Integration of Artificial Intelligence in Teaching–Learning: A Study in Indian Classrooms with Special Reference to Assam

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***Abstract*—The rapid advancement of Artificial Intelligence (AI) is reshaping the educational landscape worldwide. In India, particularly in the state of Assam, the integration of AI into the teaching–learning process is gaining momentum through various initiatives at both government and institutional levels. This study explores the current trends, tools, and practices of AI integration in Indian classrooms, emphasizing the impact and implementation in Assam. It examines AI-driven educational tools, administrative applications, teacher preparedness, and student engagement. The paper also investigates the challenges faced in adopting AI in school education, including infrastructural limitations, low uptake of AI as an elective subject, and ethical concerns. Using a mixed-method approach, the study gathers qualitative and quantitative data from schools across Assam. Findings suggest that while AI tools like AI-based attendance systems and teaching aids such as AI teachers and lesson planners are revolutionizing administrative and pedagogical practices, their effectiveness depends on adequate training, awareness, and policy support. The study concludes with recommendations for inclusive, equitable, and ethical AI integration in the Indian education system.**

***Index Terms*—Artificial Intelligence, Teaching–Learning, Assam, Educational Technology, AI Tools, Indian Classrooms, NEP 2020, Teacher Training, AI Electives, Digital Education**

I. INTRODUCTION

Artificial Intelligence (AI) has emerged as a transformative force across multiple sectors, with education being one of the most profoundly impacted domains. In the Indian context, the integration of AI into classrooms aligns with the National Education Policy (NEP) 2020, which envisions a technologically empowered, learner-centric, and equitable education system. As AI continues to influence pedagogy, assessment, administration, and content delivery, Indian schools are progressively embracing its potential.

In recent years, the state of Assam has taken significant steps toward embedding AI into its teaching–learning ecosystem. Government initiatives such as the Shiksha Setu Axom app, AI-based attendance systems, and the deployment of AI-powered humanoid teachers like Iris, underscore the region's commitment to innovation in education. Additionally, tools developed by local educators—including AI lesson planners and proofreading assistants—have enhanced instructional planning and personalization.

Despite these developments, challenges persist. The uptake of AI as a school elective remains low, with only a small fraction of students opting for AI and Robotics in Class IX. Factors such as limited digital infrastructure, lack of teacher preparedness, language barriers, and ethical concerns hinder widespread adoption. At the same time, national-level interventions like the SOAR (Skilling for AI Readiness) initiative and the PadhAI Conclave provide strategic direction for inclusive and ethical AI integration.

This study investigates the status, effectiveness, and barriers of AI integration in Indian classrooms, with a special focus on Assam. It explores how AI technologies are transforming teaching practices, improving administrative efficiency, and shaping educational experiences. The research aims to generate evidence-based insights to support policymakers, educators, and stakeholders in fostering a future-ready education system.

II. OBJECTIVES OF THE STUDY

1. To explore the current status of Artificial Intelligence integration in teaching–learning processes in Indian school classrooms, with a special focus on Assam.
2. To identify the key AI tools and technologies being implemented in educational institutions across Assam, including administrative and pedagogical applications.
3. To examine the perceptions, readiness, and training needs of teachers regarding the use of AI in classroom instruction.
4. To assess the impact of AI-based interventions on student engagement, performance, and inclusivity in selected schools of Assam.
5. To analyze the challenges and barriers faced by educators and institutions in integrating AI into the teaching–learning environment.
6. To evaluate the role of state and national **policies**, such as NEP 2020 and SOAR, in supporting AI adoption in school education.
7. To provide recommendations for effective, ethical, and inclusive integration of Artificial Intelligence in the Indian education system, particularly in under-resourced or rural settings.

III. REVIEW OF RELATED LITERATURE

The integration of Artificial Intelligence (AI) in the education sector has been a topic of academic interest since the early 2000s, with increasing momentum in the past decade. Studies prior to 2021 have laid a strong theoretical and experimental foundation for understanding how AI can enhance various aspects of teaching and learning.

Luckin et al. (2016) provided one of the most comprehensive early frameworks for understanding the potential of AI in education. Their study highlighted how AI can support teachers through intelligent tutoring systems, learner analytics, and adaptive feedback. They emphasized that AI should complement—not replace—human educators, especially in decision-making and socio-emotional support.

Woolf (2010) discussed the emergence of intelligent tutoring systems (ITS), which could adapt content delivery based on students' performance, pace, and learning styles. ITS applications, such as Carnegie Learning and AutoTutor, were shown to improve learning outcomes in subjects like mathematics and science through personalized instruction.

Baker and Siemens (2014) introduced the concept of learning analytics powered by AI algorithms. They discussed how data generated by students' interactions with digital platforms could be analyzed to predict learning outcomes, identify at-risk learners, and guide pedagogical interventions. These insights significantly influenced the development of AI-based educational dashboards and monitoring tools.

In the Indian context, Rao (2018) explored the potential of AI in improving access to quality education in rural areas. He proposed that AI-enabled mobile learning tools and voice-based virtual assistants in local languages could help bridge the urban-rural educational divide. However, his study also raised concerns about infrastructural readiness, teacher digital literacy, and policy-level support.

Sharma and Patel (2019) examined teacher attitudes towards AI-based classroom tools in selected Indian private schools. Their findings revealed cautious optimism, with most teachers acknowledging AI's potential to reduce workload through automated grading and lesson planning. However, they also expressed concern over job security, lack of training, and data privacy.

A significant contribution by Spector (2014) was the distinction between automation and augmentation. He argued that AI's role in education should not merely be the automation of repetitive tasks but should aim to augment teachers' capabilities and promote deeper learning experiences for students.

These early studies demonstrate a general consensus that AI has transformative potential in education. However, they also point to critical barriers such as ethical concerns, socio-economic inequality, and insufficient teacher preparation—all of which remain relevant in the Indian context, especially in states like Assam. The literature establishes a foundational understanding that this study builds upon to examine current implementations and challenges of AI integration in Indian classrooms.

IV. METHODOLOGY OF THE STUDY

This study adopted a mixed-method research design to comprehensively examine the integration of Artificial Intelligence (AI) in the teaching–learning process in

Indian classrooms, with special emphasis on the state of Assam. The combination of quantitative and qualitative approaches enabled both statistical analysis and deeper contextual understanding of AI applications in school education.

1. Research Design

A descriptive and exploratory design was employed:

- Descriptive, to map existing AI tools, practices, and perceptions in classrooms.
- Exploratory, to identify emerging trends, challenges, and opportunities in AI integration across different school settings.

2. Sampling Technique

- Sampling Method: Purposive and stratified sampling
- Sample Size: 60 schools (40 government, 20 private) across 8 districts in Assam, including both urban and rural areas.
- Participants:
  - 120 school teachers
  - 60 school administrators (Principals/HMs)
  - 240 students (Classes 9–12)
  - 10 education department officials and policymakers

3. Data Collection Tools

- Questionnaires (for teachers, students, administrators):
  Designed to assess awareness, usage, attitudes, challenges, and outcomes of AI use in education.
- Semi-structured Interviews (for policymakers, selected school heads and teachers): Focused on institutional readiness, training programs, policy impact
- Focused on institutional readiness, training programs, policy impact, and ethical considerations.
- Classroom Observations:
  On-site visits were conducted to observe the actual use of AI tools like digital assistants, attendance systems, and lesson planning software.
- Document Analysis:
  Relevant state government reports, NEP 2020 guidelines, Shiksha Setu Axom data, AI curriculum modules, and EMS dashboards were reviewed.

4. Data Analysis Techniques

- Quantitative Data:
  Statistical analysis (descriptive statistics: mean, percentage, frequency) was conducted using SPSS to evaluate trends and usage patterns.
- Qualitative Data:
  Thematic analysis was applied to interview transcripts and observational notes to identify recurring themes related to AI implementation, perceptions, and barriers.

5. Ethical Considerations

- Informed consent was obtained from all participants.
- Anonymity and confidentiality of responses were maintained.
- The study followed ethical research guidelines as per the University and UGC norms.

6. Delimitations of the Study

- The study was geographically limited to Assam and may not reflect the situation in other Indian states.
- Focus was restricted to school-level education (Grades 6–12).
- The study examined AI in teaching–learning and administrative processes, excluding higher education or private EdTech platforms outside schools.

Major Findings of the Study: -

1. Widespread Use of AI in Administration
   - 85% of government schools adopted AI-based attendance systems like *Shiksha Setu Axom* and RNIT's EMS platform.
   - These systems significantly improved attendance monitoring, eliminated ghost entries, and increased transparency.
2. Limited Pedagogical Use in Government Schools
   - Only 10% of government schools had exposure to AI teaching tools like the humanoid teacher *Iris* or AI-generated content.
   - In contrast, 40% of private schools incorporated such tools, mostly through NITI Aayog's Atal Innovation Mission initiatives.
3. AI Elective Curriculum Still Underutilized
   - Only 5% of government schools and 20% of private schools reported offering AI & Robotics as elective subjects for Class IX–X.
   - Low student uptake (e.g., 500 out of 4.28 lakh students) suggests a need for awareness-building and infrastructure enhancement.
4. Higher Usage of AI Planning Tools in Private Schools

- 65% of private schools used AI tools for lesson planning and assessment design, compared to 45% in government schools.
- Tools like the AI Lesson Plan Creator and AI Proofreader were preferred where teacher training had been provided.

5. Moderate Adoption of Nipun Mitra App

- The AI-powered *Nipun Mitra* teacher support app saw moderate uptake in both sectors **(**60% in government schools**,** 50% in private schools**).**
- Teachers found it useful for multilingual lesson access, policy reference, and curriculum mapping.

6. Infrastructure and Training as Key Barriers

- Many rural schools reported inadequate devices, slow internet, and lack of AI-trained staff as major obstacles.
- Teachers expressed interest in AI tools but requested localized training, especially in Assamese.

7. Positive Student Engagement Were Implemented

- In schools using AI teaching aids, 72% of students reported higher interest in class, particularly due to interactive and visual content.

V. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are proposed to enhance the integration of Artificial Intelligence (AI) in the teaching–learning process, particularly in the context of Assam and similar regions:

1. Infrastructure Development in Rural Schools
   - Provide AI-ready digital infrastructure, including smart classrooms, stable internet, and electricity, especially in government and rural schools.
2. Teacher Capacity Building
   - Organize continuous professional development (CPD) programs on AI tools in teaching, lesson planning, and assessment.
   - Collaborate with institutions like IIT Guwahati and DIETs for hands-on training workshops in local languages.
3. Curriculum Design and AI Literacy Promotion
   - Integrate AI education from early grades (6–8) to foster foundational AI literacy.
   - Develop regionally contextualized and multilingual AI modules aligned with NEP 2020 and NCF guidelines.
4. Incentivize Elective Participation
   - Encourage student enrollment in AI & Robotics electives through awareness campaigns, AI exhibitions, and real-world problem-solving projects.
   - Provide academic credits or certification for participation in AI-based initiatives.
5. Policy-Level Support and Monitoring
   - Establish an AI-in-Education Task Force at the state level to oversee implementation, monitor outcomes, and ensure ethical standards.
   - Encourage public–private partnerships (PPP) for scalable AI solutions in education.
6. Promote Inclusive and Ethical Use of AI
   - Develop guidelines to prevent algorithmic bias and protect student data privacy.
   - Ensure that AI tools are inclusive and do not widen existing digital divides.

VI. CONCLUSION

The integration of Artificial Intelligence into the teaching–learning process in India marks a significant shift in educational practice and policy. In Assam, early-stage interventions such as AI attendance systems, lesson planners, and AI-based electives reflect a growing commitment to educational innovation. However, the study reveals that these tools are unevenly adopted across school types, with government schools facing infrastructural, linguistic, and training challenges.

Despite these limitations, the impact of AI on administrative efficiency and student engagement is promising. To unlock its full potential, there is a pressing need for targeted policy support, inclusive infrastructure, and teacher empowerment. As India moves towards becoming a digitally literate society under the vision of NEP 2020, AI holds the potential to transform classrooms into adaptive, learner-centric spaces—provided its integration is equitable, ethical, and educationally grounded.

This study contributes to the growing body of research on AI in Indian education by offering region-specific insights and practical directions for future policy, pedagogy, and practice.

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