

Effectiveness of Digital India and Artificial Intelligence in Indian Education System

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Abstract

The Indian education system is undergoing a significant transformation through the "Digital India" initiative and the integration of artificial intelligence (AI) technologies. This paper investigates the multifaceted impact of these innovations on education in India, examining their influence and effectiveness. The integration of "Digital India" and AI holds the potential to revolutionize education delivery and accessibility, enhancing personalized learning and administrative efficiency. However, challenges such as the digital divide and privacy concerns must be addressed. Striking a balance between innovation and overcoming these challenges is essential for establishing an equitable and effective educational system in India.

Introduction

With the rapid advancement of technology, Artificial Intelligence (AI) has undeniably emerged as a pivotal catalyst for growth and innovation across a multitude of industries. This transformative force has permeated nearly every facet of our lives, and it is increasingly crucial that the younger generation is exposed to its basic concepts from an early age. India, with its longstanding commitment to universal education, should recognize the integral role AI can play in achieving this goal.

Incorporating AI into the educational curriculum is not just a matter of choice; it is an imperative. Educators across states in India must begin to integrate AI into their classrooms. The benefits are manifold. First and foremost, AI can aid teachers in streamlining administrative tasks such as generating student feedback, grading papers, and scheduling parent-teacher interactions. This automation can alleviate a significant burden on educators, freeing up their time for more important and creative aspects of teaching.

One of the tangible ways AI can assist educators is through text-to-speech applications. This technology can help teachers save precious time in tasks such as reading out materials to students, making classroom content more accessible, and accommodating various learning styles. Moreover, AI can provide personalized learning experiences, tailoring content to individual student needs, thereby enhancing the effectiveness of education.

Furthermore, integrating AI into the classroom can make learning more engaging and interactive. AI-powered educational tools can adapt to a student's pace and learning style, ensuring that they grasp concepts effectively. This adaptability can foster a love for learning by making it more student-centered and less rigid.

However, it's essential to approach this integration thoughtfully and ethically. Teachers should be provided with the necessary training to effectively leverage AI tools in their teaching practices, ensuring that they remain in control of the educational process. Moreover, privacy and data security concerns must be addressed to protect students' personal information.



Figure 1. Artificial Intelligence

AI-Powered Education: A New Era of Learning

In India, the journey towards achieving universal digital education in schools is still far from completion. Many schools, especially in rural areas, lack the basic infrastructure required for digital education, including a reliable electricity supply. However, there have been significant efforts to enhance the availability of digital educational content through Open Educational Resources (OER) initiatives driven by both central and state governments. Two notable platforms, the National Repository of Open Educational Resources (NROER) and Diksha (National Teacher Platform), have been initiated by the Government of India to provide access to a wide range of educational materials.

Despite these initiatives, the integration of meaningful Information and Communication Technology (ICT) in schools remains limited, and the digital data generated through student interactions is scarce. Nevertheless, some private sector entities have stepped in to collect and leverage student data through their applications and platforms. One such example is the Indian company Education Initiatives (EI), which has been accumulating data from millions of assessments using its Mindspark product. This tool has been implemented in various Indian states over the last 18 years and has reached over two million students.

Mindspark employs algorithms to analyze student responses and create personalized learning paths based on individual learner profiles. These algorithms engage with students through targeted questions, identify their current learning levels, and pinpoint areas where they face challenges. In a short amount of time, Mindspark can provide a report on each student's learning level, enabling it to suggest tailored content for that student. This approach is not limited to the classroom but can also support self-directed learning.

In essence, while the broader infrastructure for digital education in India is a work in progress, the emergence of private sector initiatives like Education Initiatives' Mindspark showcases the potential for data-driven, personalized learning experiences.

Research Methodology

The Indian education system has experienced a profound shift in recent years, largely attributed to the government's "Digital India" initiative and the integration of artificial intelligence (AI) technologies. This article investigates into the multifaceted impact of these innovations on education in India, providing an in-depth

analysis of their influence and effectiveness. The integration of "Digital India" and AI in the Indian education system has the potential to revolutionize the way education is delivered and accessed. It has improved access, personalized learning, and administrative efficiency. However, challenges such as the digital divide, privacy concerns, and the need for educator training must be addressed to ensure that these technologies reach their full potential. The future of education in India is undoubtedly being shaped by these initiatives, and it is imperative to strike a delicate balance between innovation and addressing the challenges to establish an equitable and effective educational system.

Collection of Data

In our qualitative research, we conducted in-depth interviews with two distinct groups of individuals to explore the impact of AI and ML in the Indian education sector. The first group consisted of subject matter experts well-versed in AI and ML technologies, offering insights into their technical aspects. The second group comprised senior managers from successful Indian educational technology startups specializing in AI-based products for K-12 education, providing real-world perspectives. This two-pronged approach allowed us to gain a comprehensive understanding of both the theoretical foundations and practical applications of AI and ML in education, offering valuable insights for the advancement of educational technology in India.

Analysis of Data

The study employed a grounded theory approach, following open, axial, and selective coding, to analyze interview accounts. Open coding involved abstracting themes from the data, categorizing concepts related to Edtech firms' use of AI, such as personalized learning and teacher support. Axial coding then subcategorized the data within these themes, and selective coding unified them around a core category: the impact of AI-based technologies on teaching and learning. This method allowed for inductive factor discovery, maintaining qualitative analysis consistency. The research aimed to explore how Edtech firms use AI and the untapped potential of AI in education.

Finding and Discussion

Revolutionizing Education: The Role of AI in Edtech Student Support

AI in education is widely recognized for its role in personalizing learning, as emphasized by Edtech respondents. With growing class sizes and diverse learning styles, teachers find it challenging to cater to individual students effectively. Educational technology firms utilize rule-based algorithms, comprehensive content databases, and data-driven insights to create a personalized learning experience. They offer tailored content, practice questions, and recommendations based on each student's strengths and weaknesses. This adaptability ensures that students receive the right support and resources for their specific needs, ultimately improving their learning journey.

Adaptive assessments

Many Edtech firms offer personalization and recommendations, a select few go further with adaptive assessments. These assessments start with a "cold start," treating all students as average performers and adjusting question difficulty based on their responses. Edtech companies integrate personalization into classrooms, offering tailored analyses and recommendations based on individual learning profiles. This approach has improved student engagement and performance across K-12 levels. Adaptive assessments provide instant feedback, highlight mistakes, and show students where they stand in the class. They align with Bloom's taxonomy and offer comprehensive solutions, while ongoing evaluation keeps students engaged and informed, offering remedial measures for improvement. This approach enhances the overall educational experience.

Role of Artificial Intelligence in Enhancing Teacher Support in Edtech

Educational technology firms extend their support to teachers beyond personalized student learning by providing detailed performance reports. AI-driven systems track students' learning behavior, including time spent on tasks, hint requests, and more. When teachers administer quizzes, these systems offer analytics on

student performance, helping identify which topics are challenging for the class. Teachers can access individual student reports, allowing them to pinpoint specific areas of struggle for each student and personalize content and recommendations accordingly. These insights empower educators to enhance their teaching methods and address students' unique needs effectively, fostering a more tailored and effective learning experience.

Adaptive assessments

The implementation of adaptive assessment systems offers significant benefits to educators by streamlining and standardizing the evaluation process while reducing the potential for human error. Intelligent adaptive systems play a pivotal role in saving teachers a substantial amount of time, as they can create dynamic question papers for each student and automate the often repetitive and monotonous task of grading answer sheets. According to one firm respondent, these systems can lead to remarkable time savings, with teachers conserving up to 90% of their time in objective-type assessments and up to 70% in subjective-type assessments.

Moreover, the assessment reports generated by these systems provide valuable insights into variations in students' performance, highlighting specific areas where students may lack understanding and offering remedial measures for improvement. These reports go a step further by presenting a time-versus-marks distribution, revealing the amount of time students took to respond to each question. This feature enables teachers to gauge whether students guessed their answers or genuinely comprehended and responded to the questions. With more time and energy freed up, teachers can focus on delivering personalized learning experiences to their students. In this way, AI-enabled systems empower educators with actionable insights into their students' performance, enabling them to make informed decisions about tailoring their teaching methods to better meet individual learning needs.

Ed-tech and Artificial Intelligence: Expert Perspectives

Latest Developments in Artificial Intelligence

The evolution of AI has moved from rule-based problem-solving to more complex knowledge representation and decision-making. Educational technology (Edtech) firms are seen as employing traditional AI or data science approaches, collecting and analyzing data to offer personalized learning experiences. However, true AI, which involves systems discovering patterns from unknown data, remains challenging due to the requirement for vast datasets. While data science can identify issues and suggest solutions, it cannot act on them, underscoring the crucial role of teachers. AI-driven conversational systems and adaptive assessments show promise but have limitations, particularly in handling nuanced student responses. The static nature of algorithms in Edtech contrasts with the dynamic learning processes of human intelligence, reflecting the current state of AI, which experts believe falls short of truly mimicking human responses.

Unexplored Horizons of Artificial Intelligence

AI has advanced significantly in augmenting human capabilities, enabling complex data analysis and decision-making. However, within the Indian education technology sector, AI is predominantly in its early stages, with a primary focus on data science and supervised learning. Adaptive assessment systems, while beneficial, are constrained by pre-programmed rules and limitations in self-determining question difficulty levels. Predictive analytics capabilities are also limited. Despite progress in computer vision and some natural language processing, the technology's complexity, especially in diverse linguistic contexts, remains a challenge. Experts suggest that AI should go beyond statistics to engage in self-learning and collaborate with teachers to enhance the teaching-learning process, allowing educators to focus on nurturing essential skills and interpersonal development in students. The future of AI in education holds the promise of transforming systems and processes, enriching the teaching experience, and improving learning outcomes.

Discussion

Personalized Learning and Student Support:

AI's ability to personalize the learning experience for students is a game-changer in education. It caters to individual students' strengths and weaknesses, offering tailored content, practice questions, and recommendations. This adaptability ensures that students receive the right support and resources for their specific needs, which can significantly improve their learning journey. The growing class sizes and diverse learning styles make it challenging for teachers to provide such personalized attention without AI's assistance.

Adaptive Assessments:

Adaptive assessments take personalization to the next level by adjusting question difficulty based on students' responses. This approach aligns with Bloom's taxonomy and offers comprehensive solutions for students. It provides instant feedback, highlights mistakes, and keeps students engaged and informed. Moreover, it offers time-saving benefits for teachers by automating the grading process and providing valuable insights into students' performance. By freeing up teachers' time from repetitive tasks, they can focus on delivering more personalized learning experiences.

Teacher Support and Performance Reports:

AI doesn't only benefit students but also teachers. AI-driven systems track students' learning behavior and offer detailed performance reports. These reports help educators identify which topics are challenging for the class and offer individual student reports. This empowers teachers to enhance their teaching methods and address students' unique needs effectively, fostering a more tailored and effective learning experience.

The Evolving Landscape of AI in Education:

AI in education has evolved from rule-based problem-solving to more complex knowledge representation and decision-making. While current AI can offer personalized learning experiences and streamline assessments, it has limitations, particularly in handling nuanced student responses. It's crucial to understand that AI complements the role of teachers rather than replacing them, as it cannot fully replicate human intelligence.

Unexplored Horizons of AI in Education:

Despite the progress made, AI in education, especially in the Indian context, is still in its early stages. There is room for growth in areas such as self-learning, dynamic question difficulty levels, and natural language processing, especially in diverse linguistic contexts. The future of AI in education holds the promise of transforming systems and processes, enriching the teaching experience, and improving learning outcomes by allowing educators to focus on nurturing essential skills and interpersonal development in students.

Conclusion

The integration of AI into India's education system under the "Digital India" initiative holds immense promise. It can revolutionize education with personalized learning and adaptive assessments, boosting student engagement and performance. AI equips teachers with valuable insights to refine their teaching methods and cater to individual student needs. However, it's vital to understand that AI supplements rather than replaces educators, given its limitations in replicating human responses. While AI has made significant progress, there are unexplored horizons in self-learning, dynamic question difficulty levels, and diverse language processing. The future of AI in Indian education aspires to enhance teaching and learning, emphasizing vital skills and personal development. Bridging the digital divide and addressing privacy concerns are essential to ensure equitable access to these technologies. Striking a balance between innovation and addressing challenges is key to building a more effective and inclusive education system for India's future.

References

1. Drigas, A.S. & R. Ioannidou (2013), A Review on Artificial Intelligence in Special Education, Communications in Computer and Information Science, DOI: 10.1007/978-3-642-35879-1_46
2. Vincent-Lancrin, S. et al. (2019), Measuring Innovation in Education 2019: What Has Changed in the Classroom?, Educational Research and Innovation, OECD Publishing, Paris.

3. Holmes, W. (2019), Artificial intelligence in education. Promises and implications for teaching and learning, Center for Curriculum Redesign, Boston.
4. Fatai Adesina Anifowose, Safiriyu Ibiyemi Eludiora, "Application of Artificial Intelligence in Network Intrusion Detection", World Applied Programming, Vol (2), No (3), March 2012.
5. Holland JH, "Adaptation in Natural and Artificial Systems", 1975.
6. Ethics Guidelines for Trustworthy AI', <https://ec.europa.eu/futurium/en/ai-allianceconsultation/guidelines#Top> (visited 2020, Jan. 17).
7. Sunita B Aher and LMRJ Lobo. 2013. Combination of machine learning algorithms for recommendation of courses in E-Learning System based on historical data. Knowledge-Based Systems 51 (2013), 1–14.
8. Gökhan Akçapınar, Mohammad Nehal Hasnine, Rwitajit Majumdar, Brendan Flanagan, and Hiroaki Ogata. 2019. Developing an early-warning system for spotting at-risk students by using eBook interaction logs. Smart Learning Environments 6, 1 (2019),
9. Bryan Alexander, Kevin Ashford-Rowe, Noreen Barajas-Murph, Gregory Dobbin, Jessica Knott, Mark McCormack, Jeffery Pomerantz, Ryan Seilhamer, and Nicole Weber. 2019. EDUCAUSE Horizon Report 2019 Higher Education Edition. Technical Report.
10. Purushottam Lal Bhari and Ashok Jetawat. [n.d.]. The Future Potential Trends, Issues and Suggestions of Artificial Intelligence in Indian Education System. ([n. d.]).
11. J Bichsel. 2002. Analytics in Higher Education: Benefits, Barriers, Progress and Recommendations (Research Report). Louisville, CO: EDUCAUSE Center for Applied Research.
12. A Boyer and G Bonnin. 2016. Higher education and the revolution of learning analytics. Report of the International Council for Open and Distance Education (ICDE) (2016).
13. Maud Chassignol, Aleksandr Khoroshavin, Alexandra Klimova, and Anna Bilyatdinova. 2018. Artificial Intelligence trends in education: a narrative overview. Procedia Computer Science 136 (2018), 16–24.
14. Sheshadri Chatterjee and Kalyan Kumar Bhattacharjee. [n.d.]. Adoption of artificial intelligence in higher education: a quantitative analysis using structural equation modelling. Education and Information Technologies([n. d.]), 1–21.
15. Ko-Kang Chu, Maiga Chang, and Yen-Teh Hsia. 2003. Designing a course recommendation system on web based on the students' course selection records. In EdMedia+ Innovate Learning. Association for the Advancement of Computing in Education (AACE), 14–21.
16. Dipendra Nath Das and Saumen Chattopadhyay. 2014. Academic performance indicators: straitjacketing higher education. Economic and Political Weekly(2014), 68–71.
17. Lindsay Daugherty, Trey Miller, Rafiq Dossani, and Megan Clifford. 2013. Building the links between funding and quality in higher education: India's challenge. Rand Corporation.
18. Rober Hunter DAVIS, DB Edelman, and AJ Gammernan. 1992. Machine-learning algorithms for credit-card applications. IMA Journal of Management Mathematics 4, 1 (1992), 43–51. Google Scholar Cross Ref
19. Colin de la Higuera. 2019. A report about Education, Training Teachers and Learning Artificial Intelligence: Overview of key issues.(2019).
20. JV Deshpande. 2004. Examining the Examination System. Economic and Political Weekly(2004), 1563–1565.
21. Priya Dialani. 2019. Use of AI and VR in Indian Education Sector.
22. Shorouq Fathi Eletter, Saad Ghaleb Yaseen, and Ghaleb Awad Elrefae. 2010. Neuro-based artificial intelligence model for loan decisions. American Journal of Economics and Business Administration 2, 1(2010), 27.