Artificial Intelligence in Education: A Strategic Tool for NEP 2020 Implementation

R. Kingston[1] & Sevagamy Jayaraman[2]

[1]*Department of Education, Gandhigram Rural Institute, Gandhigram*
[2]*Lecturer Faculty of Education and Liberal Arts, INTI, International University, Malaysia*

Abstract
This paper examines the applications and implications of Artificial Intelligence (AI) in Indian education within the framework of the National Education Policy (NEP) 2020. The policy highlights the role of technology in achieving universal literacy, equitable access, and experiential learning. AI-based tools such as adaptive learning systems, intelligent tutoring, virtual simulations, and automated writing assessment can enhance student engagement and learning outcomes. These technologies also enable personalized instruction and improved educational efficiency. However, the adoption of AI raises concerns related to ethics, bias, data privacy, and the evolving role of teachers. Addressing these challenges requires thoughtful policy frameworks and responsible implementation. While AI can support educational transformation, human teachers remain essential in guiding learners with empathy, values, and judgment.

Keywords: artificial intelligence, education policy, NEP 2020, virtual simulations, student engagement, human intelligence

Introduction

Artificial Intelligence (AI) is increasingly being integrated into education to enhance both teaching–learning processes and administrative functions. In alignment with India's National Education Policy (NEP) 2020, AI supports personalized, adaptive, and learner-centric education. By analyzing learner data, AI systems tailor content, pace, and assessment to individual needs. AI-driven automation improves institutional efficiency by streamlining tasks such as admissions, attendance, and evaluation. Key AI technologies in education include machine learning, natural language processing, computer vision, robotics, and expert systems. These technologies enable intelligent tutoring, automated assessment, and immersive learning experiences. Data-driven insights allow continuous improvement in instructional design and learner support. Overall, AI contributes to more effective, inclusive, and future-ready education systems.

AI Applications in Education

Intelligent tutoring systems (ITS) use techniques like machine learning to tailor instruction to each student's abilities. They provide step-by-step guidance that adapts based on the learner's responses and needs. For example, Carnegie Learning's MATHia software provides customized math instruction and just-in-time assessments aligned to

the Indian CBSE curriculum. Such adaptive learning platforms help actualize the NEP's vision of experiential learning.

- Adapt instruction based on student responses and needs
- Align to Indian curriculum standards like CBSE
- Enable experiential learning per NEP 2020

Automated writing evaluation uses NLP to analyze student writing and provide feedback. This can augment writing instruction in Indian languages as well. For instance, Pariksha provides automated essay scoring that evaluates local language writing for aspects like vocabulary, grammar, and style. Teachers can use the diagnostics to improve writing skills.

- Apply NLP to evaluate and provide feedback on writing.
- Support writing development in Indian languages.
- Aligns with multilingual education initiatives in NEP 2020.

Immersive simulations create engaging virtual environments grounded in real-world topics. For example, Embibe's Osmosis visualization technology immerses students in 3D worlds related to curriculum concepts. Game-based learning aligns with the NEP's emphasis on joyful education.

- Game-based learning provides joyful education per NEP.
- Virtual labs and simulations enable experiential learning.

Intelligent Tutoring Systems

Use techniques like machine learning to provide customized instruction for each student. They adjust the curriculum and feedback based on the learner's abilities and needs.

Carnegie Learning's Cognitive Tutor provides step-by-step guidance in math that adapts based on student responses. It offers hints and scaffolds concepts from basic to complex. Studies show it can raise student test scores.

ALEKS is another ITS that tailors' math instruction through periodic assessments. It then creates customized learning paths addressing each student's knowledge gaps.

Automated Essay Scoring

Automated essay scoring systems employ natural language processing techniques to assess written responses by analyzing features such as vocabulary usage, grammar, spelling, coherence, and syntactic structure. These systems are designed to evaluate writing quality in a manner comparable to human assessment. For example, ETS's *e-rater* scores essays used in standardized tests such as the GRE by examining traits including fluency, diction, organization, and linguistic complexity, while also providing formative feedback for improvement. Similarly, Pearson's *Write To Learn* offers automated feedback on writing assignments at the high school and college levels, enabling students to revise and refine their drafts effectively.

Virtual Learning Environments

Interactive games and simulations create immersive environments for experiential digital learning. Students can practice skills through 3D worlds tailored to curriculum topics.

Newton's Playground teaches physics concepts like mass and acceleration through an engaging game with physics puzzles. Students solve real-world engineering problems.

Other systems like ALEKS and Kidbot use discovery-based learning with activities adaptable to skill level. These provide hands-on learning experiences.

Adaptive Testing

Adaptive testing systems assess students' abilities dynamically by adjusting the difficulty of questions based on individual performance, resulting in more precise measurement than traditional fixed-form assessments. Tools such as the NWEA MAP utilize machine learning algorithms to select subsequent questions according to students' previous responses and estimate their achievement levels. The detailed performance data generated helps teachers customize instruction and address specific learning needs.

Similarly, Computer Adaptive Sequential Testing (CASTLE) adapts test items in real time based on learner ability, enabling accurate placement, diagnosis, and targeted intervention

Automated Grading

Automated scoring tools for handwritten work use computer vision and machine learning. They can identify different handwriting and quickly score work, saving teachers time.

Grade scope allows teachers to assign handwritten work which is then scored by algorithms. It provides analytics on class mastery and feedback to students.

Similar systems can automate the scoring of diagrams, mathematical expressions, sketches, and more. This expands beyond multiple-choice tests.

AI Teaching Assistants

AI tutors and chatbots simulate human conversation using NLP to answer student questions. They offer responsive support at scale.

Jill Watson, a virtual TA created at Georgia Tech, helped students in an AI course by answering questions on discussion boards using natural language capabilities.

Mookie, an AI teaching assistant robot, engages students with facial expressions and motions. It can take attendance, deliver quizzes, and encourage class participation.

AI and Personalized Learning

Using techniques like machine learning, AI education systems can continuously model each student's understanding and adapt instruction to their individual needs.

AI analyzes how students interact with lessons and activities to infer their knowledge, skill levels, misconceptions, and learning styles. It then provides personalized content and feedback.For example, Carnegie Learning curricula generate individual student profiles to tailor instruction and direct them to review topics they are struggling with.

Challenges of AI in Education

While AI has promising applications, there are challenges to consider. Issues like costs, biases, privacy, and teacher acceptance must be addressed. AI should be used ethically to support educators in aligning with Indian educational priorities and values.

- High costs associated with AI infrastructure, implementation, and maintenance
- Risk of algorithmic bias affecting fairness and inclusivity
- Need for strong data privacy and security protections
- Importance of teacher acceptance, training, and professional readiness
- Ethical use of AI to support—not replace—educators
- Alignment of AI applications with Indian educational values and priorities

Future Outlook

As adaptive AI and immersive simulations continue improving, blended classrooms leveraging these tools are likely to expand under the vision of the NEP 2020. With responsible development, AI can play a role in powering more student-centered, individualized, and engaging education in India.

- Blended classrooms integrating AI tools with traditional teaching practices will become more prevalent
- Responsible and ethical development of AI systems is essential
- AI has strong potential to support the NEP 2020 vision of student-centered education.

AI for Indian Education: Nurturing Wisdom, Ethics and Service

Foster holistic development beyond academics - AI should nurture ethics, wisdom, empathy, creativity, and critical thinking, in line with India's ancient education system.

Promote pluralism and diversity - AI systems should be inclusive of India's many languages, cultures, and different learning needs.

Align to Indian knowledge systems - NLP models and virtual environments could incorporate India's rich literary and scientific traditions.

Address societal challenges - AI applications could help provide education on issues like health, agriculture, environment, and empower people.

Support teachers - AI should act as assistants to amplify human guidance, not replace teachers and their nurturing role.

Focus on student-centric learning - AI tools should enable self-paced, experiential learning focused on students' interests and potential.

Uphold equity - AI should help bridge digital divides and make quality education accessible to all of India's children regardless of background.

Safeguard ethics - Student privacy, fairness, and transparency should be ensured in AI algorithm design and use.

Complement existing pedagogies - Blend technological innovation thoughtfully with time-tested teaching practices suited for Indian classrooms.

Conclusion

The National Education Policy 2020 envisions a comprehensive transformation of India's education system by emphasizing universal literacy, equitable access, and experiential, holistic, and multilingual learning. Artificial Intelligence, when used responsibly, has the potential to support this vision by enabling personalized learning at scale and improving access to quality education. AI-driven innovations such as adaptive learning systems, intelligent tutoring, automated writing evaluation, and immersive simulations can enhance student engagement, motivation, and learning outcomes while making education more interactive and learner-centered.

However, the successful integration of AI in education requires thoughtful policy frameworks and ethical safeguards. Concerns related to data privacy, algorithmic bias, accountability, and teacher acceptance must be carefully addressed to ensure fair and inclusive implementation. Human teachers remain central to the educational process, as they guide learners with empathy, values, and critical judgment. When grounded in India's educational traditions and ethical principles, AI can serve as a supportive tool that strengthens human capacities and contributes to realizing the NEP 2020 vision of an inclusive, humanistic, and future-ready education system

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