examined the combined pedagogical and psychological implications of AI integration within teacher education. This gap is particularly relevant in contexts where policy initiatives strongly promote technological adoption but institutional readiness, professional training, and ethical governance structures continue to evolve. Understanding how AI shapes both instructional practices and psychological experiences is therefore essential for ensuring that technological innovation contributes to sustainable and human-centered educational development.

Teacher education institutions have begun adopting AI-supported tools by using adaptive platforms, automated evaluation systems, virtual teaching simulations, and generative content services to help with lesson design, formative assessment, and feedback. These tools can reduce routine workload and improve the timeliness and specificity of instructional guidance; however, they also introduce new institutional dynamics such as continuous performance monitoring, algorithmic feedback loops, and data-management responsibilities that may increase anxiety, raise questions about professional autonomy, and create data-privacy risks for both teacher-educators and student-teachers. International guidance stresses that these technical benefits must be balanced with teacher training, ethical safeguards, and governance frameworks.

Despite policy momentum, recent reviews and policy analyses indicate a gap in systematic empirical work that simultaneously examines instructional effectiveness and the psychological consequences of AI adoption in teacher preparation programmes. Much of the literature to date treats technological capability and teacher attitudes separately, so there is a pressing need for mixed-method research that documents actual classroom and institutional practices, measures impacts on educator well-being, and evaluates alignment with policy goals to ensure human-centred, equitable implementation. The present study examines the integration of Artificial Intelligence in teacher education as a multidimensional phenomenon that encompasses pedagogical transformation, institutional adaptation, and human experience. By exploring both instructional applications and psychological outcomes within the framework of national policy priorities, the study seeks to generate empirical insights that can inform responsible implementation, professional capacity building, and well-being-oriented educational reform.

II. REVIEW OF RELATED LITERATURE

The expanding role of artificial intelligence in enhancing instructional planning, formative assessment, and learner engagement **(Holmes et al., 2019)**. AI-supported feedback systems facilitate reflective teaching practices and enable data-informed instructional decisions. AI tools contribute to efficiency by reducing administrative workload associated with lesson planning and assessment processes.Despite these pedagogical advantages, critical concerns accompany AI integration in education. **Zawacki-Richter et al. (2019)** highlight ethical challenges such as surveillance risks, algorithmic bias, and data privacy issues. Complementary research on digital monitoring technologies indicates that increased technological oversight may contribute to stress, performance anxiety, and techno-stress among educators, highlighting the psychological dimensions of AI adoption.

The conceptual work by **Nur Fitria (2021)** identified AI's potential to support automated assessment, personalized learning systems, and administrative automation. However, this work primarily emphasized technological functionalities rather than examining teachers' cognitive engagement or psychological well-being. **Viberg et al. (2023)**, through an international survey of over 500 K–12 teachers across six countries, found that teacher self-efficacy and understanding of AI significantly predicted trust and adoption, underscoring the importance of psychological and professional readiness in AI integration.

Wang et al. (2024) identified diverse AI applications in education, including adaptive learning, intelligent assessment, and predictive analytics. While the review documented extensive research on functional and instructional impacts, it also revealed limited attention to teacher professional development and well-being. **Saharuddin et al. (2025)** highlighted the complexity of integrating AI within the Technological Pedagogical Content Knowledge (TPACK) framework, emphasizing the need for both conceptual understanding and practical competence to ensure sustainable implementation. The qualitative evidence from **Tripathi et al. (2025)** indicates that although teachers recognize AI's efficiency and instructional support, concerns persist regarding over-dependence, erosion of critical thinking, and gaps in ethical literacy. These findings suggest that AI adoption is not merely a technological shift but also a transformation in teachers' professional identity and pedagogical agency.

National Education Policy (2020) advocates digital transformation while emphasizing human-centric implementation. However, empirical research examining AI's psychological implications for teacher educators and student teachers remains limited.

Therefore, the present study addresses this gap by examining the pedagogical applications of AI in teacher education, psychological well-being implications of AI integration and institutional alignment with NEP 2020

Research Gap

Much of the current literature emphasizes technological capabilities, student learning outcomes, adaptive learning platforms, and automated assessment systems. Although these studies demonstrate the instructional use of AI, they provide limited insight into its implications for teacher preparation programmes.Empirical investigations of AI integration within teacher education institutions remain unusual, especially within the Indian educational system. The research is mostly conceptual and technology-focused, withfew mixed-method studies examining educators lived experiences with AI. The psychological consequences of AI adoption including techno-stress, anxiety associated with data-driven monitoring having concerns related to professional identity, and broader mental well-being have received inadequate consideration. Research has largely prioritized student outcomes, leaving educator well-being comparatively underexplored.There is also limited research examining AI integration in relation to national education policies such as NEP 2020. While the policy advocates digital advancement alongside holistic teacher development, empirical studies assessing the alignment between AI practices and policy objectives remain minimal. Issues such as ethical governance, institutional preparedness, structured professional training, and human-centered AI implementation have not been comprehensively addressed. There is a need for policy-aligned, mixed-method research that investigates pedagogical applications of AI and their psychological implications within teacher education institutions. Addressing this gap is vital for developing sustainable, ethically responsible, and human-centered frameworks for AI integration consistent with the vision of NEP 2020.

Need and Significance of Study

The integration of Artificial Intelligence (AI) into education is transforming teaching–learning processes, assessment practices, and institutional governance across the world. Teacher education occupies a critical position in the educational ecosystem, as it shapes the competencies, beliefs, and attitudes of future educators. The professional demands placed on teachers by AI including continuous upskilling, adaptation tofeedback systems, and accountability through digital monitoring have not been adequately examined within teacher

preparation contexts.The lack of attention to teacher education also directs the psychological dimensions of AI adoption. Issues such as techno-stress, anxiety related to performance analytics, concerns about professional autonomy, and uncertainty regarding long-term career relevance may significantly influence teachers' readiness to adopt AI-supported pedagogies. Without systematic investigation into these factors, teacher education programmes risk emphasizing technical proficiency at the expense of educator well-being and reflective professional growth. The imbalance in prevailing research emphasizes the need for a deeper and more holistic examination of AI integration in teacher education moves beyond technical efficiency and student outcomes to address pedagogical transformation, professional development, and the psychological well-being of educators.

Teacher educators and student teachers occupy a pivotal position in shaping future classroom practices; therefore, understanding how AI influences their pedagogical approaches and psychological well-being has become an urgent academic and policy concern. The need of the study arises from the developing nature of pedagogical practice in technology-mediated learning situations. AI-driven tools are increasingly used for instructional planning, automated feedback, adaptive learning pathways, and data-informed decision-making. These developments require teachers not only to acquire technological competence but also to understand their instructional roles, professional identity, and pedagogical autonomy. Teacher education institutions mustprepare educators who can critically evaluate AI tools, integrate them meaningfully into curriculum design, and maintain human-centered pedagogical relationships. However, existing literature provides limited empirical evidence on how teacher education programmes are responding to these emerging demands.Teachers may experience techno-stress, anxiety related to performance tracking, concerns about professional relevance, and uncertainty regarding ethical responsibilities in AI-mediated environments. These psychological dimensions influence teacher motivation, instructional quality, and long-term professional sustainability. Despite their importance, such factors remain underexplored in empirical research, particularly within teacher preparation contexts.

The study is also essential to examine institutional readiness for AI integration. Successful implementation of AI in education depends not only on technological availability but also on policy alignment, professional training frameworks, ethical governance mechanisms, and organizational support systems. Teacher education institutions must develop structured capacity-building initiatives that enhance technological pedagogical competence while safeguarding educator well-being. Yet, there is insufficient research investigating whether institutional structures adequately support balanced and responsible AI adoption.

This study is significant in several ways as it contributes to theoretical understanding by integrating perspectives from educational technology, teacher cognition, and psychological well-being within a unified analytical framework. By examining both pedagogical applications and psychological outcomes, the research moves beyond technology-centric approaches and offers a more comprehensive understanding of AI's impact on teacher education.

The study also contributes to policy discourse by examining the alignment between AI integration practices and national educational priorities. By generating context-specific evidence, the research supports informed decision-making regarding curriculum design, regulatory frameworks, and ethical standards for AI use in teacher preparation.

The present study addresses a critical gap by systematically investigating how AI integration shapes pedagogical practices and psychological well-being within teacher education institutions. Its findings are expected to support the development of sustainable, ethically grounded, and human-centered frameworks for AI adoption that strengthen teacher preparedness and institutional effectiveness in contemporary educational contexts.

Statement of the Problem

"Integrating Artificial Intelligence in Teacher Education: A Study on Pedagogical Applications and Psychological Well-Being in the Context of NEP 2020."

Operational Definitions of Key Terms Used:

1. Artificial Intelligence (AI)

In this study, Artificial Intelligence refers to digital systems and applications that simulate intelligent functions such as content generation, adaptive learning, automated assessment, and data-based feedback. AI is operationally measured through participants' reported use of AI-enabled tools for lesson planning, evaluation, feedback, and instructional support within teacher education institutions.

2. Teacher Education Institutions
Teacher education institutions refer to formal higher education organizations that prepare preservice teachers through structured training programmes. For this research, the term includescolleges and universities in India offering teacher preparation programmes aligned with nationalpolicy expectations.

3. Pedagogical Applications of AI
Pedagogical applications of AI denote the instructional uses of AI technologies in teaching-learning processes. These include AI-supported lesson design, adaptive content delivery, automated evaluation, feedback generation, and classroom simulation training. This variable is measured through questionnaire items assessing frequency, purpose, and perceived instructional usefulness of AI tools.

4. Psychological Well-Being
Psychological well-being refers to participants' perceived mental and emotional state in relation to AI integration in teacher education. It includes experiences of stress, anxiety, workload perception, confidence, and professional comfort. This construct is measured through self-reported responses regarding emotional impact, stress levels, and perceived pressure associated with AI use.

5. Teacher Educators
Teacher educators are faculty members responsible for training and mentoring student teachers in teacher education programmes. In this study, they are participants who report their experiences of integrating AI into instructional and evaluative practices.

6. Student Teachers
Student teachers refer to individuals enrolled in teacher education programmes who arepreparing for professional teaching roles. Their responses represent experiences of learning,assessment, and training within AI-supported educational environments.

Research Objectives of the study
1. To examine the extent of AI usage in selected teacher education institutions of Jammu district.
2. To analyze perceived pedagogical benefits of AI integration in selected teacher education institutions of Jammu district.
3. To assess the psychological impact of AI on teacher educators and student teachers.
4. To identify challenges related to training, ethics, and implementationin selected teacher education institutions of Jammu district.
5. To evaluate alignment of AI practices with NEP 2020 provisions in selected teacher education institutions of Jammu district.

Research Questions of the study
1. What is the level of AI usage in selected teacher education institutions of Jammu district?
2. How do stakeholders perceive AI's pedagogical benefits in selected teacher education institutions of Jammu district?
3. What psychological effects are associated with AI integration in selected teacher education institutions of Jammu district?
4. What challenges hinder effective implementation?
5. To what extent does AI integration align with NEP 2020?

Research Design of the study
A mixed-method research design was adopted, quantitative as well as qualitative approach was used by the investigators.By integrating both approaches, the mixed-method design ensured **triangulation of data**, enhancing the validity and reliability of the findings.

Sample of the study
The sample for the present study consisted of 120 participants drawn from ten teacher education institutions located in Jammu district. These institutions were selected to ensure adequate representation of diverse organizational settings within the teacher education sector. The participants included teacher educators and student teachers who were actively engaged in academic and instructional activities at the time of data collection.

A random sampling technique was employed to select the participants, providing each eligible individual an equal chance of inclusion in the study.

Sample Profile

Participants	Sample taken
Teacher Educators:	50
Student Teachers	50
Administrators	20
Total	**120**

Tools Used

- AI Integration and Psychological Well-Being scale (AIPWS-TE) developed by the researcher(Dimensions; AI Usage Patterns, Pedagogical Applications, Psychological Well-Being Indicators & Alignment with NEP 2020).
- Semi-structured interview schedule constructed by the investigators.

Data Analysis

- Quantitative data were analyzed by using percentage method.
- Qualitative data were analyzed using contentanalysis.

Major Findingsof the study

- Majority of respondents (80%) reported regular use of AI tools for instructional planning and assessment. AI usage is widespread but largely practice-driven rather than policy-driven. Integration is functional but lacks systematic institutional support.
- Majority of respondents (78%) perceived AI as enhancing teaching efficiency. AI is strongly perceived as a pedagogical enhancer, particularly in efficiency, personalization, and assessment practices. Pedagogical impact is predominantly positive.
- Findings revealed mixed outcomes as 44% respondents reported AI reduced academic stress and participants indicated improved work efficiency.
- 61% reported increased anxiety due to continuous performance monitoring. Findings revealed that AI demonstrates a dual psychological effect; It reduces workload related stress as well as it increases performance related anxiety and techno-stress.
- 66% respondents identified lack of structured AI training. Participants noted absence of institutional guidelines, infrastructure limitations, need for professional development.Implementation challenges are significant and may contribute to anxiety levels. Ethical and governance frameworks remain underdeveloped.
- 74% respondents acknowledged AI integration aligns with NEP 2020's vision of digital empowerment.

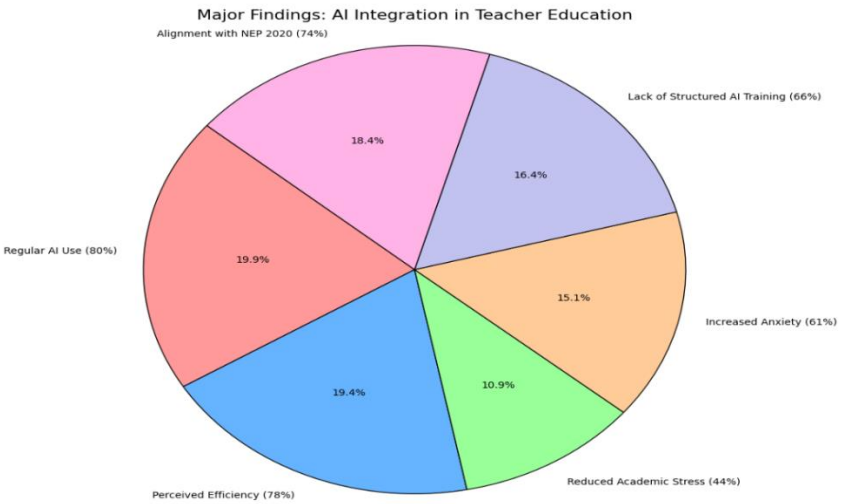

Fig.1.1.Pie chart representing the major findings of study on AI integration in teacher education.

Fig 1.1. illustrates that AI adoption in teacher education is widespread, with a majority of respondents actively using AI tools for instructional planning, assessment, and personalized learning. The high percentages related to regular use (80%) and perceived efficiency (78%) indicate that teachers recognize AI as a significant pedagogical enhancer that supports teaching effectiveness and streamlines classroom practices.At the same time, the pie chart highlights critical challenges associated with AI integration. While 44% of respondents reported reduced academic stress, a substantial proportion (61%) experienced increased anxiety, suggesting a dual psychological impact of AI reducing workload-related stress but introducing performance monitoring pressures and techno-stress. Additionally, 66% of participants noted a lack of structured training and institutional support, reflecting gaps in professional development, infrastructure, and clear guidelines.Despite these challenges, 74% of respondents acknowledged alignment with NEP 2020, indicating that AI integration is consistent with national policy objectives aimed at digital empowerment and innovation in teacher education. Overall, the figureunderscores the need for strengthened policy, ethical frameworks, and systematic institutional support to ensure that AI adoption is not only effective but also sustainable and psychologically supportive for educators.

Content Analysis of the study

The content analysis reveals that the integration of Artificial Intelligence (AI) in teacher education is perceived as a transformative development. Participants across categories; teacher educators, student teachers, and administrators expressed predominantly positive attitudes toward AI's pedagogical contributions, while simultaneously articulating psychological and ethical concerns.

Interview reflects that AI is widely recognized as a tool that enhances instructional planning, assessment practices, personalized learning, and professional efficiency. Participants highlighted its ability to reduce routine workload, support reflective teaching, and facilitate data-informed decision-making. These insights affirm AI's pedagogical relevance and its alignment with the digital empowerment vision of NEP 2020.

However, the qualitative data also uncover a parallel discourse of psychological ambivalence. While some participants reported reduced stress due to automation of routine tasks, many expressed anxiety associated with continuous performance monitoring, data-driven evaluation systems, rapid technological change, and uncertainty about professional autonomy. Techno-stress, fear of replacement, and adaptation pressure emerged as significant emotional undercurrents. These findings suggest that AI's psychological impact is dual in nature both empowering and pressurizing.

Respondents more stressed on a human-centric approach. AI was consistently viewed as a supportive instrument rather than a replacement for pedagogical judgment, empathy, and human interaction. Participants supported for balanced integration that preserves teacher autonomy, safeguards mental well-being, and ensures ethical accountability.

Overall, AI in teacher education holds significant transformative potential, but its sustainability depends on structured professional development, ethical governance mechanisms, institutional support systems, and alignment with the holistic vision of NEP 2020. The success of AI integration is not determined solely by technological capability but by the extent to which it supports pedagogical effectiveness while protecting the psychological well-being of educators.

III. DISCUSSION OF RESULTS OF STUDY

The findings suggest that AI integration significantly enhances pedagogical efficiency, consistent with global research emphasizing automation and personalization benefits. However, psychological findings reveal a dual effect. While AI reduces workload in some domains, it simultaneously increases anxiety related to monitoring and accountability.

The results highlighted the importance of a human-centric approach. NEP 2020 emphasizes holistic development and teacher well-being; therefore, AI adoption must balance efficiency with emotional sustainability.The absence of structured training and ethical guidelines may amplify anxiety and resistance. Institutional support systems are critical to successful implementation.

Educational Implications of the study

The findings of the study suggest that Artificial Intelligence (AI) has likely to enhance the quality of teacher education when integrated thoughtfully and systematically. AI-enabled tools can strengthen instructional planning, assessment practices, personalized learning, and reflective teaching. Therefore, teacher education programmes should formally incorporate AI literacy and digital pedagogy modules into B.Ed. and M.Ed. curricula to prepare future educators for technology-driven classrooms.At the institutional level, structured professional development is essential. Regular training workshops, hands-on practice sessions, and guided exposure to ethical AI use can reduce techno-stress and build professional confidence. Institutions must move

beyond informal adoption and establish clear policies, guidelines, and support systems to ensure responsible and effective AI integration.

The study also highlights the importance of safeguarding psychological well-being. While AI improves efficiency, it may increase anxiety due to monitoring and data-driven evaluation. Hence, teacher education institutions should adopt a human-centric approach, ensuring that AI functions as a supportive tool rather than a performance-control mechanism. Counseling support, mental health awareness, and balanced workload policies are crucial.Finally, aligning AI integration with the vision of NEP 2020 requires a holistic framework that combines technological innovation with ethical governance and teacher empowerment. AI should promote competency-based education, digital empowerment, and professional autonomy while preserving the central role of human judgment and empathy in teaching.

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