

Role of Artificial Intelligence in Revolutionising Education Technology

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Abstract

This research thoroughly explores the diverse impact of Artificial Intelligence (AI) within the educational sector, specifically focusing on the Indian societal context. The introduction lays the foundation for this exploration, underscoring the increasing prominence of AI. Subsequent sections examine the intricate relationship between AI and education, addressing recent challenges encountered by Indian society in incorporating AI into educational practices. The study also scrutinizes government initiatives aimed at propelling AI in Edtech, along with presenting case studies that offer practical insights into the efficacy of AI solutions. The paper concludes by consolidating key findings, emphasizing the pivotal role of AI in driving India's educational transformation. It underscores the significance of ongoing research, collaborative efforts, and adaptable policies to fully harness the potential of AI in constructing a resilient and inclusive education system for the future of Indian society.

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Index Terms

Artificial Intelligence (AI), Fourth Industrial Revolution, G20, AI in Education, Sustainable Development Goals, Deep Learning, Facial Recognition, National Education Policy, CBSE, NISHTHA, YUVAi, UNESCO, Data Privacy, AI Ethics.

Introduction

As the global community advances into the era of the fourth Industrial Revolution (I.R. 4.0), the substantial role of Artificial Intelligence (AI) becomes increasingly evident. Virtually every facet of our lives has felt the impact of AI, underscoring its pervasive influence. Within this transformative landscape, the educational sector stands prominently at the forefront, undergoing significant changes through the seamless integration of cutting-edge technologies. This is exemplified by the recent gathering of education ministers from G20 countries in Pune, where unanimous agreement was reached on the equitable and inclusive implementation of “Artificial Intelligence in Education and Skilling,” emphasizing a commitment to human rights.

This research is dedicated to unraveling the nuanced role of AI in education, particularly within the context of the Indian educational sector. It is unequivocal that AI has the potential to address the existing quality gaps in the education system, making it a pivotal area of focus. Furthermore, the utilization of AI applications can enhance the efficiency of educators by automating routine tasks, allowing them to dedicate more time to high-level intellectual endeavors in teaching.

The study presented here conducts a thorough examination of the challenges inherent in the integration of AI into education, acknowledging the diverse socio-economic landscape of India. Understanding and addressing these challenges are paramount for charting an effective path forward. The research culminates by consolidating key discoveries and offering recommendations to fully unlock the potential of AI in both societal and educational domains within India.

This paper not only contributes to the expanding body of literature on the impact of AI but also provides practical insights that hold significance for policymakers, educators, and stakeholders dedicated to advancing India’s socio-economic landscape.

Artificial Intelligence

Artificial Intelligence (AI) is the emulation of human intelligence within computer systems, enabling them to replicate human-like thinking and behavior. Engineered to mimic essential human cognitive functions such as perception,

reasoning, learning, and problem-solving, AI systems leverage algorithms and computational models. They process extensive datasets, extracting patterns and making predictions or decisions based on the analyzed information. The transformative impact of AI extends across various sectors, with its implementations in education playing a crucial role in revolutionizing how we process information and make decisions.

According to the data given by BlueWeave Consulting (Figure 1), India's AI market size which currently stands at \$672 million in 2022, will exponentially rise to \$3967 million by 2029.

Therefore, to tap into the expanding market scope of AI, it is imperative to cultivate a substantial pool of skilled labor. This underscores the necessity for our education sector to prioritize and emphasize AI education.

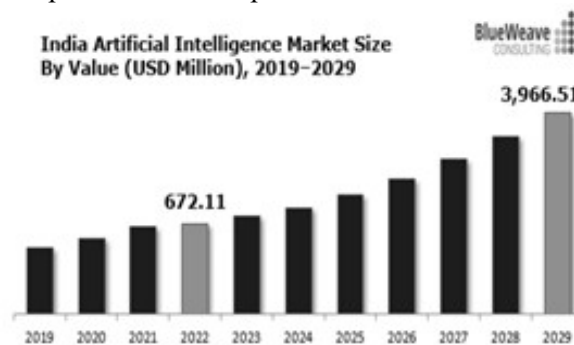


Figure 1. India's AI Market Size by Value, 2019-2029

Impact of AI on Education

AI holds the potential to revolutionize the Indian education system, effectively addressing persistent challenges and enhancing access, quality, and efficiency. The following key insights highlight its transformative impact:

- 1) Large student population: AI can tackle the challenge of managing a vast and diverse student population by offering personalized learning experiences and automating administrative tasks.
- 2) Multilingual environment: AI can facilitate the translation of learning materials and provide language support, enhancing accessibility for students from diverse linguistic backgrounds.
- 3) Teacher shortages: AI can mitigate teacher shortages by offering automated support and personalized feedback, enabling teachers to effectively reach a larger number of students.

- 4) Focus on rote learning: Shifting the emphasis from rote learning to critical thinking and problem-solving is achievable through AI, providing interactive and engaging learning experiences.

In summary, AI has the potential to markedly enhance the Indian education system, introducing elements of personalization, accessibility, efficiency, and engagement. However, successful implementation hinges on addressing challenges related to the digital divide, cost, data privacy, teacher training, and standardization.

Applications of AI

Within the unique educational landscape of India, AI applications are being tailored to address specific local needs and challenges. AI-powered intelligent tutoring systems are now being customized to seamlessly integrate with the Indian curriculum, offering students personalized learning paths that cater to their individual needs and pace. Additionally, the deployment of automated assessment tools is helping educators efficiently manage large classrooms, enabling them to provide timely feedback and intervene when necessary. Furthermore, AI-driven language processing capabilities are proving to be invaluable in India's diverse classrooms, supporting students in their efforts to learn and master multiple languages.

These applications not only elevate the quality of education but also align with the government's initiatives aimed at harnessing technology for educational development. The nuanced integration of AI in the Indian education sector signifies a strategic approach to meet the specific nuances and requirements of the diverse Indian society. This approach aims to render education more accessible, inclusive, and effective, aligning with broader goals of fostering technological advancements in the educational landscape.

Indian Education System and AI

AI holds the potential to address some of the most significant challenges in the Indian education system today. This encompasses the innovation of teaching and learning practices, propelling advancements toward achieving Sustainable Development Goal 4 (SDG 4) by 2030, as illustrated in Figure 2.

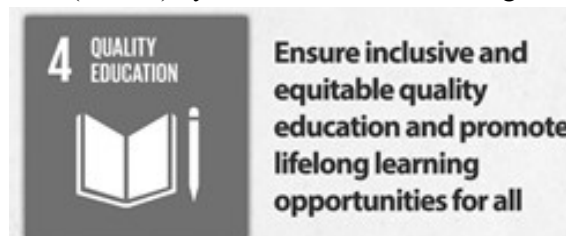


Figure 2. Sustainable Development Goal 4 – Quality Education

AI is ushering in transformative changes in the Indian education sector through various initiatives:

- 1) *AI adoption in the curriculum:* Recognizing the significance of AI, Andhra Pradesh CM Y.S. Jagan Mohan Reddy has emphasized its inclusion in the curriculum, signaling a strategic move towards integrating AI into the educational framework.
- 2) *Telangana Public Schools:* Government school complexes in Telangana State have embarked on the deployment of AI tools to automate diverse processes, including formative assessments, attendance tracking, and recording mid-day meal data. This forward-looking approach reflects a commitment to leveraging AI for improved operational efficiency.
- 3) *Attendance automation:* Addressing the challenge of student attendance in public schools in Tamil Nadu, an initiative aims to automate attendance marking, alleviating the burden on teaching resources and minimizing errors. The Tamil Nadu e-Governance Agency (TNeGA) has developed a cost-effective deep learning facial recognition-based attendance system, providing a secure and efficient solution.
- 4) *Identify potential school dropout rate:* In collaboration with Microsoft, the Andhra Pradesh Government has utilized AI technology to tackle the issue of increasing school dropout rates. Leveraging Microsoft's Azure machine learning platform, an application was developed to predict and address potential school dropouts, demonstrating the practical application of AI for educational improvement.

Effort is taken by the Government of India

As outlined in UNESCO's 'The State of Education Report for India 2022: Artificial Intelligence in Education', India boasts the highest relative AI skill penetration rate, surpassing the global average by over three times, and this became possible only because of the major boost given to AI in education by the govt. of India. Some major initiatives taken are:

- 1) **New Education Policy (NEP) 2020:** The NEP, introduced in 2020, recommends the incorporation of contemporary subjects like Artificial Intelligence into the curriculum, reflecting a forward-looking approach to align education with evolving technological trends.
- 2) **AI as a subject in CBSE:** The Central Board of Secondary Education (CBSE) has taken a proactive step by introducing Artificial Intelligence as a subject in class IX and class XI from the academic session 2020-2021. This move

ensures that students are exposed to AI concepts early in their educational journey.

- 3) **National Initiative for School Heads' and Teachers' Holistic Advancement (NISHTHA):** The government has launched the Four Year Integrated Teacher Education Program (ITEP) and the NISHTHA Integrated Training Program for teachers, head teachers/principals, and other educational management stakeholders. The NISHTHA training program utilizes AI tools on the DIKSHA portal to offer self-paced learning and close supervision.
- 4) **Responsible AI for Youth Programme:** This national program targets students from Government schools across India, aiming to provide them with opportunities to join the skilled workforce inclusively. It emphasizes responsible AI practices among the youth.
- 5) **YUVAi – Youth for Unnati and Vikas with AI:** Launched by the National e-Governance Division, Ministry of Electronics & IT, Government of India, the YUVAi program (figure 3) addresses the growing skills gap. It focuses on building digital readiness among the next generation, continuing the momentum of the inclusive and collaborative AI Skilling program initiated in 2020.



Figure 3. YUVAi – A National Program for Youth

Challenges and Ethical Concerns Related to AI in Education

While the integration of Artificial Intelligence (AI) in the education sector holds the potential to accelerate progress towards Sustainable Development Goal 4 (SDG 4), ensuring inclusive and equitable quality education, it brings forth several risks and challenges:

- 1) **Overreliance on AI:** The potential overreliance on AI systems raises concerns about neglecting the essential human elements of guidance, mentorship, and the social aspects inherent in education. It is imperative to view AI as a complementary tool rather than a substitute for human teachers to maintain a balanced educational environment.
- 2) **Ethical Use and Transparency:** Ensuring the ethical use of AI necessitates transparency in how algorithms make decisions and provide recommendations. Building trust among students, educators, and stakeholders relies on a clear understanding of AI processes.
- 3) **Lack of Universal Access and Equity:** Disparities in access to technology, reliable internet connectivity, and training can result in a digital divide, leaving certain students at a disadvantage. Addressing these inequities is essential to ensure that the benefits of AI in education are accessible to all.
- 4) **Data Privacy and Security:** The extensive collection and analysis of student data by AI systems raise concerns about data privacy and security. Implementing robust data protection measures and ensuring compliance with privacy regulations are crucial to safeguard sensitive information.
- 5) **Algorithmic Bias and Fairness:** AI systems, if not carefully designed, may unintentionally perpetuate biases present in the data they are trained on. Failure to address these biases can lead to unfair treatment and discrimination in educational outcomes, highlighting the importance of continuous scrutiny and mitigation efforts.

Way Forward

Giving top priority to AI ethics in education is crucial for ensuring responsible and unbiased AI applications. Efforts should be directed towards eliminating biases associated with algorithms, thereby addressing discrimination concerns. Ensuring universal access to the latest technology for all students and teachers is imperative, accompanied by the acceleration of a comprehensive regulatory framework for AI in education. Reforms are essential to enhance public confidence in AI, and the private sector's expertise should be leveraged through effective public-private partnerships for the development of AI products.

Case Studies

Several countries worldwide have implemented AI in education, offering valuable insights for the Indian education sector:

- 1) *South Korea*: South Korea has successfully implemented AI-based systems to tailor homework and assignments based on students' educational levels and learning behaviors. Personalized AI tutors and online learning platforms empower teachers to focus on social-emotional and hands-on lessons.
- 2) *USA*: The rapid advancements in generative AI in the USA have led to the implementation of restrictive policies in schools, primarily driven by concerns over student cheating. This case highlights the importance of carefully considering the ethical implications of AI applications in an educational context.
- 3) *Finland*: Finland's AI in Learning project, a collaboration of international researchers and companies, aims to promote equity and quality in learning globally. This initiative produces scholarly papers emphasizing the ethical use of AI in education and its potential to enhance teaching and learning.
- 4) *China*: China has made substantial investments in AI tools, such as the adaptive tutoring platform Squirrel AI, focused on large-scale data sets and camera surveillance. However, concerns about ethics, equitable access, and privacy are less emphasized, emphasizing the need for a balanced approach to AI implementation.

These case studies offer valuable lessons for the Indian education sector, illustrating best practices and potential pitfalls associated with the integration of AI into educational frameworks

Conclusion

The government should approach the integration of AI in education with a strategic focus on the 5 'I's: Inclusiveness, Indigenization, Innovation, Investment in Infrastructure, and international cooperation. The primary role of AI in education spans the automation of both academic and administrative tasks, personalized learning, intelligent content creation, and ensuring all-time accessibility. Notably, AI has successfully addressed accessibility challenges in various fields, such as health and the environment.

Recognizing India's significant potential for AI growth, it becomes imperative for the country to embrace technology in education to leverage its benefits. By doing so, India can enhance its education system, preparing its young population more effectively for the challenges and opportunities of the future. This strategic incorporation of AI aligns with the broader goals of inclusivity, innovation, and sustainable development, positioning India at the forefront of educational advancements on the global stage.

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