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Transforming Indian Education through AI: Opportunities and Challenges

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Abstract

Artificial intelligence (AI) is the result of innovations and developments that culminated in computers, machines, and other artifacts having human-like intelligence characterized by cognitive abilities, learning, adaptability, and decision-making capabilities. India, with its rich cultural heritage and diverse educational system, is adopting AI for use by educational institutions, in different forms. AI which initially began with computer and computer related technologies, transitioned to web-based online intelligent education systems, and embedded computer systems, to perform instructors' duties and functions with humanoid robots and web-based chatbots. Using these platforms, instructors are able to perform different administrative functions, such as reviewing and grading students' assignments more effectively and efficiently, and achieve higher quality in their teaching activities.

Platforms using AI assess the strengths and weaknesses of students through data-driven insights and offer customized content that caters to the needs of each learner. The systems leverage machine learning and adaptability, to customize curriculum and content in line with students' needs, which has fostered uptake and retention, thereby improving learners experience and overall quality of learning.

The paper explores policy-level initiatives for AI inclusion, looks at how AI-powered solutions are enabling learning experiences and also identifies significant challenges in AI adoption in Indian Education. The study delves into initiatives that further the administration's commitment to SDG 4 and at reports that track its intent and implementation.

Keywords: Artificial Intelligence, SDGs, Goal 4, #AIFORALL, Indian education system.

Introduction

India initiated several key programmes and policies to provide free and compulsory education to all in the age group of six to fourteen years as a Fundamental Right. This significantly improved the enrolment rates across the country in primary education, but the challenge of quality in terms of learning outcomes remained to be addressed. This made India contextualize SDG Goal 4 on education, by integrating it into the formulation of New Education Policy and its positive impact on achieving quality education.

The United Nations has constantly worked to build a safer, more prosperous and equitable world. In September 2000, leaders of 189 countries met at the United Nations in New York and endorsed the Millennium Declaration and set out eight time-bound and measurable goals to be reached by 2015-

i). Eradicate extreme poverty and hunger
ii). Achieve universal primary education
iii). Promote gender equality and empower women
iv). Reduce child mortality
v). Improve maternal health
vi). Combat HIV/AIDS, malaria and other diseases
vii). Ensure environmental sustainability
viii). Develop a global partnership for development

These MDGs, Millennium Development Goals, formed in 2000, were focused on reducing poverty, mortality and lack of education in developing nations. MDGs were successful to an extent, but there were issues related to their implementation. These issues were addressed by 2015, when SDGs, Sustainable Development Goals, were formulated with intent similar to that of MDGs. Although the SDGs sounded similar to MDGs, they were different in below aspects.

- MDGs were meant for more developing countries and contained individual problems focused on poverty, hunger and health. SDGs were more wholesome and focused on both developing countries as well as sustainable management.
- MDGs consisted of 8 goals; SDGs increased to 17 goals, including more factors.
- MDGs were focused on poverty, education, and health. Besides these topics, SDGs also sought to promote equality, climate change and gender equality.

Thus sustainable development goals project was more inclusive as it embraced both developing and developed countries. The SDGs were created with the conviction that every nation would participate in achieving these goals thus leading toward sustainable development. SDGs were

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therefore a universal appeal to create a more fair, just, and equitable world to ensure no one was left behind. In 2015, all member states of the United Nations adopted the '2030 Agenda for Sustainable Development'. This agenda comprised of 17 SDGs that shared blueprint for a more peaceful, prosperous, and sustainable future for all.

The SDGs are grouped into three broad categories: Social, Environmental, and Economic Goals. As mentioned, there are a total of 17 SDGs:

i). **No Poverty:** Complete eradication of poverty in all of its forms everywhere.
ii). **Zero Hunger:** End hunger, promote agriculture, and provide food for every person.
iii). **Good Health and Well-being:** Ensure health and provide care for everyone regardless of their age.
iv). **Quality Education:** Ensure quality education that is equitable and inclusive.
v). **Gender Equality:** Eradicate gender-based discrimination and empower all women.
vi). **Clean Water and Sanitation:** Ensure and develop appropriate water supply and waste disposal systems.
vii). **Affordable and Clean Energy:** Provide access to affordable, reliable and modern energy.
viii). **Decent Work and Economic Growth:** Provide constant and inclusive enhancement of economic activities.
ix). **Industry, Innovation, and Infrastructure:** Develop resilient infrastructure and enhance creativity.
x). **Reduced Inequalities:** Further decrease and eradicate the inequalities that exist.
xi). **Sustainable Cities and Communities:** Develop cities and communities that are inclusive, safe, resilient and sustainable.
xii). **Responsible Consumption and Production:** Promote patterns of consumption and production that are sustainable.
xiii). **Climate Action:** Make urgent efforts to combat climate change and its effects.
xiv). **Life below Water:** Protect and manage the oceans, seas, and marine resources.
xv). **Life on Land:** Conserve and promote the sustainable use of land-based ecosystems.
xvi). **Peace, Justice, and Strong Institutions:** Support the achievement of peaceful and constructive solid societies.
xvii). **Partnerships for the Goals:** Revamp and strengthen global partnerships for sustainable development.

In India, these SDGs came into effect on January 1, 2016. The Ministry of Finance, Government of India in its Union Budget allocates funds to Ministries/Departments for various schemes and programmes which impact the achievements of SDGs.

Assessment of India's performance in achievement of SDGs is a continuous process based on the National Indicator Framework (NIF), developed by the Ministry of Statistics and Programme Implementation (MoSPI) in consultation with NITI Aayog, related Ministries and various stakeholders**.** MoSPI publishes progress report annually on National Indicator Framework for SDGs, based on the latest data supplied by various Ministries and Departments. This facilitates monitoring the progress of country on the SDGs. NITI Aayog also releases the SDG India Index to measure the progress achieved by all States and Union Territories in their journey towards achieving the SDGs. These reports are available in the public domain.

The NITI Aayog is the nodal institution for achieving SDGs in our country. It monitors the performance of States/UTs through the SDG India Index, North-Eastern Region District SDG Index, Multi-dimensional Poverty Index, promotes SDG localization, and encourages a competitive spirit among States and UTs. The SDG India Index Report, released by NITI Aayog, monitors the performance of all States and UTs, benchmarking them based on their overall achievements across various goals. It identifies critical developmental gaps and supports targeted interventions to expedite SDG achievement nationwide.

The Sustainable Development Report (SDR) provides an annual review of how well countries are advancing towards the Sustainable Development Goals (SDGs), which were adopted by 193 UN Member States in 2015. The 2024 report shows the progress of all 193 UN Member States, with Finland, Sweden and Denmark leading the way. India is ranked 109th out of 166 countries in the Sustainable Development Report 2024. This annual report tracks how well countries are making progress toward the Sustainable Development Goals (SDGs) since they were adopted by 193 UN Member States in 2015.

According to the SDG India Index released by NITI Aayog, India's SDG-4 index score in 2023-24 stands at 71, which shows much progress has been made by the country toward quality education. This score is a percentage, where 100 would mean all the goals are fully met. On the report's map, India is shown in the yellow zone, indicating that there are still considerable challenges ahead.

SDG Goal 4

Goal 4 of the Sustainable Development Goals (SDGs) focuses on education and ensures inclusive and equitable quality education for all. In the Indian context, Goal 4 aims to "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all."

To achieve this goal, India has been working on various initiatives and strategies to enhance access to education, improve the quality of education, reduce disparities in education, and promote lifelong learning opportunities.

This includes efforts to increase enrollment rates, improve the quality of teaching and learning, enhance infrastructure in schools, and address issues related to gender and social inclusion in education.

Focus of our Government on Sustainable Development Goal 4 is on the following parameters:

- **Target 4.1 and 4.2:** Free, equitable, accessible and quality primary and secondary education with childcare development.
- **Target 4.3:** Affordable and quality technical, vocational, and tertiary education, including university.
- **Target 4.4:** Increase the number of youth and adults who have relevant skills.
- **Target 4.5:** Eliminate gender disparities in education and ensure access to all levels for the vulnerable population.
- **Target 4.6:** Ensure that all youth and a substantial proportion of adults achieve literacy and numeracy.
- **Target 4.7:** Ensure that all learners acquire the knowledge and skills needed to promote sustainable development.

Initiatives Taken by the Government of India to Achieve SDG 4

The Government of India has taken several initiatives to achieve SDG 4, which focuses on ensuring inclusive, accessible, and equitable quality education. It is also aimed at promoting lifelong learning opportunities for all. Some of the

key initiatives and programs aimed at achieving Sustainable Development Goal 4 in India include:

1. **Target 4.1 and 4.2:** Free, equitable, accessible, and quality primary and secondary education with childcare development.
   i). **Sarva Shiksha Abhiyan (SSA):** SSA focuses on providing free and compulsory education to all children aged 6 to 14 years.
   ii). **Rashtriya Madhyamik Shiksha Abhiyan (RMSA):** RMSA aims to enhance the enrollment rate in secondary schools and improve the quality of education by providing resources, infrastructure, and teacher training.
   iii). **Mid-Day Meal Scheme:** This scheme aims to improve school attendance and nutrition among students by providing free midday meals in government schools.

2. **Target 4.3 and Target 4.4:** Affordable and quality technical, vocational, and tertiary education, including university. Increase the number of youth and adults who have relevant skills.
   i). **National Skill Development Mission (NSDM):** NSDM aims to provide skill development and vocational training opportunities to equip the youth with relevant skills for employment. It includes schemes like Pradhan Mantri Kaushal Vikas Yojana (PMKVY) and Skill India Mission.
   ii). **Community Colleges:** The concept of community colleges has been introduced to offer vocational and skill-based courses at an affordable cost. These colleges collaborate with local industries to provide practical training.
   iii). **Polytechnic and ITIs:** Polytechnic colleges and Industrial Training Institutes (ITIs) offer technical and vocational courses at the post-secondary level. These institutions focus on skill development and prepare students for a wide range of technical careers.

3. **Target 4.5:** Eliminate gender disparities in education and ensure access to all levels for the vulnerable population (People with disabilities etc.)
   i). **Gender Sensitization:** Gender sensitization programs in schools and communities have been taken to raise awareness about the importance of gender equality in education.
   ii). **Beti Bachao, Beti Padhao (BBBP):** While primarily focused on gender equality and female empowerment, BBBP also promotes girls' education as a means to empower women and ensure their participation in society.

4. **Target 4.6 and 4.7:** Ensure that all youth and a substantial proportion of adults achieve literacy and numeracy. Ensure that all learners acquire the knowledge and skills needed to promote sustainable development.
   i). **National Education Policy (NEP) 2020:** The NEP 2020 is a comprehensive reform in the education sector that aims to transform the Indian education system. It emphasizes holistic development, flexible curriculum, technology integration, and increased funding for education.
   ii). **Digital India Initiative:** The Digital India campaign seeks to enhance digital literacy and access to information and communication technology (ICT) in schools and rural areas. This initiative aims to improve the quality of education through technology.

Indian Education System

Indian education has evolved significantly, from ancient oral traditions in gurukuls to modern, diverse systems with a growing emphasis on technology and digital learning.

The shift from residential gurukuls to the current school system reflects a change in pedagogical approaches and the emphasis on formal schooling. The British introduced English as the medium of instruction, which had a lasting impact on Indian education. After independence, the constitutional right to education for children aged 6-14 became a significant step towards ensuring access to education for all. The National Education Policy (NEP) 2020 aims to revamp the education system in India and align it with the Sustainable Development Goal 4 (SDG-4). NEP 2020 emphasizes leveraging technology to improve access to education and enhancing the overall learning experience. The rise of online and blended learning models has systematized access to education, particularly for students in remote areas. Digital transformation is adopting new technologies to reshape processes and create value.

Advent of AI

Artificial intelligence (AI) is generally considered as the ability of machines or computers to think and act as humans do; it represents the efforts towards computerized systems to imitate the human mind and actions. Artificial Intelligence is intelligence demonstrated by machines. AI is a technology that uses computer functions and processes to mimic human intelligence to perform a variety of tasks. There are many types of AI, with generative AI (gen AI) being the most commonly known. Gen AI algorithms are used to create chatbots, automated replies and more.

Artificial intelligence is a key driver of digital transformation. AI systems use algorithms, machine learning, and natural language processing to analyze data, make predictions, and automate processes. It supports digital transformation through task automation, predictive analysis, personalized experiences and improved decision-making. AI automates repetitive tasks like data entry and customer service and saves time and reduces errors while freeing employees for strategic work. It also analyzes data to predict trends, help optimize supply chains, and anticipate market changes. Simultaneously, AI enhances experiences with personalized recommendations and targeted marketing. By processing vast data in real time, it delivers insights for quick, informed decisions. It also optimizes processes like inventory management and quality control to improve efficiency.

The history of AI in education began in 1965 when Stanford University used the first AI program, the PLATO (Programmed Logic for Automated Teaching Operations) computer program. The "PLATO" taught students the basic concepts of mathematics and science. The PLATO computer program, developed in the University of Illinois in the early 1960s, was a significant breakthrough in the history of AI in education. As AI evolved and became more refined, so did its purposes and uses across many industries. Education, in particular, reaped the benefits of AI algorithms and programs as technology advanced.

Artificial Intelligence (AI) has the potential to address some of the biggest challenges in education today and to accelerate progress towards SDG 4. However it also has disruptive

properties such as scalability, adaptability, and ability to uncover insights from data that are invisible to the human eye. This could lead to job losses in certain sectors due to automation, highlighting the need for adaptation and regulation. Noticing its disruptive properties, UNESCO mandated a 'Human centered approach to AI'. Human-centered AI (HCAI) is an approach to AI development that prioritizes the needs, experiences, and well-being of human users. It focuses on creating AI systems that are understandable, ethical, and designed to augment human capabilities rather than replace them. HCAI emphasizes a holistic approach, considering the human context and impact of AI solutions. It aims to shift the conversation to include AI's role in addressing current inequalities regarding access to knowledge, research and the diversity of cultural expressions and to ensure AI does not widen the technological divides within and between countries.

With above HCAI in view, UNESCO developed 'Artificial Intelligence and education: Guidance for Policy Makers' to foster the readiness of education policy-makers in artificial intelligence. It aims to generate a shared understanding of the opportunities and challenges that AI offers for education, as well as its implications for the core competencies needed in the AI era. UNESCO also published 'AI competency framework for students and teachers' to guide countries in supporting students and teachers to understand the potential as well as risks of AI; so that its application in educational contexts genuinely helps achieve SDG 4 which is to: 'Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.'

AI in Education

AI in education refers to using artificial intelligence technologies to enhance learning experiences, personalize education, automate administrative tasks, and provide intelligent tutoring systems. It involves leveraging AI to create customized learning environments, support educators, and ultimately improve educational outcomes. It entails:

i). **Personalized Learning:** AI can analyze student data to understand individual learning styles, paces, and needs. This allows for adaptive learning platforms and content that can be tailored to each student, ensuring they receive the right support and challenges. Examples include using AI to adjust the difficulty of a lesson based on a student's performance or providing personalized feedback and resources.

ii). **Automated Administrative Tasks:** AI can automate tasks like grading, scheduling, and report generation, freeing up educators' time. This can lead to teachers being able to focus more on instruction and student engagement. Examples include AI-powered tools for automated grading and feedback, as well as scheduling software that can optimize class timetables.

iii). **Enhanced Learning Experiences:** AI can be used to create engaging and interactive learning materials, such as virtual classrooms and simulations. Natural language processing (NLP) can enable AI to interact with students in a more human-like manner, providing support and guidance. AI can also be used to identify areas where students are struggling and provide targeted interventions.

iv). **Data Analysis and Insights:** AI can analyze large datasets of student performance to identify patterns and trends. This can help educators gain a better understanding of student progress and identify areas where they need to provide more support. AI can also provide insights into the effectiveness of different teaching methods and strategies.

v). **Accessibility and Inclusivity:** AI can help make education more accessible to students with disabilities by providing tools like text-to-speech software and adaptive learning platforms. It can also help to personalize learning for students with diverse learning needs, ensuring that they all have the opportunity to succeed. In essence, AI in education is about using technology to create a more personalized, efficient, and engaging learning environment for all students, while also providing valuable support for educators.

AI in Indian Education

In an article Dr. Avantika Tomar, Partner, EY-Parthe mentions that government of India's education vision for Viksit Bharat 2047 is to create an inclusive, high-quality education system for skill development and life abilities. However, the country's education system is characterized by fixed curriculums, archaic education delivery models and static testing concepts. This has caused a gaping chasm between education and contemporary work skills.

The advent of AI changed things. It helped the system move away from standardized to personalized, making it relevant and effective for the present. AI has taken serious strides to alter many aspects of the system– from curriculum to test delivery. In the efforts for skilling for Viksit Bharat 2047, these changes are causing a paradigm shift and helping Indian education come at par with global systems. Some noticeable shifts being-

Focus on High-value Activities for Teachers: The most immediate impact of AI in teaching has been in streamlining administrative tasks. AI tools for Indian teachers which automate repetitive tasks like grading assignments, attendance tracking and maintaining student records, allow them more time to engage with students and improve lesson delivery. Lesson planning and curriculum design is also undergoing radical shifts, with teachers utilizing AI to design lesson plans tailored to specific curriculum standards or student needs. Many Indian edtech companies have developed solutions where learners get self-generated quizzes and tests during lessons based on deep understanding of a student's areas of struggle. They also suggest additional options such as supplementary reading materials in real-time. This level of personalization also allows teachers to view dashboards of specific developmental areas of focus of each individual student. Edtech platforms are continually expanding the scope to equip teachers with better real-time intelligence and teaching aids.

Bridging Differential Learning Paths: AI is helping educators unlock talent in differential learning paths who may typically have unrealized potential. AI for multilingual education is helping students to bridge learning gaps from language difficulties. Development of voice-based learning models in local languages is on the rise. A number of companies are continually working to enrich datasets in Hindi, Tamil, Telegu and other Indian languages. This is helping students to bridge language gaps by offering lessons in local languages or learn new languages effectively. Learners also have access to tools which can adapt to dialectal differences, enabling more inclusive education. With respect to special needs education with AI, the capability to create customized content is turning out to be revolutionary. 'Auticare', by ISTI, under the Dept. of Science and

Technology, GoI, is an assistive technology learning platform which uses different virtual reality scenarios based on applied behaviour analysis to assist learners with autism.

Adaptive Learning: AI's adaptive learning abilities have a big impact on education delivery. Leading Indian edtech platforms are continually looking to utilize AI's adaptive nature to analyze student performance and suggest tailored learning experiences to address specific areas of improvement. Edtech solution development is presently focused on using AI/GenAI to analyze learning patterns, strengths and weaknesses in the form of intelligent and interactive platforms. Leading adaptive systems adjust difficulty levels dynamically; ensuring students remain engaged without feeling overwhelmed. They also create diverse content types, such as videos, info-graphics and quizzes to cater to different learning styles.

Policy-level Initiatives for AI Inclusion: Government of India's New Education Policy (NEP) 2020 emphasizes the integration of AI curriculum at all educational levels and aims to equip students with skills like digital literacy, coding and computational thinking. CBSE introduced AI as a subject for students in classes IX to XII, and has also partnered with IBM to launch the SkillsBuild Program, which includes orientation sessions on generative AI. In collaboration with Intel, CBSE has also developed an AI Facilitator Handbook which provides educators with comprehensive training materials and real-life examples. From the 2025-26 sessions, the CISCE board has introduced robotics and AI as part of its curriculum. AI/GenAI features prominently in the curriculum of India's top business schools, including the IIMs and ISB.

National Strategy for Artificial Intelligence #AIFORALL, a report authored by Anna Roy brings out that AI has the potential to bring about changes in the sector by supplementing pedagogy and establishing systems to inform and support decision making across stakeholders and administrative levels. However, implementation of AI needs to be preceded by efforts to digitize records of teacher performance, student performance, and curriculum.

Challenges in AI Adoption in Indian Education

Despite the immense benefits which AI provides for the Indian education system, there still exist a certain number of challenges:

i). **Digital Divide:** Many rural areas in the country need proper access to the internet and digital devices, which puts a limit on the reach of AI-enabled learning tools. These regions require requisite infrastructure; so that students there can make use of AI-powered learning platforms.

ii). **Cost and Accessibility:** Most AI-based learning platforms remain expensive, beyond the budgets of students coming from economically deprived backgrounds. Therefore, making AI tools more affordable and accessible would guarantee equal chances for all.

iii). **Teacher Training:** AI encompasses a wide range of digital and technical skills and thus it demands a certain minimum of digital literacy from teachers. However, a large number of educators in India are not well-trained to incorporate AI into their pedagogical practices, which becomes a major hinderance.

iv). **Ethical Issues:** The integration of AI into educational colleges and schools gives rise to a number of concerns regarding the protection of personal data and objectivity. AI systems rely on collecting and analyzing large amounts of student data, raising concerns about data breaches and potential misuse of personal information. Robust privacy measures, such as encryption and users with control over their data become essential. AI tools can potentially facilitate academic dishonesty and over-reliance on AI can hinder the development of critical thinking and engagement. Therefore AI tools need to be used to support and enhance learning without replacing human interaction and guidance.

These are, in fact, challenges that still lie ahead if AI-driven education were to actually be inclusive and equitable.

Looking Forward

In the latest Budget session, the government allocated Rs 500 crore for setting up a Centre of Excellence in AI for education to improve India's education system by using AI, aiming to enhance skills, personalize learning, and transform education. Five National Centres of Excellence for Skilling (NSTIs) are proposed to be established in Bhubaneswar, Chennai, Hyderabad, Kanpur, and Ludhiana, focusing on areas like AI, robotics, and cyber security, to equip the workforce with industry-relevant skills. This initiative builds on the three AI centres set up in 2023 for agriculture, healthcare, and sustainable cities.

The AI Centre of Excellence will focus on developing cutting-edge AI solutions for education, including personalized learning platforms, AI-driven assessment tools, smart content generation, and virtual learning environments. It aligns with India's National Education Policy (NEP) 2020, which emphasizes integrating technology to enhance learning outcomes. The centre is expected to foster collaboration between academic institutions, industry leaders, and government bodies to drive AI-driven educational innovation

Conclusion

In a society where education is paramount and opportunities are highly valued, the use of AI education in India emerges as a transformative force. By revolutionizing traditional educational paradigms, AI fosters a generation of learners equipped with the skills, adaptability, and critical thinking needed to thrive in an ever-evolving world.

AI personalizes learning, which means students will always get tailored content based on their learning needs and pace to create better engagement with the academic performance. In addition, AI's role in curriculum development and teacher efficiency allows a more focused approach toward education by equipping educators with the ability to channel the energy into instruction and interaction with students rather than into the time-consuming, laborious administration procedures of processing paperwork.

The conclusion is that AI has the potential to bring about a sea change in the Indian education system, helping to solve some of the eternal problems that beset it, such as large class sizes, inequality of high-quality educational provision, and limited opportunities for personalized learning. These AI-driven technologies, including adaptive learning platforms, intelligent tutoring systems, and automated administrative tools, have significant impacts on how students learn, teachers teach, and institutions function.

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