Leveraging Artificial Intelligence to Personalise Learning in Digitally Transformed Classrooms

Prof. Dr. Kanchan Fulmali[1], Ms. Neha S. Nikam[2]

Research Guide[1], Dr. Professor, Department of Commerce, M. L. Dahanukar College, University of Mumbai, kfulmali@gmail.com

Assistant professor[2], Research Scholar, M. L. Dahanukar College, University of Mumbai, nehas.nikam@gmail.com

Abstract

"Artificial intelligence enhances education by aligning instructional support with learners' unique needs and pace."
The digital transformation of education has been rapid, accelerating the integration of artificial intelligence (AI) into learning and teaching processes. AI-based personalisation is emerging as a transformative force capable of reshaping and reconstructing pedagogical practices, improving learner engagement, and enabling data-informed instruction. Despite its potential, the adoption of AI in education raises complex questions regarding data ethics, algorithmic bias, teacher autonomy, and long-term institutional readiness. This research paper examines how AI supports personalised learning, the mechanisms underlying adaptive systems, the evolving role of educators, and the broader sociotechnical implications of AI-driven schooling. Through a conceptual analysis, the study argues that effective adoption of AI requires not only technological readiness but also robust ethical guidelines, comprehensive teacher training, and a commitment to digital equity. The paper concludes by offering insights into integrating AI in classrooms that enhance personalisation while safeguarding educational values and students' interests.

Keywords: *Artificial intelligence, Personalised learning, Digital transformation, Adaptive learning systems, Intelligent tutoring systems, Educational technology, Algorithmic bias, Data ethics, Teacher autonomy, Digital equity.*

1. Introduction

Digital transformation in education has moved from being a minor effort to becoming a major priority for institutions around the world. Tools like cloud computing, mobile learning, learning management systems, and online content libraries or repositories have changed the way students access information. Among these technologies, artificial intelligence is especially important because it can significantly change how lessons are designed, how assessments are done, and how students receive support.

AI-driven systems, ranging from intelligent tutoring systems to predictive analytics dashboards (e.g., Warning systems for at-risk students, performance forecasting, and engagement prediction), offer unprecedented opportunities to personalise instruction at scale. Personalisation is crucial for addressing the long-standing challenge of meeting the diverse needs of learners. Traditional classroom structures, constrained by time, class size, and standardization pressures, often fail to meet individual learning pathways. AI promises to bridge this gap by processing large datasets, recognising patterns, and adapting learning pathways in real time.

However, integrating and implementing AI into schooling is neither straightforward nor neutral. AI systems are built using certain assumptions, rely on the data they are given, and work within the rules and structures of schools or institutions. Because of this, it is important to understand how AI affects teaching, ethics, and society. This paper looks at these issues and examines how AI-driven personalised learning fits into the wider changes happening in digital education.

Table 1. Key facts and figures on AI-driven personalization in India

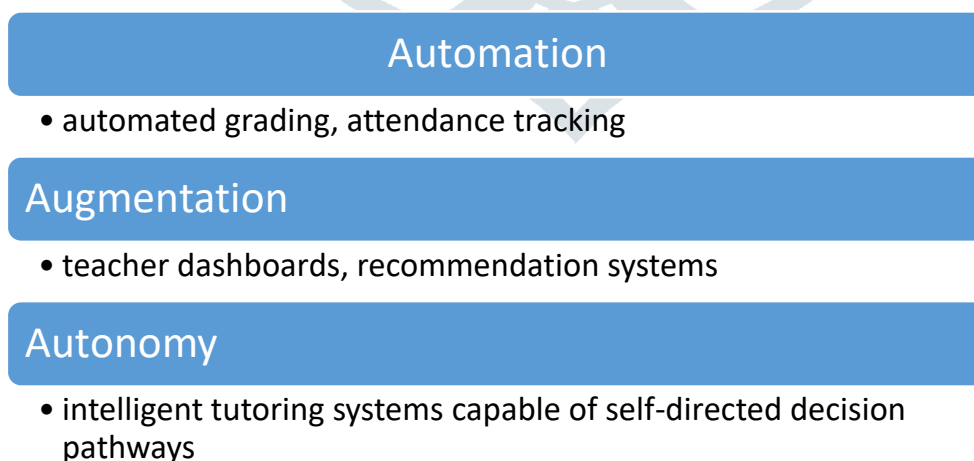| Facts	Finding (India)	Indication
India AI market projection (all sectors)	USD 17 Bn by 2027	Indicates the national AI investment scale
Indian education market	Projected ~ US $313 Bn by FY 30	Shows the large education sector where AI-personalisation can scale
Teachers using AI tools in India	~70-75% of teachers report using AI tools in their work	High teacher uptake implies tools for personalisation are already entering classrooms; however, capability gaps remain.
Students using generative AI	~77% of children reported using generative AI tools to help with schoolwork	High adoption affects assessment integrity, learning behaviour etc
Institutional policy	NITI Aayog published a national AI strategy and responsible AI guidance documents, encouraging sectoral pilots	Policy backing is critical for funding, ethical frameworks, and large-scale deployment.
Risks & academic concerns	Widespread adoption has increased assessment & academic-integrity challenges	Important to balance personalization benefits with integrity, pedagogy, and evaluation reforms.

Source: Self-compiled and data extracted from Reuters, India Brand Equity, Business Standard, NITI AAYOG

2. AI in Education: Foundations and Scope

2.1 Conceptualising AI in Educational Contexts

Artificial intelligence (AI) refers to computer systems that can perform tasks that usually require human thinking, such as recognising patterns, making predictions, solving problems, and understanding language. In education, AI is used in several ways: it can automate routine tasks like grading and attendance, help teachers make better instructional decisions by analyzing student data, and improve interactions with students by providing personalised support, feedback, and learning materials.

Figure 2: AI in education can be classified into three functional domains:

Automation
- automated grading, attendance tracking

Augmentation
- teacher dashboards, recommendation systems

Autonomy
- intelligent tutoring systems capable of self-directed decision pathways

Source: Self-compiled

Each domain offers different degrees of control, transparency, and pedagogical influence.

2.2 Key Technologies Behind AI-Powered Personalised Learning

Machine Learning (ML)

Machine learning (ML) is a part of artificial intelligence where computers learn from data and make predictions or decisions on their own, without being directly programmed.

Implication: ML algorithms analyse learner performance patterns to predict next steps, determine difficulty adjustments, and identify potential misconceptions.

Natural Language Processing (NLP)

Natural Language Processing (NLP) is a technology that helps computers understand, read, and work with human language.

Implication: NLP enables systems to interpret student writing, generate feedback, and facilitate conversational agents (Chatbots) that provide clarification.

Reinforcement Learning

It is a kind of machine learning where a system learns to make the best decisions by trying actions and receiving rewards for good results.

Implication: Some adaptive platforms learn optimal instructional sequences by receiving feedback based on learner responses, allowing them to refine recommendations.

Learning Analytics

Learning analytics involves gathering and examining information about students and their learning activities to better understand and improve learning results.

Implication: Large datasets collected from learners' interactions with digital platforms permit continuous monitoring and fine-grained diagnostic insights.

These technologies coalesce to form a personalised learning ecosystem capable of real-time adaptation.

3. Mechanisms of AI-Driven Personalisation

AI-enabled personalisation is operationalised through several interconnected mechanisms that adjust content, pathways, and support based on learner input.

3.1 Adaptive Learning Systems

Adaptive platforms continuously analyse and evaluate performance and modify the instructional sequence. For example, if a learner demonstrates mastery of introductory algebraic concepts, the system may accelerate progression, alternatively, repeated errors will trigger remediation modules. Adaptive learning is dynamic, granular, and responsive, providing a level of differentiation that would be impractical for a single teacher to replicate manually.

3.2 Intelligent Tutoring Systems (ITS)

ITS aim is to simulate one-on-one human tutoring.

For example, **Khan Academy's AI-driven practice system**

- Provides step-by-step guidance for math problems.
- Gives hints and explanations when a student struggles.
- Adjusts the difficulty of questions based on the student's performance.
- Tracks progress and recommends topics for practice.

Unlike generic digital resources, ITS uses diagnosis and inference to adjust pedagogy, not just content.

3.3 Recommendation Engines

Recommendation engines work based on prior behaviour, knowledge gaps, and learning preferences. AI recommends videos, readings, question sets, or interactive simulations. These systems emulate the logic of recommendation engines used in consumer digital platforms but with pedagogical goals.

3.4 Real-Time Assessment and Feedback

AI can evaluate and grade short answers, essays, and problem sets very quickly, which gives students instant feedback on their work. This ongoing feedback helps students understand their strengths and weaknesses, think more about how they learn, and make improvements right away. It also means students do not have to wait for teachers to be available before getting guidance.
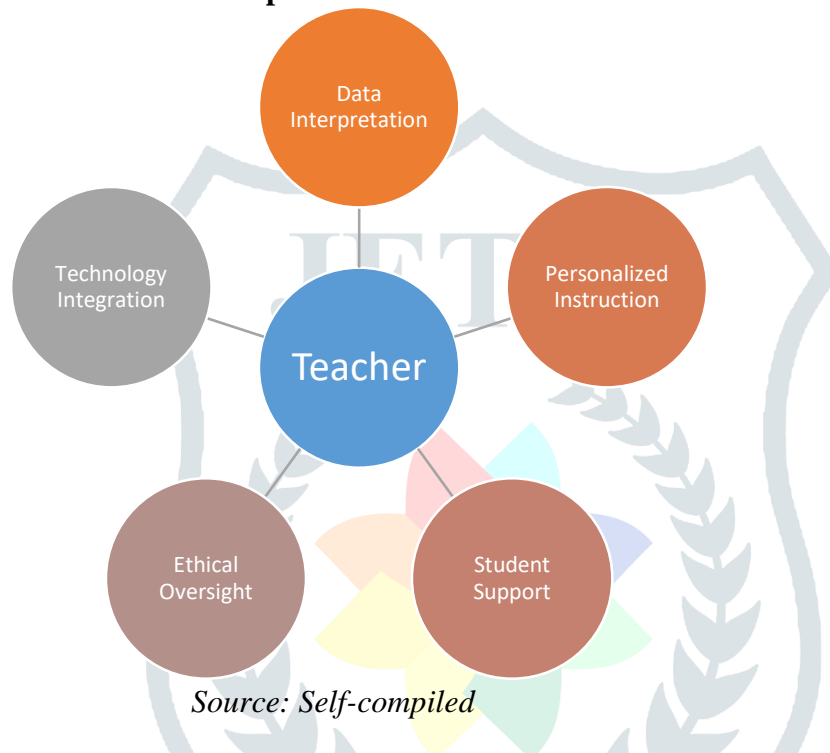
3.5 Predictive Analytics for Early Intervention

AI can analyse student data and predict how well each student is likely to perform. It also spot and recognises early signs that a student may be falling behind, such as low participation or declining scores. With this information, teachers can step in sooner and provide the help that the student needs. By offering support early, schools can improve student success, prevent dropouts, and ensure more learners stay engaged and on track.

4. The Evolving Role of Teachers in AI-Personalised Environments

As AI becomes increasingly integrated into education, the role of teachers is changing rather than diminishing. AI can manage routine tasks such as grading, tracking progress, and generating personalised learning suggestions, but teachers remain essential to guiding and supporting students. In AI-personalised environments, teachers act as facilitators who interpret data, make informed instructional decisions, and provide the human connection that technology cannot offer.

Figure 1: Role of teachers in an AI-personalized environment

Source: Self-compiled

Teachers now rely on AI-generated insights to identify learning gaps, adjust teaching strategies, and deliver targeted support. This shift requires educators to develop stronger skills in understanding data and using technology effectively. At the same time, teachers continue to play a vital role in motivating students, helping them reflect on their progress, and providing emotional and social support.

Teachers also serve as ethical stewards, ensuring AI tools are used responsibly and fairly, especially when concerns about privacy or bias arise.
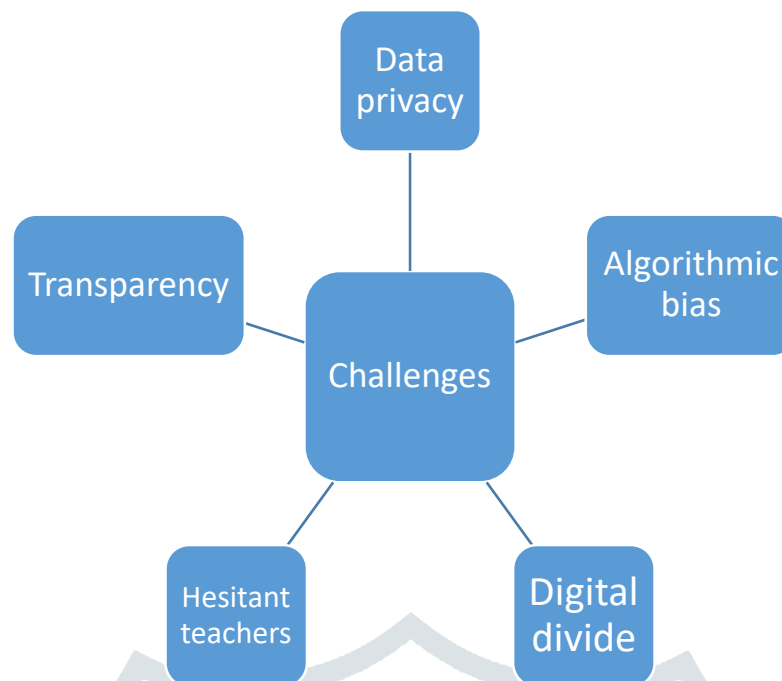
5. Impact on Learner Experience and Outcomes

AI has an evident effect on how students learn and how well they perform. By providing personalised lessons and immediate feedback, AI helps students stay engaged and better understand what they are learning. When learning materials are adjusted to each student's pace, requirement and skill level, students are less likely to feel bored or overwhelmed. This makes learning more enjoyable and helps them build confidence in their abilities.

AI tools have been a support for better academic performance. When students receive quick feedback and targeted practice, they can correct mistakes sooner and strengthen areas where they struggle. For students with different learning needs, AI can offer visual, audio, or interactive resources that match their learning styles. This makes education more inclusive and accessible. Overall, AI positively influences the learning experience by making it more engaging, personalised, and supportive, which contributes to better learning outcomes.

6. Ethical, Social and Practical Challenges

While AI has the potential to greatly improve education, its use also brings several important challenges that must be addressed.

Source: Self-compiled

7. Future Directions

Looking forward, AI in education is expected to become even more advanced and supportive of personalised learning. Generative AI will be able to create customised and personalised materials, such as quizzes, explanations, and examples, based on each student's needs, reducing teachers' workload and improving responsiveness. Future AI tools may also use multiple types of data, such as speech, facial expressions, or handwriting, to better understand a student's emotional and cognitive state, though this will require careful ethical design. AI will further enhance collaborative learning by forming student groups, suggesting teamwork activities, and helping manage interactions. To make these advancements successful, institutions must be prepared with strong ethical guidelines, clear data policies, reliable technology infrastructure, and ongoing research and policy support at both institutional and national levels.

8. Conclusion

Artificial intelligence is reshaping education by making personalised learning more accessible, responsive, and effective. As AI tools continue to evolve, they offer valuable opportunities to support teachers, improve student engagement, and address diverse learning needs. However, these benefits can only be fully realised when institutions integrate AI responsibly and thoughtfully. Ensuring data privacy, preventing algorithmic bias, promoting digital equity, and preparing teachers for new technological demands are essential steps in this process. A future-oriented framework for AI adoption must therefore balance innovation with ethical considerations, emphasising transparency, fairness, and the protection of students' interests. By combining technological advancement with strong educational values, AI can contribute to more inclusive and meaningful learning environments that support the success and well-being of all learners.

9. References

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