

AI ADVANCEMENTS IN INDIAN EDUCATION

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ABSTRACT

The integration of Artificial Intelligence (AI) into the realm of Indian education has emerged as a transformative force with the potential to reshape traditional teaching and learning paradigms. "Making AI Work in Indian Education" explores the multifaceted impact of AI on the education landscape of India. This comprehensive study delves into the challenges and opportunities presented by AI in Indian classrooms and elucidates how AI technologies can be harnessed to enhance the quality and accessibility of education. The paper underscores the imperative of a learner-centric approach, advocating for personalized learning experiences tailored to the diverse needs and contexts of individual students. However, it emphasizes the necessity of creating an enabling policy environment that empowers educators to make informed decisions about AI integration, thus avoiding undue dependence on AI-driven content and pedagogical choices. Furthermore, the document highlights the importance of promoting teacher and student participation in the design and implementation of AI-based systems, fostering a sense of agency and responsibility. It draws from successful models of ICT integration in education and underscores the significance of educators and students being at the forefront of AI adoption. The paper also addresses the broader socioeconomic implications of AI in education, emphasizing the need for awareness and critical perspectives on AI's role in society. It calls for interdisciplinary education that goes beyond superficial discussions and dives deep into the ethical, societal, and economic dimensions of AI. Additionally, the document advocates for frameworks that safeguard the beneficial use of community data, ensuring data privacy and security while preventing monopolistic control over educational data. It encourages decentralized ownership and control of data to avoid the centralization of power and protect school autonomy. In conclusion, "Making AI Work in Indian Education" urges a balanced and informed approach to AI integration in education, fostering active participation, ethical considerations, and awareness to harness AI's potential as a force for positive social transformation in the Indian educational landscape

INTRODUCTION

The nature of education encompasses a vast and dynamic field that plays a pivotal role in shaping individuals and societies. Education is not merely a process of imparting knowledge and skills but also a transformative journey that influences personal development, social progress, and the overall well-being of individuals and communities. Education can be formal or informal, taking place in schools, colleges, universities, or through self-directed learning and experiences. It involves the acquisition of knowledge, the development of critical thinking and problem-solving abilities, and the cultivation of values and attitudes that guide one's behavior and interactions with others. The nature of education has evolved significantly over time, reflecting changes in societal needs, technological advancements, and pedagogical approaches. Traditional classroom-based learning is now complemented by online and digital platforms, offering a more flexible and personalized learning experience. Education is a multifaceted concept that addresses various dimensions, including academic, vocational, moral, and civic education. It prepares individuals for diverse roles in society, from skilled professionals and innovators to responsible citizens who contribute positively to their communities. Moreover, the nature of education extends beyond the acquisition of knowledge and skills; it encompasses the fostering of creativity, critical thinking, empathy, and adaptability. It equips learners with the ability to navigate an ever-changing world, make informed decisions, and embrace lifelong learning. In this context, education is not a

static entity but a dynamic process that adapts to the evolving needs and challenges of the modern world. It reflects the values and aspirations of a society and serves as a powerful instrument for personal growth, social development, and global progress.

"Indian Education Landscape: A Comprehensive Overview"

The context of Indian education is a multifaceted landscape shaped by its rich history, diverse culture, and evolving socio-economic dynamics. India's education system is one of the largest in the world, catering to a massive and diverse population. Indian education has a deep-rooted history dating back to ancient times, with a legacy of renowned educational institutions like Nalanda and Takshashila. The traditional Gurukul system emphasized holistic education and personalized learning. This historical context continues to influence modern educational practices. India is a diverse nation with numerous languages, cultures, and regional variations. This diversity is reflected in its education system, where different states have their own education boards, languages of instruction, and curricula. While India has made significant progress in expanding access to education, there are still disparities in terms of rural-urban divide, gender inequality, and socio-economic gaps. Ensuring equitable access to quality education remains a critical challenge. In addition to formal schooling, India has a robust tradition of informal education, including vocational training, apprenticeships, and skill development programs. These informal avenues play a vital role in addressing employment needs. India has implemented several policy initiatives to reform its education system, such as the National Education Policy (NEP) 2020. These policies aim to modernize curriculum, promote holistic development, and enhance vocational education. India is home to prestigious institutions like the Indian Institutes of Technology (IITs) and Indian Institutes of Management (IIMs). These institutions attract students from around the world and contribute to India's reputation in the global higher education landscape. The proliferation of technology and the internet has transformed the way education is delivered and accessed in India. E-learning platforms and digital resources have become increasingly popular, especially in the wake of the COVID-19 pandemic. India's education system is increasingly integrated into the global context. Many Indian students pursue higher education abroad, and foreign universities collaborate with Indian institutions for research and academic partnerships. Challenges facing Indian education include the need for quality improvement, teacher training, infrastructure development, and addressing educational inequalities. The digital divide also poses a challenge in ensuring equitable access to online education. The Indian education landscape is evolving rapidly, with a focus on promoting innovation, research, and entrepreneurship. The NEP 2020 emphasizes the importance of critical thinking, creativity, and a flexible curriculum to prepare students for the future.

Digital Transformation in Indian Education: Navigating the ICT Frontier

The context of "Digital Transformation in Indian Education: Navigating the ICT Frontier" revolves around the significant changes and advancements that Information and Communication Technology (ICT) is bringing to the education sector in India. It explores how the integration of digital technologies and ICT tools is transforming the traditional education landscape in the country. The rapid growth of digital technologies, internet connectivity, and the availability of smart devices are reshaping how education is delivered and accessed. Digital transformation is making education more accessible to a broader population, including remote and underserved areas. The use of ICT is influencing teaching methodologies and pedagogical approaches, emphasizing interactive and personalized learning experiences. Various government initiatives and policies aimed at promoting digital literacy and online education are driving this transformation. The context also involves challenges such as the digital divide, data security, and the need for teacher training alongside opportunities like innovative learning platforms and increased collaboration. The digital transformation of education has significant economic and societal implications, affecting both students and the workforce.

Transforming Learning through Artificial Intelligence

The context of "Transforming Learning through Artificial Intelligence" revolves around the integration of artificial intelligence (AI) into the field of education. It encompasses the ways in which AI technologies are

reshaping and enhancing various aspects of the learning experience. AI is being used to create personalized learning experiences for students, adapting content and pace to individual needs and preferences. AI-driven analytics provide educators with valuable insights into student performance, allowing for more informed decision-making and targeted interventions. AI streamlines administrative tasks, grading, and assessment, freeing up educators to focus more on teaching and mentoring. AI-powered tools are improving accessibility for students with disabilities, making education more inclusive. AI facilitates continuous learning throughout one's life, offering opportunities for upskilling and reskilling in a rapidly changing job market. The context also acknowledges challenges such as data privacy, bias in algorithms, and the need for ethical AI in education. AI in education has global implications, affecting learners of all ages and across various educational institutions.

Leveraging Data for Improved Learning Outcomes and Decision-Making"

The context of "Datafication in Education: Leveraging Data for Improved Learning Outcomes and Decision-Making" revolves around the growing trend of datafication in the field of education. Datafication refers to the process of collecting, analyzing, and utilizing large volumes of data to inform and enhance various aspects of education. Data-Driven Instruction: Educational institutions are increasingly using data to tailor instruction to individual student needs, thereby improving learning outcomes. Assessment and Evaluation: Data analytics are applied to student assessments and evaluations to identify areas of improvement and track progress over time. Predictive Analytics: Educational data is leveraged to predict student success, identify at-risk students, and provide timely interventions. Resource Allocation: Schools and universities use data to allocate resources efficiently, ensuring that funding and support are directed where they are needed most. Personalized Learning: Data-driven insights enable the creation of personalized learning pathways, catering to each student's strengths and weaknesses. Educational Research: Datafication facilitates educational research, allowing scholars to explore trends, patterns, and correlations in education.

"Implementing Artificial Intelligence in Education: Revolutionizing Learning and Teaching"

The context of "Implementing Artificial Intelligence in Education: Revolutionizing Learning and Teaching" revolves around the integration of artificial intelligence (AI) into the field of education. AI-Powered Learning Tools: The implementation of AI in educational settings involves the use of AI-powered tools and platforms that enhance the learning experience for students. These tools can adapt to individual student needs, provide personalized feedback, and offer engaging content. Teacher Support: AI is used to support educators by automating administrative tasks, such as grading and attendance tracking, allowing teachers to focus more on instructional activities. AI also assists in curriculum development and lesson planning. Personalized Learning: AI algorithms analyze student data to create customized learning pathways, adapting content and pacing to match each student's abilities and learning style. Early Intervention: AI systems can identify students who may be struggling academically or socially, enabling early intervention and support to prevent learning gaps or address emotional well-being. Accessibility: AI tools can improve accessibility for students with disabilities, providing features like text-to-speech, speech recognition, and customized learning materials. Data-Driven Decision-Making: Educators and administrators use AI-generated insights and analytics to make data-driven decisions, such as optimizing teaching methods, allocating resources, and improving overall school performance. Global Perspective: The implementation of AI in education is a global phenomenon, with educational institutions around the world adopting AI-driven solutions to enhance learning outcomes. Challenges and Ethical Considerations: The context also addresses challenges related to AI implementation in education, including concerns about data privacy, bias in algorithms, and the need for ethical AI use.

Scarce Educational Data Resources for AI

The non-availability of big data in the context of AI in education refers to the limited access to extensive and comprehensive datasets that can be used to train and improve artificial intelligence models and algorithms for educational purposes. In the field of education, having access to large and diverse datasets is crucial for developing AI-driven solutions that can enhance teaching, learning, and administrative processes. Limited Personalization: Big data is essential for creating personalized learning experiences for students. Without access to extensive data on individual students' learning patterns, preferences, and progress, it is challenging to develop

AI systems that can tailor educational content and recommendations to each student's unique needs. Ineffective Adaptive Learning: Adaptive learning systems rely on data to adjust the difficulty and content of lessons based on individual student performance. In the absence of sufficient data, these systems may not provide meaningful adaptability. Early Warning Systems: AI-based early warning systems can identify students at risk of falling behind or dropping out. These systems require data on various student factors, including attendance, grades, behavior, and socio-economic background, to make accurate predictions. Data-Driven Decision-Making: Educational institutions and policymakers often use data to inform decisions related to curriculum development, resource allocation, and policy formulation. The lack of comprehensive data can hinder evidence-based decision-making. Teacher Support: AI tools designed to assist teachers in planning lessons, assessing student work, and providing timely feedback rely on data from various sources. Without access to rich data, these tools may have limited utility. Bias and Fairness: Big data helps in identifying and mitigating biases in AI algorithms. Limited data may result in biased AI systems that inadvertently discriminate against certain groups of students. Research and Development: Researchers in the field of AI in education depend on large datasets to test and validate their models and hypotheses. The absence of such data can hinder the progress of research in this area. Efforts to address the non-availability of big data in AI in education may involve data collection initiatives within educational institutions, collaboration between educational organizations and researchers, and the development of data-sharing agreements that prioritize student privacy and data security. Additionally, data anonymization and privacy-preserving techniques can be employed to protect sensitive information while still making valuable data available for AI development.

"Debate over Data Ownership"

Contentious issues surround the ownership of data that is gathered in the context of teacher and student activities. These issues involve debates about who should have the right to store this data and determine who can or cannot access it. During an interview conducted for this research, a representative from Education Initiatives made the argument that their company possesses ownership of the data that is gathered from student assessments, citing that it has been acquired through their Mindspark platform. This assertion is akin to the claims made by companies like Google and Facebook, who maintain control and ownership over the data they collect via their respective platforms. The NITI Aayog report highlights the necessity for frameworks that facilitate the sharing of data, aiming to prevent monopolistic control by those collecting the data. Monopolistic control over data, particularly when held by entities primarily driven by profit motives, is seen as a potential hazard. This is because it can render users susceptible to both political and economic surveillance.

Exclusive control over algorithms in AI education

The context of "Exclusive control over algorithms in AI education" pertains to the debate and concerns surrounding the control and ownership of algorithms used in artificial intelligence (AI) applications within the field of education. This includes the development, implementation, and utilization of AI algorithms and systems for various educational purposes, such as personalized learning, assessment, and educational analytics. In this context, the primary issue revolves around whether these AI algorithms should be proprietary, meaning owned and controlled by specific commercial entities or organizations, or whether they should be open-source and freely accessible to the educational community and the public. Proprietary ownership of AI algorithms can have implications for access, transparency, data privacy, and ethical considerations in the education sector.

Exacerbation of prejudice in AI education

The context of "Exacerbation of prejudice in AI education" refers to the concerning issue of how artificial intelligence (AI) and machine learning algorithms, when used in educational settings, can potentially reinforce and magnify existing biases and prejudices. These biases may manifest in various forms, such as gender bias, racial bias, socioeconomic bias, or other forms of discrimination, and they can impact educational outcomes and opportunities for students. In the context of AI education, the concern is that algorithms, which are trained on historical data, may perpetuate and even exacerbate biases present in that data. For example, if historical data shows a bias in teacher evaluations or grading practices, AI systems that learn from this data may continue to replicate those biases, leading to unfair treatment or opportunities for certain groups of students. Addressing and

mitigating the exacerbation of prejudice in AI education is crucial to ensure fair and equitable learning experiences for all students. It involves careful algorithm design, ongoing monitoring, and the development of ethical guidelines to prevent discriminatory outcomes in educational AI systems.

Undermining Educational Quality

The context of "Compromising education in AI education" refers to situations where the implementation or use of artificial intelligence (AI) in educational settings leads to negative consequences that undermine the quality of education. It suggests that while AI has the potential to enhance education, there are instances where it may fall short or even have adverse effects on the educational experience. Overreliance on AI: If educational institutions rely too heavily on AI tools and automation, it may lead to a depersonalized learning experience, where students miss out on valuable human interaction with teachers and peers. Lack of individualized support: While AI can provide personalized recommendations and adaptive learning paths, it may not fully replace the need for one-on-one guidance and support from educators, especially for students who require additional assistance. Data privacy concerns: AI systems in education often collect and process sensitive student data, raising concerns about data privacy and security. Mishandling of this data can compromise students' privacy. Biased algorithms: If AI algorithms used in education exhibit biases or discrimination, it can result in unfair treatment and hinder educational equity. Reduced critical thinking and creativity: Overreliance on AI for tasks such as grading and problem-solving might discourage students from developing critical thinking skills and creative problem-solving abilities. Technological inequalities: Not all students have equal access to technology and AI tools, which can exacerbate educational inequalities. Teacher disempowerment: In some cases, teachers may feel disempowered or threatened by AI's role in education, affecting their job satisfaction and effectiveness. Addressing these concerns and finding a balance between the benefits and potential pitfalls of AI in education is essential to ensure that AI contributes positively to the learning experience and does not compromise the quality of education.

Escalation of Broader Socioeconomic Issues

The context of "Escalation of Broader Socioeconomic Issues in AI Education" refers to the worsening or intensification of socio-economic challenges and concerns within the realm of artificial intelligence (AI) education. It suggests that the issues associated with AI in education have grown in complexity and significance, potentially affecting larger societal and economic systems. This could encompass issues related to access, equity, ethics, privacy, economic disparities, and other socio-economic factors that intersect with AI technologies in education.

Recommendations

The primary contribution that AI should bring to the Indian education system is the promotion of learner-centered learning. This approach involves tailoring curricular content and teaching methods to the specific needs and contexts of each student, moving away from the prevalent one-size-fits-all approach. AI has the potential to facilitate this shift by suggesting diverse and contextually relevant content and pedagogical methods, encouraging teachers to expand their traditional practices. However, to make this transformation effective, it is crucial to establish an enabling policy environment that empowers teachers to make informed decisions about content and pedagogy. Without such empowerment, AI could inadvertently disempower teachers by imposing predetermined content and pedagogical choices. Given the various social concerns associated with AI in education, the development of a comprehensive policy framework becomes essential. One of the key recommendations is to promote active participation from both teachers and students in the design and implementation of AI solutions. Rather than treating teachers as passive consumers of AI products and services, AI models should involve them in the decision-making process. This approach can be illustrated by the contrast between the failed BOOT model of ICT integration, which treated schools and teachers as consumers of proprietary digital products, and the successful participatory model of the IT@Schools program in Kerala, where teachers took the lead in integrating ICT into education. Learning from these experiences is vital for the design and deployment of AI programs in education. Education aims to build agency and foster a sense of participation, which means that AI programs must align with these principles. Moreover, education should support students in

becoming responsible citizens who can question prevailing perspectives and beliefs. Therefore, the use of AI in education should be context-appropriate and developed in consultation with and active participation from teachers and educators. Leslie Loble, Deputy Secretary in the New South Wales Department of Education, Australia, emphasizes the importance of educators being at the forefront of designing and developing AI-based systems. Teachers and school leaders should play a central role in defining the purpose of AI in the classroom and receive training to effectively understand and utilize AI technologies. Involving students in decisions about AI usage and educating them about the associated ethical frameworks is also critical, as their future will be influenced by the policies and approaches adopted today.

Expanding AI and Technology Literacy through Education

If AI's potential to disrupt and undermine the educational process is to be addressed, education itself must be the solution. It is imperative to introduce AI into secondary and tertiary education to foster an understanding of its implications for education and society. Currently, AI remains largely within the domain of a small segment of society, including researchers, think tanks, a handful of major digital corporations, and developed world governments. However, the impact of AI extends across society, with potentially greater adverse effects on developing countries and marginalized communities worldwide. To address the challenges posed by AI, solutions must be sought through political avenues rather than solely relying on technological fixes. Creating widespread awareness about AI and its possibilities and challenges is a pressing need to elevate political consciousness. Undergraduate programs should incorporate critical perspectives on AI into foundational courses in various fields such as science, sociology, economics, and political science. This educational approach goes beyond the sensationalism often associated with popular AI discourse and is crucial for guiding technology development towards the common good. Furthermore, the question of the suitability of technology adoption is a significant political issue that education must contemplate. This question has been raised by figures like Gandhi, Schumacher, and Lewis Mumford for decades. In the current context, where AI usage can exacerbate power imbalances, addressing this question becomes paramount.

Establishing Protocols for Data Collection, Storage, and Sharing in the Common Good

Establishing frameworks to ensure the responsible use of community-collected data without negatively impacting students and educators is crucial before permitting data collection in educational settings. Data should be aggregated and anonymized before being accessible beyond the school and its teachers. While the collective ownership of data should involve the school, teachers, and parents (as guardians), the school should serve as its custodian. To prevent the risk of eroding school autonomy and the agency of teachers and learners due to centralized data collection and storage, it is advisable to explore federated AI implementations. These implementations would involve control over data and algorithms at the school and district levels, promoting decentralization rather than complete centralization. The concept of "community ownership" of data, as mentioned in the Justice Srikrishna Data Protection Committee's report, could be further investigated to support decentralized ownership, control, and storage. Recently, NITI Aayog proposed sharing fintech data with competitors to prevent data monopolies/oligopolies. Another potential solution could involve establishing data cooperatives within the public education system, where public data sets are developed, and data access, storage, and utilization prioritize the public interest over profit motives.

Establishing Open and Free AI Frameworks for Education

Similar to any curriculum framework or model, algorithms should be made available as open-source, enabling them to undergo public scrutiny and evaluation. This transparency allows for a thorough examination of the assumptions, educational objectives, and potential biases embedded within these algorithms. Moreover, it is essential for educators to have the capacity to comprehend the functioning of the AI systems they employ. When AI is proprietary and closed, educators may not have the means to gain this understanding, even if they desire to do so. Open AI initiatives provide an avenue for teachers or interested individuals to delve into the intricacies of the algorithms, enabling them to contribute insights for further improvement. Drawing from Kerala's successful adoption of Free and Open Source Software (FOSS) and Open Educational Resources (OER) in its ICT education programs, fostering a culture of collaboration and active participation among teachers has been

feasible. This approach facilitates scalability, content sharing, and avoids reliance on paid software and content licenses. The concept of Free and Open AI presents an alternative perspective to NITI Aayog's commercial-oriented approach to digital technology provisioning in education. Additionally, leveraging Free and Open datasets and open-source algorithms promotes a collaborative atmosphere and serves as a deterrent against data monopolies and oligopolies.

Encourage Studies on Artificial Intelligence in Education

Education is a sphere where any change holds profound implications, given its far-reaching impact on future generations. The IDRC report serves as a cautionary note, highlighting that proceeding with technological advancements in education without careful consideration could exacerbate inequality, disrupt economies, incite social unrest, and even lead to political instability, disproportionately affecting the technologically disadvantaged and underrepresented groups. Hence, it is imperative that the integration of AI into education is guided by evidence-based practices, including comprehensive research and well-structured pilot programs. Research endeavors should extend beyond surface-level impacts, such as improvements in efficiency or diagnostic accuracy, and delve into the broader societal consequences of AI implementation in education. Furthermore, research should focus on fostering participatory approaches in the design and development of AI applications that prioritize inclusivity. This involves understanding how these approaches can effectively counter bias and ensure the relevance of AI solutions for marginalized communities. In addition to examining the advantages and drawbacks of open AI, such as the sharing of AI resources and datasets, research efforts should also bridge the gap between the technical aspects of providing open access to AI algorithms and tools and the critical aspect of engaging diverse populations. This inclusivity ensures that open AI resources are accessible and adaptable for a wide range of users, rather than being limited to those already possessing the requisite skills and resources. While research is indispensable for enhancing our comprehension of AI's role in education, the establishment of a conducive policy framework is equally vital. This framework plays a pivotal role in determining whether AI can fulfill its potential as a catalyst for positive social transformation within the realm of education, rather than becoming a tool of subjugation.

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