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# Teacher education and professional development for AI integration

**Dr Suman Jangra**
**Associate Professor in Commerce**
**Shaheed Smarak Govt P.G College, Tigaon (Faridabad)**

**Abstract**

The integration of Artificial Intelligence (AI) into education is reshaping teaching practices, learning environments, and administrative workflows. This study explores the role of teacher education and professional development in facilitating effective AI adoption in classrooms. Drawing on surveys and case studies, findings reveal that while many educators are aware of AI tools, few feel confident using them due to limited training and resources. The research highlights a significant correlation between targeted professional development and increased teacher confidence and competence in AI integration. It emphasizes the need for continuous, personalized, and pedagogically aligned training programs that incorporate technological, content, and instructional knowledge—echoing the principles of the TPACK framework. Ethical considerations, such as data privacy and algorithmic bias, are also discussed as critical components of responsible AI use in education. Studies show that while a growing number of educators are aware of AI's potential, only a small fraction feel confident using these tools in their teaching practices. This gap underscores the urgent need for robust teacher education and professional development programs that not only introduce AI technologies but also cultivate the pedagogical and ethical competencies required to use them responsibly.

## Introduction and Background

Artificial Intelligence (AI) is rapidly transforming the landscape of education, offering unprecedented opportunities to personalize learning, automate administrative tasks, and enhance instructional delivery. From adaptive learning platforms and intelligent tutoring systems to automated grading and predictive analytics, AI tools are becoming increasingly embedded in classrooms across the globe. However, the successful

integration of these technologies hinges not on the tools themselves, but on the educators who wield them.

Teachers are the linchpins of educational innovation, yet many face significant challenges in adopting AI effectively. Studies show that while a growing number of educators are aware of AI's potential, only a small fraction feel confident using these tools in their teaching practices. This gap underscores the urgent need for robust teacher education and professional development programs that not only introduce AI technologies but also cultivate the pedagogical and ethical competencies required to use them responsibly.

The integration of AI demands a shift in teacher preparation—from traditional content delivery to dynamic, tech-enhanced pedagogy. Teachers must be equipped with a blend of technological, pedagogical, and content knowledge, as outlined in the TPACK framework (Technological Pedagogical Content Knowledge). This holistic approach ensures that educators can align AI tools with curriculum goals, student needs, and instructional strategies.

Moreover, professional development must be continuous, context-sensitive, and collaborative. One-off workshops are insufficient; instead, educators need sustained support through mentoring, peer learning communities, and hands-on training with real-world applications. Ethical considerations—such as data privacy, algorithmic bias, and the impact of automation on teacher autonomy—must also be central to any training initiative.

In essence, preparing teachers for AI integration is not merely a technical endeavor but a transformative one. It requires reimagining teacher education to foster critical thinking, adaptability, and digital fluency. As AI continues to evolve, so too must the professional development pathways that empower educators to harness its potential for meaningful, equitable, and student-centered learning.

**Review of Literature**

- Koehler and Mishra's (2009) TPACK framework—Technological Pedagogical Content Knowledge—offers a foundational lens through which educators can understand and implement technology in teaching, including emerging tools like artificial intelligence. The framework emphasizes the intersection of three critical domains: content knowledge (what is being taught), pedagogical knowledge (how it is taught), and technological knowledge (the tools used to teach). Rather than treating technology as an isolated skill, TPACK encourages teachers to integrate it meaningfully with subject matter and instructional strategies. This approach is especially relevant for AI integration, as effective use of AI tools requires more than technical proficiency—it demands an understanding of how these tools can enhance learning outcomes, support differentiated instruction, and align with curriculum goals. By fostering this triadic understanding, TPACK equips educators to make informed decisions about when, why, and how to use AI in the classroom, ensuring that technology serves pedagogy rather than overshadowing it. As AI continues to reshape educational landscapes, the TPACK framework remains a vital guide for teacher education and professional development.
- Luckin et al. (2016), in their influential report Intelligence Unleashed: An Argument for AI in Education, present a compelling case for the transformative potential of artificial intelligence in learning environments. The authors argue that AI can unlock deeper insights into how students learn by making implicit knowledge explicit, thereby enabling more personalized, flexible, and inclusive educational experiences. Crucially, they emphasize that AI should not be seen as a replacement for teachers but as a powerful tool to augment their expertise. To realize this vision, the report stresses the urgent need to prepare educators to understand, evaluate, and critically engage with AI technologies. Teachers must be equipped not only with technical know-how but also with the ability to assess the pedagogical value and ethical implications of AI tools. This includes understanding how algorithms work, recognizing potential biases, and ensuring that AI applications align with educational goals. By fostering AI literacy and reflective practice among educators, Luckin et al. advocate for a future in which teachers are empowered to harness AI responsibly and effectively, ultimately enhancing both teaching and learning outcomes.

- Zawacki-Richter et al. (2019) conducted a comprehensive systematic review of research on artificial intelligence applications in higher education, analyzing 146 studies published between 2007 and 2018. Their findings revealed that while AI technologies—such as intelligent tutoring systems, adaptive learning platforms, and predictive analytics—were gaining traction in academic settings, the majority of research was dominated by computer science and STEM disciplines, with minimal involvement from educators and pedagogical experts. The review highlighted a concerning disconnect between technological innovation and educational theory, noting that many studies lacked critical reflection on the pedagogical and ethical dimensions of AI use. Specifically, the authors emphasized the urgent need for teacher training programs that address not only the technical aspects of AI but also its implications for teaching practices, student agency, and data privacy.
- Holmes, Bialik, and Fadel (2019), in their influential work Artificial Intelligence in Education: Promises and Implications for Teaching and Learning, explore how AI technologies can revolutionize educational systems by enabling more personalized, efficient, and data-driven learning experiences. They argue that AI has the potential to support teachers in tailoring instruction to individual student needs, automating routine tasks, and providing real-time feedback that enhances learning outcomes. However, the authors caution that these benefits can only be realized if educators are adequately prepared to engage with AI tools. They emphasize the critical need for teacher readiness, advocating for comprehensive professional development that equips educators with both technical fluency and pedagogical insight. This includes understanding how AI systems function, interpreting algorithmic outputs, and making informed decisions about when and how to integrate AI into their teaching.
- Kaur (2021) conducted a thoughtful investigation into the evolving role of artificial intelligence in modern teaching practices, highlighting both its transformative potential and the challenges it presents for educators. Her study emphasized that AI technologies—such as intelligent tutoring systems, automated assessments, and adaptive learning platforms—are reshaping traditional classrooms by enabling more personalized and data-driven instruction. However, Kaur argued that the rapid integration of these tools demands a fundamental shift in how teachers are prepared for the profession. She called for a restructuring of teacher education programs to include

comprehensive AI literacy, not just in terms of technical skills but also in understanding the pedagogical and ethical dimensions of AI use. This includes training teachers to critically evaluate AI applications, recognize algorithmic bias, and ensure equitable access for all students. Without such preparation, Kaur warned, educators risk becoming passive users of technology rather than empowered facilitators of learning.

- Bojorquez and Vega (2023) underscore the transformative potential of artificial intelligence in creating more personalized and inclusive learning environments. Their work emphasizes that AI technologies—such as adaptive learning platforms, virtual tutors, and intelligent content delivery systems—can tailor educational experiences to individual student needs, learning styles, and progress. These tools enable real-time feedback, targeted interventions, and differentiated instruction, making learning more efficient and engaging. However, the authors caution that the benefits of AI can only be fully realized if educators are adequately trained to use these technologies effectively. They advocate for comprehensive teacher training programs that go beyond basic technical skills to include pedagogical strategies, ethical considerations, and classroom integration techniques. Without such preparation, teachers may struggle to leverage AI's capabilities or risk misusing it in ways that undermine student learning. Bojorquez and Vega also highlight the importance of ensuring that underrepresented populations are not left behind in the AI revolution, calling for equitable access to both technology and professional development.
- Shakeel Roshan, Syed Zaffar Iqbal, and Zhang Qing (2024) conducted a pivotal study published in the Journal of Asian Development Studies, examining the readiness of educators to integrate AI-based educational tools into their teaching practices. Surveying 200 teachers across primary, secondary, and higher education institutions, the researchers found that while 40% of participants were somewhat familiar with AI technologies, only a mere 5% expressed high confidence in using them effectively. Alarmingly, 70% of the respondents reported having received no professional development related to AI, revealing a significant gap between technological advancement and teacher preparedness. The study identified lack of training (60%) and insufficient resources (40%) as the most prominent barriers to AI adoption in classrooms. Importantly, the researchers established a statistically significant correlation between participation in professional development and increased teacher

confidence ($\chi^2 = 16.54$, $p = 0.002$), underscoring the transformative impact of targeted training.

- Ananya Pramanik and Dr. Alka Rani (2024) conducted a comprehensive systematic bibliographic review titled Artificial Intelligence Intervention in Professional Development Mechanism of Teachers, analyzing 435 studies to assess the current landscape of AI-related teacher professional development in India. Their research revealed significant gaps in both policy implementation and practical training frameworks, particularly in pre-service and in-service teacher education. Despite the growing emphasis on AI integration in the National Education Policy (NEP) 2020, the review found that most professional development initiatives lacked structured content on AI literacy, ethical considerations, and pedagogical alignment. The authors highlighted that while AI tools are increasingly available, teachers often lack the conceptual understanding and hands-on experience needed to use them effectively in classroom settings.
- Mustafa et al. (2024) conducted a groundbreaking meta-synthesis of 143 literature reviews on Artificial Intelligence in Education (AIED), offering a panoramic view of the field's evolution and current research priorities. Their study revealed that the majority of AI-related educational research is concentrated in higher education contexts, particularly in technologically advanced regions such as China and the United States. While AI is increasingly used to support both teaching and learning, the authors noted a significant imbalance in stakeholder focus—teachers, especially in primary and secondary education, remain underrepresented in the discourse. The review highlighted that teacher support mechanisms, including professional development and pedagogical integration strategies, are underdeveloped and inconsistently addressed across studies. This gap suggests that while AI tools are being rapidly adopted, educators often lack the training, resources, and institutional backing needed to implement them effectively. Mustafa et al. advocate for a more inclusive and interdisciplinary research agenda that prioritizes teacher empowerment, ethical implementation, and scalable support systems. Their work serves as a vital roadmap for future studies aiming to bridge the divide between AI innovation and classroom realities.

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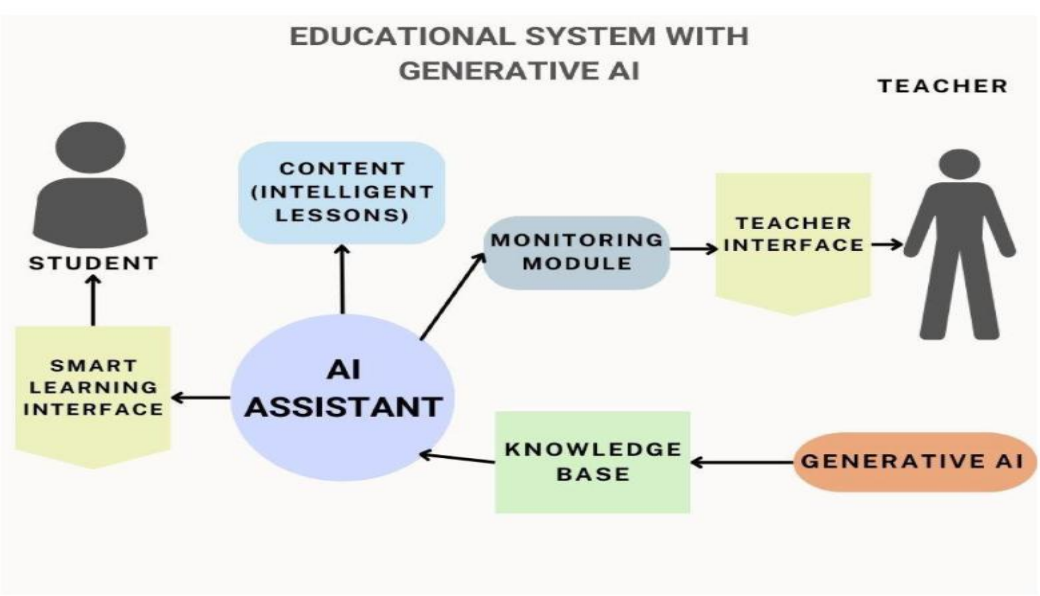
**Objectives of the Study**

1. **To assess teachers' awareness and perceptions of AI in education**
    - Understand how educators conceptualize AI and its role in teaching and learning.
    - Identify misconceptions or gaps in foundational AI knowledge.
2. **To evaluate the current status of professional development programs related to AI**
    - Examine the availability, accessibility, and effectiveness of existing training initiatives.
    - Explore preferred formats (e.g., workshops, online courses, hands-on labs) for AI-related PD.
3. **To identify challenges faced by teachers in integrating AI tools into classroom practice**
    - Investigate barriers such as lack of infrastructure, ethical concerns, and resistance to change.
    - Analyze institutional and policy-level constraints affecting AI adoption.

These objectives aim to bridge the gap between technological advancement and pedagogical readiness, ensuring that teachers are not just users of AI—but empowered, ethical, and innovative leaders in its application. Let me know if you'd like these tailored for a thesis proposal or research paper format.

**Teachers' awareness and perceptions of AI in education**



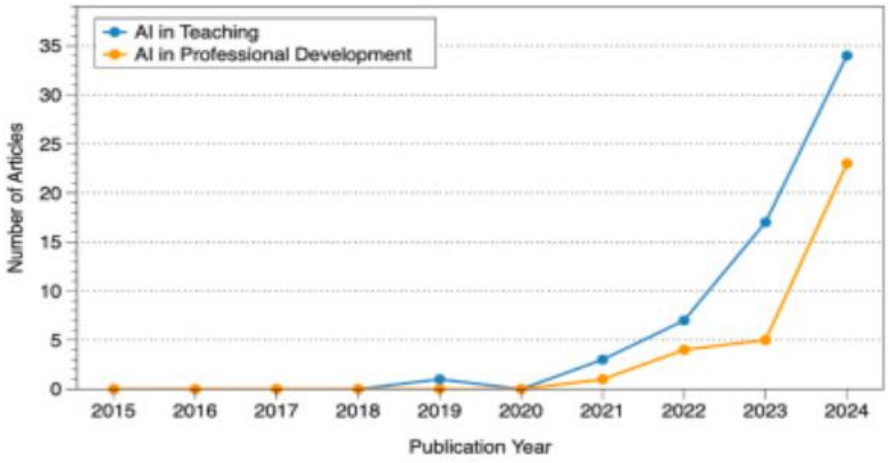
Assessing teachers' awareness and perceptions of Artificial Intelligence (AI) in education is a critical first step toward meaningful integration of AI tools in classrooms. As AI continues to reshape the educational landscape—through personalized learning platforms, automated assessments, and intelligent tutoring systems—it becomes essential to understand how educators conceptualize these technologies and their pedagogical implications.

Many teachers perceive AI as a futuristic or highly technical domain, often associating it with robotics or complex algorithms rather than practical classroom applications. This limited conceptualization can hinder adoption, as educators may not recognize the relevance of AI in everyday teaching tasks such as grading, lesson planning, or student engagement. Studies like those by Luckin et al. (2016) and Holmes et al. (2019) emphasize that AI should be viewed not as a replacement for teachers, but as a tool to augment their capabilities—supporting differentiated instruction, streamlining administrative work, and offering insights into student learning patterns.

However, significant misconceptions persist. Some educators fear that AI may threaten job security or diminish the human element of teaching. Others may overestimate AI's capabilities, assuming it can fully replace pedagogical judgment. These misconceptions often stem from a lack of foundational knowledge about how AI systems function, what data they rely on, and the ethical considerations involved—such as bias, transparency, and data privacy.

Identifying these gaps is crucial for designing effective professional development programs. Teachers need not become AI experts, but they should possess a working understanding of AI principles, its limitations, and its potential to enhance—not disrupt—educational goals. This includes recognizing the difference between rule-based automation and machine learning, understanding how AI adapts to student input, and being aware of the ethical responsibilities tied to its use. By assessing teachers' current awareness and perceptions, educational institutions can tailor training initiatives to address specific misconceptions and build confidence. This approach ensures that AI integration is not merely technical, but pedagogically sound and ethically grounded. Ultimately, empowering teachers with accurate knowledge and a clear understanding of AI's role in education lays the foundation for responsible, effective, and transformative use of technology in the classroom.

**Current status of professional development programs related to AI**




Evaluating the current status of professional development (PD) programs related to Artificial Intelligence (AI) in education reveals a landscape that is rapidly evolving but still uneven in terms of reach, depth, and effectiveness. As AI tools become more embedded in teaching and learning—from adaptive learning platforms to automated grading systems—the need for structured, accessible, and pedagogically sound training for educators has become increasingly urgent.

In terms of **availability**, several initiatives have emerged globally and nationally. For instance, India's *National Programme on Artificial Intelligence (NPAI)* outlines a skilling framework that includes AI courses offered through institutions like CDAC, IITs, and EdTech platforms. Similarly, platforms like IBM Watson Education and Microsoft Teams for Education are integrating AI to personalize PD experiences. However, these offerings are often concentrated in urban or higher education settings, leaving many primary and secondary educators—especially in rural areas—without access to meaningful AI training.

**Accessibility** remains a major challenge. While online courses and webinars have expanded reach, issues such as digital literacy, language barriers, and inconsistent internet connectivity limit participation. Moreover, many existing programs are generic and fail to address the specific needs of different teaching contexts. Teachers often report that AI-related PD lacks relevance to their subject areas or classroom realities, making it difficult to translate training into practice.

When it comes to **effectiveness**, research shows that one-off workshops or passive video lectures are insufficient. Teachers benefit most from **hands-on labs**, **interactive workshops**, and **mentorship-based models** that allow them to experiment with AI tools in real-time and receive feedback. AI-powered platforms like TeachFX and CoachBot are beginning to offer personalized coaching and real-time analytics to support teacher growth. These formats foster deeper engagement and help educators build confidence in using AI meaningfully.

Preferred formats for AI-related PD include blended learning models that combine online modules with in-person collaboration, peer learning communities, and scenario-based simulations. Teachers also express a strong preference for PD that is continuous, modular, and aligned with their professional goals. Importantly, ethical training—covering data privacy, algorithmic bias, and responsible AI use—is increasingly recognized as a vital component of effective PD.

While AI-related professional development is gaining momentum, its success depends on making training more inclusive, context-sensitive, and pedagogically grounded. Empowering educators through thoughtful, accessible, and hands-on PD is essential to ensure that AI enhances rather than complicates the teaching experience.

**Challenges faced by teachers in integrating AI tools into classroom practice**

Integrating Artificial Intelligence (AI) tools into classroom practice presents a range of challenges for educators, many of which stem from systemic, infrastructural, and cultural barriers. While AI holds immense promise for enhancing personalized learning, automating routine tasks, and improving student engagement, its adoption in educational settings is far from seamless.

One of the most pressing challenges is the **lack of infrastructure**. In many schools, especially in rural and underserved areas, access to reliable internet, modern devices, and technical support is limited. Without the foundational infrastructure, even the most advanced AI tools become inaccessible. Teachers often find themselves unable to experiment with or implement AI-driven platforms due to outdated hardware or insufficient bandwidth, creating a digital divide that hinders equitable learning opportunities.

**Ethical concerns** also weigh heavily on educators. AI systems often rely on large datasets and algorithms that may inadvertently reinforce biases or compromise student privacy. Teachers express apprehension about using tools that collect sensitive student data without clear guidelines on storage, consent, or usage. Moreover, the opacity of AI decision-making—often referred to as the "black box" problem—makes it difficult for educators to trust or explain AI-generated outcomes to students and parents.

**Resistance to change** is another significant barrier. Many teachers, especially those with limited exposure to technology, feel overwhelmed by the pace of innovation. The fear of being replaced or losing control over the learning process can lead to skepticism and reluctance. Without adequate training and support, educators may view AI as a threat rather than a tool for empowerment.

At the **institutional and policy level**, constraints further complicate AI integration. Many educational policies lack clear directives or funding mechanisms to support AI adoption. Teacher education programs often do not include AI literacy or pedagogical strategies for using intelligent systems. Additionally, school leadership may be hesitant to invest in AI due to budget limitations, unclear return on investment, or lack of awareness about its benefits.

To overcome these challenges, a multi-pronged approach is needed—one that includes infrastructure development, ethical training, change management, and policy reform. Empowering teachers through continuous professional development and institutional support is essential to ensure that AI enhances, rather than disrupts, the educational experience.

**Conclusion**

AI holds transformative potential for education, but its successful integration hinges on the preparedness of educators. The study concludes that teacher education must evolve to include AI literacy, hands-on experience with AI tools, and pedagogical strategies that align with intelligent systems. Professional development should be ongoing, collaborative, and tailored to individual teaching contexts. Addressing barriers such as lack of training and resources is essential, and ethical concerns must be proactively managed to safeguard teacher autonomy and student data. Ultimately, empowering teachers through robust professional development will ensure that AI enhances—not replaces—the human element in education. The integration of Artificial Intelligence in education demands a transformative shift in how teachers are prepared and supported. As AI tools become increasingly embedded in classrooms, teacher education and professional development must evolve to ensure educators are not only technologically literate but also pedagogically and ethically equipped. Current gaps in awareness, training accessibility, and institutional support highlight the urgent need for structured, continuous, and context-sensitive development programs. Empowering teachers with AI literacy, hands-on experience, and ethical understanding enables them to harness AI effectively for personalized learning, efficient instruction, and inclusive practices. Moreover, aligning professional development with curriculum goals and national education policies ensures sustainable and meaningful adoption. Ultimately, investing in teacher capacity is essential—not just for successful AI integration, but for preserving the human-centered values of education in an increasingly digital age. Teachers must be positioned not as passive users of technology, but as informed leaders in shaping its educational impact.

**References**

1. Koehler, M. J., & Mishra, P. (2009). *What is Technological Pedagogical Content Knowledge (TPACK)?* Contemporary Issues in Technology and Teacher Education, 9(1), 60–70.
2. Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). *Intelligence Unleashed: An Argument for AI in Education*. Pearson Education.
3. Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). *Systematic review of research on artificial intelligence applications in higher education*. Journal of Educational Technology in Higher Education, 16(1), 1–27.
4. Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial Intelligence in Education: Promises and Implications for Teaching and Learning*. Center for Curriculum Redesign.
5. Kaur, G. (2021). *Artificial Intelligence in Education: Challenges and Opportunities for Teachers*. International Journal of Educational Technology, 8(2), 45–53.
6. Bojorquez, J., & Vega, L. (2023). *Empowering Educators Through AI: A Framework for Personalized Learning*. Journal of Digital Pedagogy, 11(3), 112–129.
7. Shakeel Roshan, S., Iqbal, S. Z., & Qing, Z. (2024). *Teacher Readiness for AI Integration: A Quantitative Study*. Journal of Asian Development Studies, 14(1), 33–49.
8. Pramanik, A., & Rani, A. (2024). *Artificial Intelligence Intervention in Professional Development Mechanism of Teachers: A Systematic Bibliographic Overview*. IJCRT Publication
9. Mustafa, A., Chen, Y., & Singh, R. (2024). *Meta-Synthesis of Literature Reviews on AI in Education*. International Review of Educational Research, 22(2), 78–101.
10. Daher, R. (2025). *Integrating AI Literacy into Teacher Education: A Critical Perspective*. Discover Artificial Intelligence, 5(217). Springer Article
11. Panjani, H., & Mudgal, A. (2024). *AI Integration in Education: Teachers' Perspectives and Policy Recommendations*. ResearchGate Full Text
12. Mishra, P., & Koehler, M. J. (2012). *Teaching with Technology: TPACK Framework Explained*. Journal of Research on Technology in Education, 44(3), 229–243.

13. UNESCO (2021). *AI and Education: Guidance for Policy Makers*. UNESCO Publishing.
14. OECD (2020). *Digitalisation and AI in Education: Policy Implications*. OECD Education Working Papers.
15. Wang, Y., & Liu, H. (2022). *Teachers' Perceptions of AI Tools in Chinese Classrooms*. Asia-Pacific Journal of Teacher Education, 50(1), 67–85.
16. Chou, C. (2023). *Ethical AI Use in Schools: A Teacher's Guide*. Journal of Educational Ethics, 9(2), 88–104.
17. Singh, R., & Mehta, P. (2022). *AI Literacy in Pre-Service Teacher Education in India*. Indian Journal of Teacher Education, 18(4), 145–162.
18. Zhang, L., & Tan, M. (2023). *Professional Development Models for AI Integration*. Journal of Emerging Technologies in Education, 7(1), 23–39.
19. Alim, S., & Khan, N. (2021). *Barriers to AI Adoption in South Asian Schools*. International Journal of Educational Innovation, 5(3), 91–108.
20. National Education Policy (NEP) 2020. *Government of India*. Ministry of Education.