Impact of Artificial Intelligence Penetration in Education System

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ORIGINAL ARTICLE

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ABSTRACT

This study examines how artificial intelligence (AI) has affected and permeated in Indian education at present, encompassing in higher education steadily, how AI-driven interventions, including adaptive learning platforms, intelligent tutoring systems, automated assessment tools, and AI-based administrative support, have affected teaching-learning methodologies, access to education, personalization, and institutional efficiency through a critical review of the literature, policy analysis, and illustrative case studies. According to the findings, AI has gradually started to change traditional educational methods in India by providing individualized learning experiences, reducing administrative hassles, and increasing access to high-quality resources—all of which are especially helpful in distant or resource-constrained settings. Widespread issues still exist, though, including gaps in digital infrastructure, differences in access between urban and rural areas, unequal preparedness among instructors, and worries about data privacy and the moral application of AI. The study comes to the conclusion that although AI's widespread use holds great promise for upgrading Indian higher education, achieving its full potential at scale will require ongoing legislative backing, infrastructural investment, teacher training, and steps to guarantee equitable and ethical deployment.

KEY WORDS

Artificial Intelligence, Education system, Adaptive Learning, Digital Infrastructure, New Educational Policy.

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INTRODUCTION

Artificial Intelligence (AI) is a futuristic approach. It has integral a part of our life. Artificial intelligence is available in everywhere. One of the most stimulating changes has come in education sector. Schools and higher education system are adopting AI rapidly. This shift is noticeable across classrooms, online learning, and even various administrative and academic tasks. In the context of education, artificial intelligence refers to the application of intelligent technologies to improve instruction. AI can assess student performance, adapt lectures, and even automate duties like grading and attendance.

EdTech, platforms are increasingly relying on AI techniques. These platforms empower teachers and students by utilizing artificial intelligence tools in the classroom. AI is capable of making tests, producing feedback, and modifying the content's degree of difficulty.

Globally, artificial intelligence (AI) has developed from a specialized area of study to a technology with significant societal ramifications. AI has the potential to improve education through data-driven decision making, scalable tutoring, effective evaluation, and individualized learning. India stands to gain a great deal from AI-driven education because of its sizable and diversified student body, stark rural-urban divide, and uneven resource distribution.

Digital technologies (computers, Internet, ICT) started to permeate Indian schools and institutions more widely at the turn of the millennium. AI-based educational tools began to appear throughout time as a result of changes in policy, advancements in technology, and growing interest in Educational technologies.

Objective of Study

1. How is the use of AI in Indian education changed?
2. What kinds of AI-based penetration tools and policies have been implemented?
3. Impact of noted in terms of institutional efficiency, quality, access, and trends of AI?
4. What obstacles and limitations prevent wider implementation, under-resourced settings?

Review of Literature and Historical Background

1. **Artificial Intelligence in Higher Education: A Critical Analysis in the Context of India's National Education Policy (NEP) 2020** Satish G. Dhokare (2024) found that Artifical intelligence can enable adapted learning, improve institutional supremacy, enhance research output – aligned with NEP's aims of access, quality, equity. However, deficiencies in digital infrastructure, academic capability, data governance, and algorithmic bias must be filled for integration to be relevant.

2. **AI in education: study of its importance and impact:** Sushma Rani & Meenakshi (2024) Concludes that AI has "ability to radically revolutionize the way students learn" by offering personalized experiences, streamlining administrative procedures, providing real-time feedback leading to improved academic achievements. An empirical examination of the application of AI in education: individualized learning pathways, automated grading, and adaptive tutoring systems

3. **An Analysis of AI Intervention in Education Systems of India:** Atheeq Sultan Ghori (2023), shows how AI may give AI-tutoring for fundamental subjects, identify difficult question patterns, automate grading (particularly regular assessments), and free up instructor time for more meaningful contact. However, it also points out that AI cannot completely replace human mentoring.

4. **Impact of Artificial Intelligence in Education Sector: A Qualitative Study in Indian Context** Era & Hemant K. Gupta (2023) Most people perceive AI positively; see benefits and new tools. Some, however, are particularly concerned about the future of education, the evolving responsibilities of educators and institutions, and legal and ethical frameworks. Lawyers and jurists, in particular, are concerned about the legal underpinnings, while engineers see AI more as a tool to improve quality.

5. **Proactive and Reactive Engagement of Artificial Intelligence Methods for Education: A Review** by Sruti Mallik & Ahana Gangopadhyay (2023) It shows how AI supports the full lifecycle of education: from admissions and scheduling (proactive) to teaching, assessment, feedback (reactive). It points out shifts over time in methodology and adoption, and outlines limitations and challenges.

Research Methodology

Research Design

Descriptive and exploratory research is used, integrating quantitative data collection (surveys) with qualitative data collection (interviews) to provide a holistic understanding of AI's impact.

Target Population

Teachers of Higher education system.

Sampling Technique

A combination of random sampling and convenience sampling is used for this study.

Sample Size

100 populations is considered for this study.

Data Collection Methods

- **Quantitative:** Structured questionnaires distributed via online platforms (e.g., Google Forms) and potentially offline, using Likert scales and multiple-choice questions to gather measurable data on AI usage, effectiveness, and perception.
- **Qualitative:** Semi-structured interviews and focus group discussions with selected respondents to explore in-depth experiences, challenges, and suggestions regarding AI integration.
- **Data Analysis:** by descriptive statistics by using percentage method.

Penetration and Adoption Data

- The Artificial Intelligence (AI) in education market in India is witnessing tremendous expansion, predicted to reach USD 1.14 billion by 2030 from USD 196.4 million in 2024, at a CAGR of 32.4%. Student penetration rates are high, and institutional penetration rates are rising.
- **Student Use:** According to a 2024 survey, 54% of students in India's higher education sector use AI tools on a weekly basis, and 86% of students already use them for their studies.
- **Institutional Adoption (Higher Education):** o An official AI policy is currently in place in 57% of Indian Higher Education Institutions (HEIs). Over 60% of HEIs let students to use AI tools. More than half of HEIs use generative AI to create educational resources.
- 39% have used adaptive learning platforms, while 40% are implementing chatbots and tutoring systems driven by AI.
- Usage of AI more than 70% of Indian educators uses of AI tools in the classroom, with lesson planning accounting for almost 60% of these uses. However, a knowledge gap remains, as many lack a comprehensive understanding of the technology. Penetration of AI skills according to the Stanford AI Index 2024, India ranks first internationally in AI skill penetration with a score of 2.8, ahead of the US and Germany.

Trends in Artificial Intelligence

- **Global Leadership in AI Skills:** According to the Stanford AI Index 2024 research, India leads world in the penetration of AI skills, with its workforce 2.8 times more competent in AI-related competences than the global average. Since 2016, the concentration of AI talent has increased by 263%.

➢ **Market Growth:** By 2025, it is anticipated that the larger Indian AI market will have grown to $7.8 billion.The market for particular AI in the education sector is anticipated to expand by $4030 million between 2025 and 2029.

➢ **Government Initiatives:** Through important policies, the government is actively encouraging the integration of AI.

➢ The National Education Policy (NEP) 2020 places a strong emphasis on creating curricula for novel subjects like artificial intelligence (AI) and utilizing AI for individualized, multilingual instruction.

➢ **National Strategy for Artificial Intelligence (NITI Aayog, 2018):** Aims to leverage AI for social and inclusive growth, addressing challenges in access and quality of education.

➢ **IndiaAI Mission:** This overarching mission involves setting up compute portals and repositories like AIKosha to foster innovation.

➢ **EdTech Adoption:** Indian Edtech platforms (e.g., Byju's, Vedantu, Embibe) are widely using AI for personalized learning paths, 24/7 chatbots, and adaptive tutoring, which enhances student engagement and performance.

➢ **Institutional Shift:** Educational institutions, including IITs and universities, are rapidly incorporating specialized AI and Generative AI courses to meet the high demand for AI skills in the workforce.

➢ **Focus on Inclusivity:** AI is a key tool for making education more inclusive, offering solutions for students with disabilities and providing content in diverse local languages to bridge learning gaps.

In summary, India is experiencing a significant and policy-supported surge in AI's role within education, positioning itself as a global leader in AI skill development and adoption.

Benefits of Artificial Intelligence in Education

Artificial intelligence has numerous advantages in the field of education. Among them are:

➢ **Personalized Learning:** AI modifies instruction to meet the needs of individual students. This enhances comprehension and maintains students' motivation.

➢ **24/7 Tutoring:** AI-driven chatbots and apps are always accessible. Help is available to students at any time.

➢ **Effective Assessment:** Automated grading and progress monitoring can help teachers save time.

➢ **Curriculum Planning:** AI assists in creating curricula based on the interests and performance of students.

Challenges, Constraints & Risks

1. **Digital Infrastructure & Connectivity Gaps:** Equitable access to AIdriven education is hampered by the fact that many areas, particularly rural ones, still lack sufficient internet connectivity, computing equipment, or dependable power.

2. **Digital Divide,Socioeconomic Divide:** Even with AI technologies, access is based on socioeconomic position; some students cannot afford gadgets or reliable internet, which could worsen ineq-nuality rather than reduce it.

3. **Teacher Readiness & Training:** It's possible that many educators lack the knowledge and experience necessary to successfully incorporate AI tools into their teaching.,AI tools may be misused or underutilized if they are not properly trained.

4. **Ethical, Privacy, Data Governance Concerns:** AI systems often rely on student data. In absence of robust data-protection policies and ethical guidelines, there is a risk of misuse, bias, or unintended harms.

5. **Uneven Penetration many Institutions Yet to Adopt:** While some urban/private institutions may adopt AI tools, many government or under-resourced schools still rely on traditional methods — making nationwide penetration uneven.

6. **Sustainability, Maintenance & Scalability Issues:** Deploying AI tools once is not enough — maintenance, updates, teacher training, hardware upgrades are needed to ensure long-term success.

Data Analysis

**Q1. Does AI have significant Impact in Education System?**
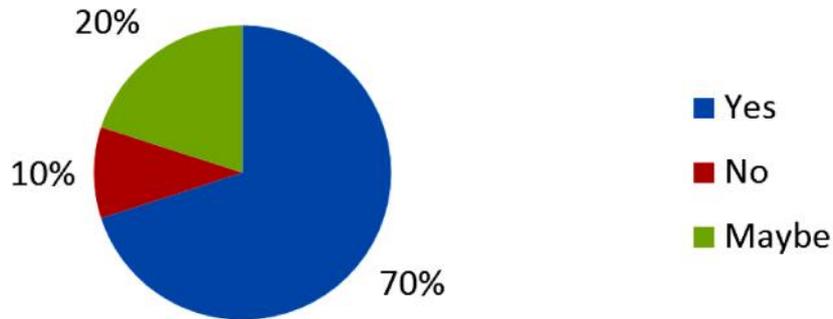
In the above pie chart, we can see that 70% of the respondents believe that AI does have a significant impact on their education. 20% of the respondents believe that AI may have an impact whereas only 10% of them do not believe that AI has impacted their education. This pie chart shows that AI has definitely impacted in education system.

**Q2. How dependent are you on AI penetration tools on various way?**
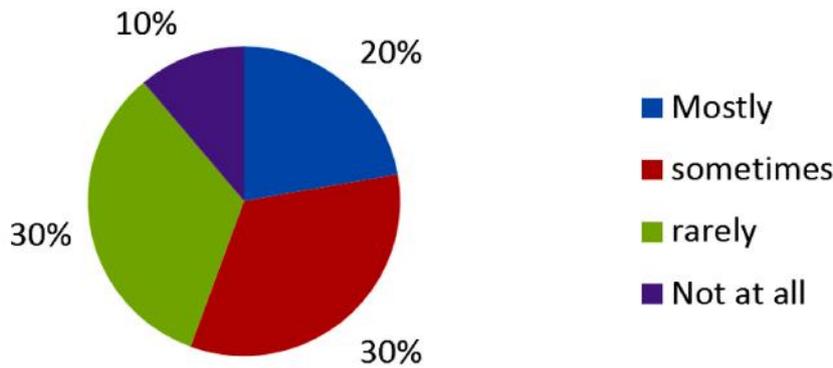
In the above pie chart, show that 20% of the respondents use AI tools and a majority of 30% of them is somewhat dependent on AI. Meanwhile, around 30% of the respondents are rarely dependent on AI for their daily tasks and small portion of 10% of them are not at all dependent as daily users of AI. Hence, we can say that most of the respondents have rarely and sometimes dependency on AI on a daily basis and rest of them being avoid users of AI.

Q3. Do you think Artificial Intelligence can replace the traditional teaching method in educational institutions?
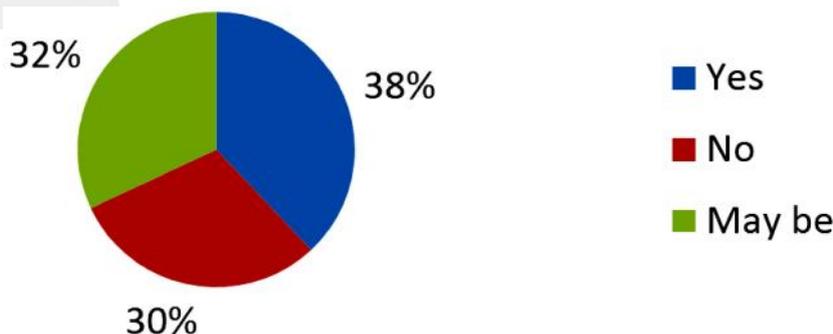
The results shows of a survey question asking people whether they think artificial intelligence can replace traditional teaching systems in educational institutions. 38% of people believe that artificial intelligence can completely replace traditional teaching Systems.30% of people disagree with this statement. 32% of people are not sure. Overall, the pie chart shows that there is no clear consensus on whether artificial intelligence can replace traditional teaching systems. There is a significant portion of people who believe It can (38%), but there is also a large portion who disagree (30%) or are not sure (32%).

Q4.   Do you think that the Indian education system has successfully influenced by advantages of Artificial Intelligence in education?
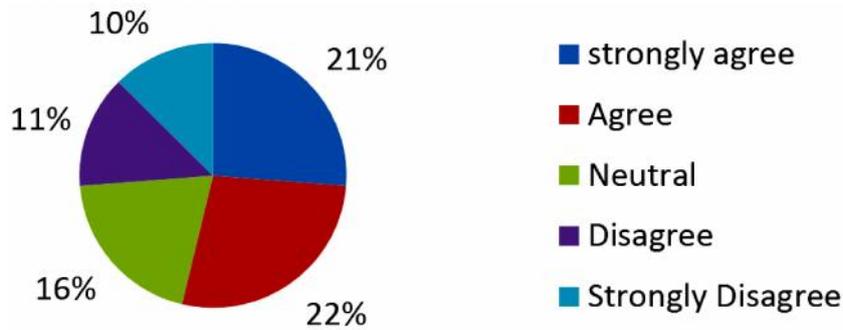
The above pie chart shows the results of a survey question asking people whether they think the Indian education system has successfully exploited the advantages of artificial intelligence in Education. 21% of respondents believe that the Indian education system has successfully exploited the Advantages of artificial intelligence in education. 22% of respondents are agree. 11% of respondents disagree with the statement. 16% respondent neutral with this statement, 10% of overall are strongly disagree. Overall, the pie chart shows that there is a mixed opinion on whether the Indian education system has successfully integrated in education system.

Q5.   What challenges in which Artificial Intelligence could affect the educational process in the future?
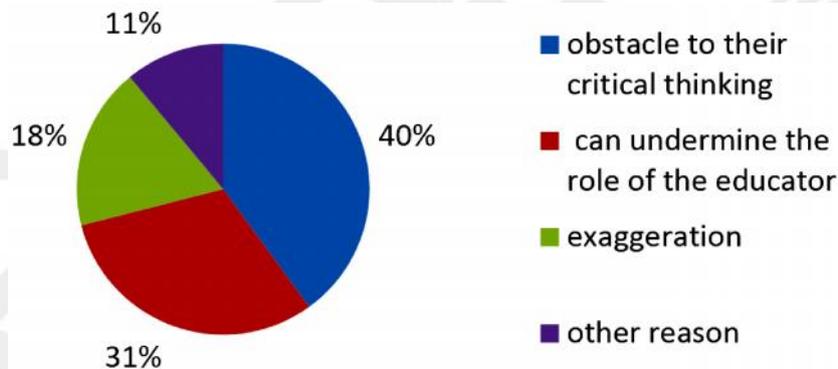
In the above pie chart shows, that 40% of the respondents think that it can become an obstacle to the critical thinking and 31% of them think that it can under judge the role of the educator while 18% of them think that it can lead to intensify in existing ones. Whereas other 11 % of responded have other reasons. Hence, we can consider that AI can majorly affect the educational process in future and can be a huge obstacle in critical thinking.

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CONCLUSION

The Future of AI in Indian Education system in India is making significant efforts to advance AI technology and generation is totally depending in these tools and digital technologies. AI awareness and digital learning are promoted by the National Education Policy (NEP 2020). AI for every initiative has also been introduced by NITI Aayog. AI will soon be more deeply incorporated into research, higher education, and career training. AI-based courses are starting to be offered by colleges. In order to collaborate with or create AI systems, students are learning new skills. AI tools are being taught to teachers. This aids in their adoption of innovative teaching and evaluation strategies. But still deep penetration of AI will impact on teachers, student and whole education system by its positive and negative penetration way. The future appears bright. AI has the potential to increase education's power and inclusivity with the correct infrastructure and support.

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