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Sustainable and Equitable Education in India: An AI-Centric Perspective

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Abstract: ***The role of Artificial Intelligence and Machine Learning in education in India, despite propelling the growth of the sector in multitudinal manners, still poses a myriad of paradoxes and perplexities, primarily due to lack of sustainable approaches and inequity.***

While AI-driven tools such as adaptive learning platforms and automated assessment systems can reduce disparities in learning outcomes across socio-economic, geographical, and linguistic divides, in a country like India, AI is an inevitable, but a risky entrant in the field of education. With a confounding amalgamation of 300 million students, 22 official languages and infinite dialects, India lays out a plethora of social, economical and geographical conundrums, thereby making AI an instrument causing social, environmental and economic disparity, resulting in bipolar infrastructural development. Our paper aims to evaluate India's preparedness for AI integration through the lenses of sustainability and equitability. We have further dissected our study to understand these core concepts from social, environmental, economic and financial perspectives.

The study adopts a qualitative research approach based on secondary data and policy analysis to assess India's preparedness for AI integration within its traditional education system. It evaluates current policy initiatives, including the National Education Policy (2020), and explores pathways for effective and inclusive implementation of AI in education. Particular attention is given to concerns related to data privacy, algorithmic bias, digital exclusion, and accessibility. The paper argues that ensuring AI functions as a tool for empowerment rather than exclusion is central to achieving equitable educational outcomes. It concludes that the success of AI in education depends on the ability of policymakers to design inclusive, context-sensitive strategies that balance technological advancement with social equity.

Lastly, the paper also analyses the various initiatives undertaken by the government of India, and attempts to identify the implementation anomalies from which they are suffering.

I. INTRODUCTION

One of the most intriguing aspects of 21st Century India is that it is filled with paradoxes, primarily with respect to its socio-economic and socio-political conundrums which poses a myriad of challenges before its citizens. With 'sustainability' and 'equity' gaining momentum in all walks of societal and environmental workforces, it is imperative for every individual, especially those engaged in the field of education to analyse their significance through both negative and positive lenses. This has become particularly important due to the disruptions caused by Artificial Intelligence, which has made 'sustainability' and 'equity' become precariously perched between being the nation's stairway for a 'smarter' future, and being an avenue through which the nation's lacunas become more glaring.

The educational ecosystem in India has primarily witnessed a distinguished upheaval after the Covid-19 pandemic, which, very interestingly, was juxtaposed right beside the release of the National Educational Policy (NEP) 2020. According to a research undertaken by IAMAI, "NEP marks a landmark shift for higher education. Allowing multiple entry and exit points and interdisciplinary offerings will help in democratising and push enrolment rates, the emphasis on technology will further push the accelerated growth of the sector." However, words and phrases such as 'democratising' and 'accelerated growth' are often left as aspirational concepts on paper, devoid of tangible action plans capable of revolutionising the education system of the country. This critical anomaly has become even more prominent due to the advent of AI. Therefore, while unravelling the dimensions of sustainability and equitability in educational practices in India, it is but necessary for educators to ponder deep into how Artificial Intelligence has propelled education towards these, and in which ways has it left education floating on a superficial zone of supposed equity and sustainability. However, at first, we need to discuss what sustainable and equitable education actually means.

Sustainable education, if seen from multitudinal perspectives, far surpasses its textbook definition of consistent quality learning, to consistent quality learning for students hailing from varied social, economical, geographic and demographic backgrounds, while building awareness regarding short-term as well as long-term environmental and financial challenges and their consequent solutions.

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Thus, sustainable education is seamlessly merged with equitable education which talks about equal educational opportunities for all, irrespective of caste, creed, religion and socio-economic status. Policies truly intended towards achieving equitable education, therefore, should not assume uniformity with respect to solutions, but should respond to specific, compounding barriers which are situationally relevant and relatable. In this context, it is important for us to understand the intricate relationship between equitable and sustainable education in India :

- Inequity can render education unsustainable. During Covid, while technology helped many learners adapt to digital learning quite effectively, it made many underprivileged students grapple hard with their studies due to an acute lack of technological aspects, thereby resulting in sustainable and equity failure.
- Environmentally and financially unsustainable education casts its worst effect on the poor, as is clearly evident from students falling prey to climate related closures in school and suffering from unavailability of technology and lack of proper mentorship. According to a study by UNICEF (2024), 54.7 million students faced problems due to climate-related disorders alone. Moreover, students with special needs are also adversely affected due to budget cuts which eliminate special educators. Eg : 87,430 government schools have been closed since 2017, affecting the rural and tribal population, leaving the urban population primarily undisturbed.
- Social Equity ensures the fair distribution of resources which leads to social sustainability. It enables marginalised communities to contribute positively towards sustainable resource management. Eg : Tribal communities who are custodians of enormous biodiversity can become primary propellers of environmental and economic sustainability.
- Education related to climate change and other environmental issues need to be contextualised socially for equitable education. Therefore, students should be given the opportunity to understand the socio-economic repercussions of environmental challenges, such as heavy rainfall or droughts, with respect to their own social and geographic situation, so that they can analyse policies with deeper levels of perception.

As Sustainable Development balances itself on the three main pillars of environmental conservation, social equity and economic sustainability, the Indian education system must defeat the challenges of political delegitimisation, social unrest, drop-out cascades, perpetual cost of remediation and both hidden and visible environmental footprints. In order to curb these challenges, our system needs to utilise AI to serve social, economic and environmental equity and achieve sustainable goals. However, AI, unless integrated with socio-demographic, academic and behavioural data, will never automatically stand for equitability or sustainability. With a confounding amalgamation of 300 million students, 22 official languages and infinite dialects, and bipolar infrastructural development, India lays out a plethora of social, economical and geographical perplexities, making AI, an inevitable but risky entrant in the Indian educational ecosystem. AI should no longer remain a mere pedagogical tool, but an apt intervention to practice regulation and ethical concerns. In this paper, we, therefore, aim to address sustainable education through ***social, financial and environmental*** lenses, equitable education from ***social, psychological and economical*** aspects, and finally discuss the role of AI in these - the possibilities that AI holds to achieve these, and the challenges it poses. With regards to the AI paradox problem as stated by a study led by Ronald Marquez that says “47% of academic institutions in high-income counties have implemented AI-driven tools, whereas only 8% have implemented AI-driven tools in low-income countries”, we hope to study the various initiatives taken by India for incorporating AI-based education, and finally draw a picture of the idea vs the reality.

To draw from Rousseau, “Natural inequalities (age, health, physical strength) are inherent and unpreventable, whereas conventional inequalities (wealth, honor, power) are man-made, unnatural, and perpetuated by societal structures, often leading to corruption, vanity, and the oppression of the poor by the rich.” In our paper we wish to address such conventional inequalities caused by AI, and discuss how it can be used to break the vicious cycle of poverty and other social, environmental and economic conditions that plague our country. Aristotle said “Rebellion occurs when citizens feel that wealth, honor, or power are unequally or unjustly distributed, leading them to revolt against the existing constitution” - therefore, our paper will be crucial in determining the role of AI as tool of empowerment of the people and the holistic welfare of the society, and not a cause of social unrest.

II. SOCIAL AND PSYCHOLOGICAL SUSTAINABILITY AND EQUITABILITY IN INDIA AND THE ROLE OF AI

One of the most prominent angles of sustainable and equitable education is the social angle, thereby, making social sustainability and equitability an indispensable component of educational progress in India. While discussing this, we first need to divide the concept into five primary components - caste, gender, linguistic, demographic and psychological.

A. Caste

The caste system is one of the most complex elements of Indian civilisation, deeply ingrained within its structure, making discrimination and disparity penetrate through every aspect of human societal well-being, including education. According to a data analysis by UDISE+, India has witnessed a 14.1% drop-out rate at the secondary level in 2023-24, the majority of which was concentrated among students belonging to the SC/ST or OBC categories. Further, with less than 40% of rural areas with proper access to the Internet, the SC/ ST and OBC communities are severely impacted. A UNICEF study exhibits the non-inclusive nature of STEM teachers in India, with most of them hailing from non-Dalit backgrounds, leaving students from the Dalit community devoid of faculty support with respect to higher education and research. AI-based education systems, if based on such an existing caste-based hierarchy, will replicate and amplify this discrimination, rather than becoming an agent of equitability and sustainability.

1) Challenges

1.1.1.1 AI-driven education systems and large language models, when developed under the umbrella of the so-called upper-castes, excluding the traditions and perspectives of the lower castes, become a harbinger of harmful stereotypes, and limit value formation among a certain class of people, giving birth to a vicious cycle of illiteracy and misinformation.

1.1.1.2 Another blatant paradox that makes AI a dangerous tool in propagating caste-based discrimination in education is its biased responses in favour of English-medium students. A study published by the PiB, Govt. of India, shows that 100% of the highest quality responses were recorded for English-medium students, and 100% of the lowest quality responses corresponded to Hindi or other regional-medium students. Therefore, AI often becomes an instrument for encoding caste-based prejudice, even without conscious inputting of such data.

1.1.1.3 Socio-technical system theory also states that AI fosters a biased underrepresentation of lower casts due training data gaps, unjustified automated proctoring of students with darker skin-tones or those without proper lighting facilities, and false narratives regarding individual ‘merit’, based on pre-existing biased data.

2) Opportunities

1.1.2.1 AI adaptivity can be used to remove discriminatory classrooms.

1.1.2.2 AI-powered socio-economic data compilers can draw accurate comparisons among all castes and identify the need for support for marginalised castes and communities for scholarships, admissions and entrance test preparations (study by EY).

1.1.2.3 AI can be utilised for predictive drop-out analytics to recognise high-risk students, most of whom belong to the SC/ST and OBC communities.

1.1.2.4 AI can be used to create caste-informed data bases, which can reduce information asymmetry and confound first-generation learners from the lower classes.

1.1.2.5 Teacher-bias being one of the major factors behind casteism in education, can be detected and subsequently corrected using AI-powered tools, such as blinded evaluation platforms, standardised feedback loops based on data-driven, pre-designed rubrics and adaptive learning algorithms.

1.1.2.6 AI can be used to build scholarship discovery tools for the marginalised communities

1.1.2.7 AI-optimised reservation systems can replace human gate-keeping with transparent data structures and elimination of proxy-based bias.

B. Gender

Analysing the Indian education system from a gender-based perspective creates a fascinating farrago of paradoxes, discrepancies and discriminations. While female students consistently outperforms male ones in Class 12 boards, academic performance is precariously juxtaposed with persistent structural exclusion. Despite an apparent increase in enrolment rates, a slightly higher dropout rate among boys (7.9%) as compared to girls (8.1%), primarily due to early marriages, safety issues and financial constraints, clearly shows that if studied through gender lenses, the education system in India is far from achieving equity and sustainability in education. Moreover, several sources of data, including the Internet Access Index, 2022, also reveals that there is a 25.6% gender gap with respect to Internet accessibility. This brings us to an array of challenges that the advent of AI has posed for gender equity in education.

1) Challenges

1.2.1.1 AI is largely inaccessible to a lot of women - only 21% of women, as opposed to 42% men, have access to mobile phones.
1.2.1.2 AI suffers from integrated gender- bias issues. Quite often, similar prompts are responded with different levels of support depending on gender.
1.2.1.3 Many AI models are trained on binary (M/F) databases which create an environment of exclusion for the LGBTQIA+ communities.
1.2.1.4 AI data, if not handled with extreme ethical care, can lead to safety risks and social unrest.

2) Opportunities

1.2.2.1 Auditing of algorithmic content can be done using AI to identify gender stereotypes.
1.2.2.2 AI powered platforms can be created for women to discuss otherwise male-dominated subjects (eg : STEM subjects) without any fear of judgment.
1.2.2.3 Adaptive platforms to especially train female students can be built using AI.
1.2.2.4 AI-based predictive retention models can be developed to identify at-risk students.
1.2.2.5 Elastic classrooms (AI-driven flexible school models) can be built to accommodate female learners across all ages and backgrounds.
1.2.2.6 AI can be used for upskilling female students with several technical and holistic skillsets, thereby enabling girls for better employability. This, consequently, can reduce wage-gaps.
1.2.2.7 AI can be used to create gender neutral identities for education - learning personalities can be made through customisable avatars and preferred pronouns.
1.2.2.8 AI-driven gender blind hiring platforms can be created to remove gender bias. (Eg: Eliminating gender markers from CV, reference letters etc.)

C. Linguistic

Linguistic and semantic barriers is one of the most foundational and structural issues faced by students in India, creating high intensity inequity and unsustainability. 22 official languages and over 1600 dialects, used by a sheer population of 1.4 million people, India truly is a perplexing landscape which automatically creates a digital divide.

1) Challenges

1.3.1.1 The de-facto two-tier language hierarchy of the Indian education system, dominated by English (which is automatically connected with better economic resources, social mobility and higher employment opportunities), is a huge marker of educational disparity. As discussed earlier, AI systems often differ in quality between English and Hindi or regional-medium students. Most edtech platforms primarily operate on English, thereby propelling underinvestment in the linguistic need for the majority of the students.
1.3.1.2 There is an acute lack of data for regional languages, such as Bodo, Maithili, Santhali and Dogri. Therefore, with a tiny digital footprint, these languages have very little scope for AI investment, which creates a data desert for students speaking these languages.
1.3.1.3 Many tribal languages which are developed in oral models have no specific written script, creating an enormous challenge for optical character recognition, text rendering, and keyboard input systems. Without this, proper AI data cannot be created for these languages. (Source : UNICEF)
1.3.1.4 In STEM education, most AI systems operate primarily on English or similar mono-lingual frameworks, further amplifying linguistic differences.
1.3.1.5 Despite several initiatives undertaken by the government of India to create linguistically inclusive AI training models, it has not been made clear whether the marginalised communities consented to their language being used for AI development. This creates a sovereignty linguistic challenge in education.

2) Opportunities

1.3.2.1 AI can be used to create mother-language based learning systems.
1.3.2.2 AI translation tools and knowledge localisation can help make learning more linguistically inclusive.
1.3.2.3 AI can be used to build speech-based oral language tools for languages which do not have proper written scripts.

1.3.2.4 Virtual teaching tools can be built with the help of AI, giving students an opportunity to benefit from multi-lingual classrooms, and also helping teachers to teach in areas which are alien to her own linguistic qualifications.
1.3.2.5 The field of STEM is not language neutral, with symbols embedded deep within its vocabulary, metaphors and learning structures. AI can be used for aligning textual, visual, and symbolic content through a tri-attentional transformer architecture — specifically designed to address the comprehension, engagement, and retention limitations of non-English speaking regional learners who have historically been excluded from high-quality STEM education by the language barrier alone.

D. Demographic

Demographic factors such as migration, urbanisation, tribal geography, age structure, and disability significantly shape access to education. Among these, migration creates particularly acute barriers. Migrant children often lack even basic access to education. According to UNESCO's Global Education Monitoring Report, nearly 80% of migrant children in seven Indian cities lack access to education near their worksites, leaving them highly vulnerable to exploitation and abuse.
Empirical data reinforces this concern. A study covering 6,168 migrant households across 189 slums in Delhi found that 23.8% of children aged 6–14 had no opportunity to attend school at all. Frequent relocation further disrupts continuity, preventing fixed enrolment in schools.
This reflects a broader paradox of urban poverty: while schools may be physically nearby, they remain socially and economically inaccessible. Additionally, tribal and Particularly Vulnerable Tribal Group (PVTG) communities—spread across multiple states—continue to face systemic exclusion.
India's demographic structure adds another layer of complexity. With a large proportion of the population below 30 years, the country faces a massive challenge of preparing its youth for employment. Reports suggest that 40–45 million existing workers will require reskilling by 2030, highlighting the urgency of inclusive and adaptive educational systems.

1) Challenges

1.4.1.1 Inaccessibility of AI devices for migrant workers
1.4.1.2 AI deployments in India are overwhelmingly concentrated in corporate schools and private institutions, largely excluding government schools → widening urban–rural divide
1.4.1.3 Tribal culture, ecological knowledge, and oral traditions are entirely absent from the training data of current AI educational systems
1.4.1.4 Lack of disaggregated data: while UDISE+ collects school-level data, it fails to track individual migrant children effectively

2) Opportunities

1.4.2.1 AI technologies combined with deep learning can model and predict the educational needs and trajectories of migrant children
1.4.2.2 AI-powered community learning centres in slum areas, equipped with solar power points, offline devices, and adaptive learning content
1.4.2.3 AI-enabled enrolment tracking systems to monitor migrant children despite frequent relocation
1.4.2.4 Development of educational content rooted in tribal knowledge systems and ecosystems
1.4.2.5 AI-driven skill assessment tools for adaptive learning pathways
1.4.2.6 AI-based information dissemination and digital learning solutions to support inclusive education delivery

E. Psychological

The Indian education system suffers from an acute lack of neurodiversity support, making psychological equity and sustainability in education a far fetched dream. Moreover, a considerable part of the Indian education system refuses to recognise individual and personalised training models for students hailing from different backgrounds. Even though AI has helped in this regard, it poses certain challenges that make this problem even more glaring.

1) Challenges

1.5.1.1 Over-dependency on AI can reduce human agency, leading to cognitive laziness, a sharp decline in high-order critical thinking and hampered emotional connection with tutors.
1.5.1.2 Many Indian college students suffer from anxiety and distress due to continuous automated assessments, done using AI.
1.5.1.3 Most AI models are trained on standard speech, leading to digital alienation for specially abled learners.

1.5.1.4 High-end AI-powered prosthetic or sensory devices remain inaccessible to a large part of the Indian population due to their lack of affordability, creating a disability wealth-gap.
1.5.1.5 Many AI tools do not have the optimisation for differently-abled children.

2) Opportunities

1.5.2.1 AI driven softwares can be developed for narrating textbooks, describing classroom environments and even recognising currency or labels to create an immersive experience for visually impaired students.
1.5.2.2 Smart classrooms with Real-time Sign Language-to-Speech AI models can be built to help hearing-impaired students participate in oral lectures.
1.5.2.3 AI can be used to prepare personalised learning content for students with ADHD or Dyslexia.
1.5.2.4 AI-driven predictive tools can be used to interpret learning patterns and problems in students and create customised solutions.
1.5.2.5 AI can be used to mitigate biases, prejudices and stereotypes in learning platforms by creating a neutral learning environment.
1.5.2.6 Students with severe motor impairments, such as cerebral palsy can use eye-tracking and brain-computer interfaces to create screen results using only their gaze.

III. ECONOMIC AND FINANCIAL DIMENSIONS OF AI IN EDUCATION IN INDIA: OPPORTUNITIES AND CHALLENGES

A. Challenges

1) High Upfront Cost and Transition Cost

The deployment of AI in education requires substantial initial investment in infrastructure, including digital devices, reliable internet connectivity, electricity, and localized content development (World Bank, 2020). Additionally, there is a need for large-scale reskilling of teachers and administrators.
Running advanced generative AI models also demands significant computational power, particularly high-end GPUs. Ensuring last-mile connectivity in rural areas remains the most significant financial hurdle.

2) Budget Constraints

The Kothari Commission (1966) and the Tapas Majumdar Committee(1998) recommended that public expenditure on education should be around 6% of GDP. However, current spending stands at approximately 4.1% of GDP (Economic Survey of India, 2023). Scaling AI across the education system would require substantial capital expenditure, potentially placing additional strain on public finances. This raises concerns about the feasibility of universal AI adoption in education.

3) Disruption of the Traditional Job Market

AI is expected to significantly disrupt the traditional job market((International Labour Organization, 2021), including the education sector. Automation of certain educational functions may lead to job displacement, particularly in administrative roles and low-skill teaching support positions.
While AI may create new job opportunities in the long run, the short-term transition may result in unemployment and require substantial investment in reskilling and workforce adaptation.

4) Digital Divide and Unequal Returns

Despite policy efforts, many government schools in India continue to lack basic infrastructure such as classrooms, sanitation facilities, and playgrounds(ASER Centre, 2022). Additionally, access to digital devices and stable internet connectivity remains limited.In contrast, private schools with better funding are more capable of adopting AI technologies, resulting in disproportionately higher returns. This may lead to the emergence of a dual education system, thereby widening socio-economic inequalities.

5) Monopoly Risks

High upfront and operational costs may act as barriers to entry, limiting competition in the AI-edtech sector(OECD, 2021). This could result in market concentration, with a few large firms dominating the industry.

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Such firms may adopt entry-deterrent pricing strategies initially and later increase subscription costs once competition diminishes, ultimately harming consumer welfare.

6) Social Unrest

Unequal access to AI-enabled education may widen disparities between different socio-economic groups(World Economic Forum, 2020). Students from urban or affluent backgrounds may benefit significantly more than those from rural or low-income groups.
This could create a divide between AI-enabled graduates and traditional graduates, potentially leading to income inequality. Over time, a perception of systemic bias in favor of the elite may emerge, triggering student dissatisfaction, protests, and inter-group tensions.

7) Commercialization of Education

AI is likely to accelerate the growth of private edtech platforms, potentially shifting the education system from a public service model to a platform-based, profit-driven model(UNESCO, 2021).
Increasing dependence on subscription-based learning may reduce affordability and accessibility, raising concerns about the commodification of education. This may also generate resistance from students and parents.

8) Data Exploitation and Trust Deficit

AI systems rely heavily on the collection and analysis of large volumes of student data, including learning patterns, performance metrics, and socio-economic information(OECD, 2019). This data is often used to train algorithms and enhance platform competitiveness.
However, concerns regarding data privacy, consent, and potential misuse may lead to a trust deficit among users. If not adequately addressed through regulation and transparency, this could result in public resistance to AI adoption in education.

B. Opportunities

1) Enhanced Productivity and Human Capital Formation

Human capital formation occurs when the number of skilled, trained, and knowledgeable individuals in a country increases. According to the Periodic Labour Force Survey (PLFS) Annual Report 2022–23, the total workforce in India is approximately 61.6 crore (Ministry of Statistics and Programme Implementation, 2023). This implies that a significantly large dependent population—over 80 crore people—relies on this workforce. One of the major constraints on productivity is the lack of adequate knowledge and skills among the masses.
The integration of AI in education can help tap the latent potential of this dependent population by expanding access to quality learning (World Bank, 2020). Easy and affordable access to knowledge can significantly enhance productivity at the grassroots level, thereby strengthening the country's human capital base.

2) Women Empowerment

As per the PLFS Annual Report 2022–23, the total female workforce in India is estimated to be around 20 crore (Ministry of Statistics and Programme Implementation, 2023). Low productivity among women can largely be attributed to inadequate access to education and skills, compounded by mobility constraints and restrictive social norms.
AI-enabled education can address these barriers by enabling flexible, home-based learning through adaptive platforms and digital tutoring (UNESCO, 2021). This is particularly beneficial for women in rural areas, allowing them to acquire market-relevant skills and improve their participation in economic activities.

3) Zero Marginal Cost and Economies of Scale

AI-based educational systems involve substantial initial (fixed) costs, similar to traditional institutions. However, unlike conventional systems where the cost increases with each additional student, AI platforms can serve millions of learners at near-zero marginal cost (OECD, 2021). This shift from a high marginal cost structure to a high fixed-cost, low marginal-cost model enhances long-term sustainability and efficiency. Additionally, AI reduces recurring operational expenses such as printing, evaluation, and administrative work. Research from Stanford University (2023) suggests that AI-enhanced tutoring systems can scale expert teaching practices at an annual cost of approximately $20 per tutor.

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4) Growth of EdTech Companies and Rural Area Penetration

The Indian EdTech market is currently valued at approximately $10.4 billion and is projected to grow to around $61 billion by 2035 (IBEF, 2023). AI-driven platforms are expected to play a crucial role in this expansion, particularly through phygital (physical + digital) models and supplemental learning ecosystems.

Given their scalability and low marginal costs, AI-powered platforms can effectively penetrate rural and underserved regions, thereby expanding access to education while simultaneously contributing to economic growth.

5) Inclusion through Affordable Learning

Traditional private coaching systems in India are expensive, often excluding a large section of students from accessing quality education. In a highly competitive environment—where millions prepare for examinations such as JEE, NEET, and UPSC—high costs act as a significant barrier. AI-based platforms reduce these entry barriers by offering low-cost or free learning resources (World Economic Forum, 2020). This democratization of knowledge enables students from lower-income groups to access quality education and compete more effectively.

6) Aligning with Emerging Economic Needs

With a budget allocation of approximately ₹10,371.92 crore towards digital and AI-related initiatives (Government of India, 2023), the government increasingly recognizes AI as a strategic asset. AI-driven vocational training in sectors such as animation, visual effects, and gaming (AVGC) creates direct pathways to high-paying employment opportunities.

This helps bridge the gap between graduate skill sets and industry requirements. Additionally, investment in regional language content can unlock the economic potential of the vast non-English-speaking population.

7) Reduction in Administrative Costs

AI can significantly reduce administrative costs in government-run educational institutions by automating repetitive and time-intensive tasks (NITI Aayog, 2021). This allows teachers to focus more on pedagogical activities.

For instance, in a recent pilot project in Jodhpur covering over 1,000 government schools, AI systems evaluated more than 70,000 students across five subjects and processed over 3 lakh assessments within three days. Similarly, AI-powered systems can automate attendance tracking, student records management, and compliance reporting. The resulting cost savings can be redirected towards improving educational infrastructure.

8) Knowledge-Driven Society and Efficient Resource Utilization

AI-powered adaptive learning platforms enable personalized education pathways that cater to individual learning pace, style, and knowledge gaps (UNESCO, 2021). This is particularly important in a diverse country like India.

AI also supports modular and lifelong learning through micro-credentials in emerging technologies, enabling continuous skill development. Consequently, AI can facilitate the transition towards a knowledge-driven economy.

IV. ENVIRONMENTAL

The concept of environmental sustainability in education runs in three parallel dimensions - education to make students aware of the environment, education defying environmental barriers, and lastly, education itself becoming an instrument of environmental sustainability through innovative methods and operations. India, being plagued by effects of climate change, such as heavy rainfall, floods, drought and cyclones, poses a serious environmental threat in front of students, especially those hailing from the affected areas to receive sustainable and equitable learning, growth and employment opportunities. According to reports published by the Ministry of Education, 54.8 million children were affected by heatwaves alone in 2024. With India ranking 26th out of 163 in UNICEF's Children Climate Risk Index, the lack of sustainable and equitable educational systems in India has become even more glaring, highlighting some major challenges.

A. Challenges

1) Climate Change issues record a severe number of absenteeism, especially among marginalised communities due to pollution-related illness, flood-related damage and reduced productivity due to scorching heatwaves. With lower access to the internet, a majority of such students remain devoid of AI-driven educational opportunities.

2) Lack of proper infrastructure and data privacy issues further widens the rural-urban gap in educational opportunities, contributing actively to inequity in education.
3) AI itself causes a huge ecological burden due to heavy costs relating to the development and operation of large models.
4) AI data centres consume vast amounts of electricity which often outpaces its contribution in power infrastructure development.
5) The delivery of knowledge regarding environmental sustainability, using fossil-fuel driven, high energy consuming data structure, creates a typical Red AI Vs Green AI paradox.
6) Most AI content regarding environmental issues and climate change have not been contextualised with appropriate localised content.
7) India's policy frame-work with respect to the digital footprint left by AI is still in a nascent state.
8) Most educational institutions do not have ethical and sustainable models for AI use. Therefore, AI used in education often lacks accountability for the severe environmental impact that they produce.
9) AI often contributes to greenwashing and similar misinformation, which poses a dangerous threat if used for school or college curriculums.

B. *Opportunities*

1) *Paperless Schooling*

AI can significantly accelerate the transition toward paperless schooling in India through multiple mechanisms. Generative AI and adaptive learning systems can create personalized learning materials, lesson plans, quizzes, and worksheets on demand in multiple languages, thereby eliminating the need for mass printing. AI tools dynamically adjust the difficulty level and content based on individual learning needs, reducing the requirement for repeated printing of differentiated materials. AI-powered evaluation systems can assess both handwritten (via OCR) and digital responses, drastically cutting down paper usage in examinations and assignments. India consumes millions of tonnes of paper annually, with a substantial share attributed to the education sector. According to industry estimates, producing 1 tonne of paper requires approximately 17 trees and 26,000 litres of water. Thus, a shift towards AI-enabled digital education can significantly reduce deforestation, water consumption, and emissions associated with paper production and transportation, contributing to environmental sustainability.

2) *Smart Campus Management*

AI-driven Internet of Things (IoT) systems can optimize energy and water usage across India's large university and school campuses. By analyzing occupancy patterns, AI systems can automate lighting, air conditioning, and ventilation systems. AI-enabled irrigation systems can optimize water usage in campus landscapes. Predictive maintenance systems can reduce energy wastage by identifying inefficiencies in infrastructure. Studies suggest that AI-based smart energy systems can reduce energy consumption in buildings by 10–30%. Given the scale of India's higher education infrastructure—with over 1,000 universities and thousands of colleges—the cumulative reduction in carbon footprint and utility costs can be substantial.

3) *Efficient Utilization of Physical Infrastructure*

Traditional education systems rely heavily on physical infrastructure. Expansion to accommodate more students requires additional land, construction materials, and energy inputs. AI-enabled education allows for:

- Virtual classrooms and remote learning platforms.
- Blended and hybrid learning models
- Shared digital resources across institutions

This reduces the need for continuous physical expansion of educational infrastructure. In a resource-constrained country like India, such optimization conserves land, reduces construction-related emissions (cement and steel production are major carbon contributors), and ensures more efficient utilization of existing infrastructure.

4) *Reduced Mobility and Transport Emissions*

AI-enabled hybrid and remote learning models significantly reduce the need for daily commuting by students and teachers:

- India's urban centers face severe congestion and high vehicular emissions.
- Millions of students travel long distances daily to attend schools, colleges, and coaching centres.

By reducing physical travel, AI-based education can lower fuel consumption and greenhouse gas emissions. According to estimates, the transport sector contributes nearly 10–12% of India's total CO_2 emissions. Even partial substitution of physical attendance with digital learning can lead to measurable environmental gains.

5) Enhanced Environmental Literacy

AI has the potential to transform environmental education by making it more personalized, data-driven, and immersive:

- AI tools can integrate real-time local environmental data (such as air quality indices, water availability, and climate indicators) into learning modules.
- Adaptive systems can tailor sustainability education based on regional environmental challenges.
- AI-powered simulations can model climate change scenarios, resource depletion, and ecological impacts, providing experiential learning.

Such approaches can foster a generation of environmentally conscious individuals. In the long run, this contributes to sustainable development by aligning human behaviour with ecological priorities and promoting informed decision-making at both individual and societal levels.

6) Green AI Infrastructure

- AI should be built on eco-friendly infrastructures to integrate renewable energy within AI systems.
- AI can be used to track emissions, climate resilience, and adaptation far outweigh energy costs, propelling India in its mission to integrate renewable energy into data centre infrastructure.

AI can create contextualised content related to climate change impact. It can also enable students to collect localised environmental content to build genuine scientific literacy and community environmental agency rather than passive awareness.

V. INITIATIVES TAKEN BY GOVERNMENT

The Indian government has taken several important initiatives to promote the use of Artificial Intelligence (AI) in creating sustainable, inclusive, and equitable educational practices across India. These initiatives aim to improve access to quality education, reduce regional and social inequalities, support teachers, and prepare students for future digital economies.The opportunities and challenges are as mentioned below.

A. Opportunities

1) National Education Policy (NEP) 2020

The foundation for AI integration in education was laid through the Ministry of Education's National Education Policy 2020. The policy emphasizes:

- equitable and inclusive education,
- digital literacy and computational thinking,
- multidisciplinary learning,
- use of emerging technologies such as AI.

NEP 2020 highlights the importance of technology-enabled learning to ensure that education reaches disadvantaged and rural populations.

2) NITI Aayog's National Strategy for AI

NITI Aayog introduced the "National Strategy for Artificial Intelligence," where education was identified as one of the key sectors for AI application.

Major goals include:

- personalized learning,
- intelligent tutoring systems,
- AI-driven assessment,
- reducing educational inequalities,
- improving learning outcomes in underserved areas.

The strategy promotes responsible and ethical AI adoption in schools and higher education institutions.

3) Introduction of AI in CBSE Curriculum

Central Board of Secondary Education introduced AI as a skill subject for Classes 8–10 and later expanded AI education further.
Benefits include:

- early exposure to AI concepts,
- computational thinking,
- coding and problem-solving skills,
- preparation for future employment opportunities.

India became one of the first countries to formally integrate AI into school education at this scale.

4) DIKSHA Digital Platform

DIKSHA (Digital Infrastructure for Knowledge Sharing) is a national e-learning platform developed by the government.
It supports:

- multilingual digital learning,
- teacher training,
- personalized educational content,
- online access for remote learners,
- QR-code-enabled textbooks.

DIKSHA became especially important for ensuring continuity of education during and after the COVID-19 period. It promotes sustainability by reducing dependence on physical resources and improving digital access.

5) SOAR (Skilling for AI Readiness)

The government introduced the SOAR initiative for students from Classes 6–12.
The programme focuses on:

- AI literacy,
- digital skills,
- teacher empowerment,
- reducing the digital divide,
- preparing students for future technologies.

Special emphasis is placed on inclusion and access for students from diverse backgrounds.

6) AI-Based Translation and Multilingual Education

AI-driven translation tools such as Anuvadini are being used to make educational materials available in Indian languages.
This supports:

- linguistic inclusion,
- equitable access to professional education,
- learning opportunities for non-English-speaking students.

For example, AI-assisted multilingual MBA programmes were launched by Indira Gandhi National Open University.

7) Teacher Training and Capacity Building

Several state governments and institutions are training teachers in AI and digital education.
An example is the collaboration between:

- IIT Kanpur and
- SCERT Uttar Pradesh

to train government school teachers in AI, coding, and computational thinking. Such programmes improve teaching quality and help rural students gain technological exposure.

8) Ethical and Responsible AI Governance

The government has also emphasized ethical AI practices in education by encouraging:

- human-centered AI,

- transparency,
- fairness,
- data privacy,
- teacher support rather than replacement.

Recent discussions led by policymakers stress that AI should enhance educational equity and sustainability instead of increasing inequalities.

B. Challenges

1) Digital Divide and Unequal Access

One of the biggest challenges is the unequal availability of:

- internet connectivity,
- digital devices,
- electricity,
- technological infrastructure.

Students in rural and economically weaker regions often lack smartphones, computers, or stable internet access. This creates inequality because AI-based learning platforms mainly benefit students who already have digital resources.

2) High Cost of Implementation

Developing and maintaining AI systems in education requires:

- advanced technology,
- data storage,
- software infrastructure,
- regular updates,
- trained professionals.

Many government schools and small institutions cannot afford these costs, making large-scale implementation difficult and affecting sustainability.

3) Lack of Teacher Training

Many teachers are not adequately trained to use AI tools effectively in classrooms.

Challenges include:

- limited digital literacy,
- fear of technology replacing teachers,
- lack of confidence in using AI-based tools,
- insufficient professional development programmes.

Without proper training, AI tools may not improve learning outcomes.

4) Data Privacy and Security Concerns

AI systems collect large amounts of student data such as:

- academic records,
- behavioral patterns,
- personal information,
- learning preferences.

Improper handling of this data can lead to:

- privacy violations,
- misuse of sensitive information,
- cybersecurity risks.

Protecting student data is essential for ethical and responsible AI use.

5) Language and Cultural Barriers

India has great linguistic and cultural diversity. Many AI educational platforms are mainly designed in English or a few major languages.

As a result:

- students speaking regional languages may face difficulties,
- local cultural contexts may be ignored,
- learning may become less inclusive.

Developing multilingual and culturally sensitive AI systems remains a challenge.

6) Dependence on Technology

Excessive reliance on AI may reduce:

- human interaction,
- emotional support from teachers,
- creativity and critical thinking,
- collaborative learning experiences.

Education is not only about information delivery; social and emotional development also plays a major role.

7) Risk of Job Displacement

Some educators fear that AI could replace certain teaching functions such as:

- grading,
- tutoring,
- assessment.

Although AI is meant to assist teachers, concerns about reduced employment opportunities may create resistance to adoption of AI.

8) Ethical Issues in AI Usage

AI in education raises several ethical concerns:

- transparency of algorithms,
- accountability for AI decisions,
- fairness in student evaluation,
- consent for data collection.

Lack of clear ethical guidelines can create mistrust among students, parents, and teachers.

9) Inadequate Policy and Regulatory Framework

Although governments are promoting AI in education, regulations regarding:

- AI governance,
- accountability,
- data protection,
- ethical standards

Yet they are still evolving. Weak policy implementation may lead to misuse or unequal distribution of technological benefits.

10) Environmental Sustainability Concerns

AI technologies require:

- large data centers,
- high energy consumption,
- continuous computing power.

This can increase carbon emissions and electronic waste if sustainable technological practices are not adopted.

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VI. GOVERNMENT FUNDING POLICIES

The Government of India has introduced several funding policies and financial initiatives to promote Artificial Intelligence (AI) development across sectors such as education, healthcare, agriculture, governance, and startups. The major policy framework is centered around the IndiaAI Mission and related government programmes.

A. IndiaAI Mission

The most significant government funding initiative for AI is the IndiaAI Mission, approved by the Union Cabinet in 2024.

Key Features

- Total budget outlay: ₹10,371.92 crore
- Objective: to build a comprehensive AI ecosystem in India
- Managed by the IndiaAI Independent Business Division under Digital India Corporation

Main areas of funding include:

- AI computing infrastructure,
- AI research and innovation,
- indigenous AI models,
- startup support,
- datasets and AI platforms,
- AI education and skill development.

B. Funding for AI Infrastructure

The government is investing heavily in AI computer infrastructure.

Important Measures

- Development of high-performance computing systems
- Procurement of over 10,000 GPUs through public-private partnerships
- Creation of AI cloud and compute platforms accessible to:
    - startups,
    - researchers,
    - students,
    - academic institutions.

The goal is to reduce dependence on foreign AI infrastructure and support “sovereign AI” development in India.

C. Budget Allocations

The Union Budget has progressively increased allocations for AI.

Recent Budget Support

- 2024–25: initial allocation around ₹551 crore
- 2025–26: allocation increased to ₹2,000 crore
- 2026–27: revised allocation around ₹1,000 crore under the IndiaAI Mission.

These funds support:

- AI research,
- AI startups,
- data centers,
- educational AI labs,
- innovation programmes.

D. Funding for Indigenous AI Models

The government launched a Call for Proposals to support Indian foundational AI models.

Financial Support Includes

- grants,
- compute credits,

- equity support,
- research funding.

Approximately ₹1,500 crore has been earmarked for developers of foundational AI models over five years.
The policy encourages development of:

- Large Language Models (LLMs),
- multilingual AI systems,
- India-specific AI applications.

E. AI Startup and Innovation Funding

The government supports AI startups through:

- incubation programmes,
- innovation challenges,
- venture funding,
- public-private partnerships.

The India AI Innovation Challenge funds AI applications in sectors such as:

- education,
- agriculture,
- climate,
- healthcare,
- governance.

F. AI Education and Skill Development Funding

A major part of the policy focuses on AI education and workforce development.
Funding is used for:

- AI courses in universities,
- AI labs in Tier-2 and Tier-3 cities,
- teacher and student training,
- FutureSkills programmes,
- research fellowships.

The government aims to create a skilled AI workforce and improve equitable access to digital education.

G. State-Level AI Funding Policies

Several Indian states have introduced their own AI funding initiatives.
Example: Maharashtra AI Policy
The Maharashtra government announced:

- investment target of ₹10,000 crore,
- AI startup support funds,
- AI incubators and Centres of Excellence,
- subsidies and tax incentives for AI companies.

Example: Uttar Pradesh AI Mission
The Uttar Pradesh government allocated:

- ₹225 crore for AI initiatives,
- AI labs in Industrial Training Institutes (ITIs),
- AI Centres of Excellence,
- AI-based healthcare systems.

H. AI Dataset and Research Funding

The government launched platforms like AI Kosha to provide non-personal datasets for AI training and research.
Funding supports:

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- open data platforms,
- Indian-language datasets,
- AI research accessibility,
- public-sector AI innovation.

I. Policy Goals Behind AI Funding

The government funding policy aims to:

- make India a global AI leader,
- support inclusive and ethical AI,
- encourage innovation and startups,
- promote AI for social good,
- strengthen digital sovereignty,
- reduce technological dependence on foreign companies.

J. Challenges in Funding Policy

Despite large announcements, some challenges remain:

- underutilization of allocated funds,
- infrastructure gaps,
- shortage of AI experts,
- unequal access for rural institutions,
- balancing innovation with regulation

VII. CONCLUSION

At present, India, indeed, is standing at a critical threshold. With the confluence of the NEP 2020, India's AI Mission and a population consisting majorly of youths, India, along with all its environmental and societal climate concerns, beckons a thorough reimagining of the education system. As our paper examines the abundant promise that AI holds in the field of education, it also reveals the areas where such promises hold the risk of being effective only by hypothesis. The paper shows AI's limitations with respect to it being trained by English-dominant urban, upper-caste data which is far from being inclusive. It also clearly portrays the sheer gap that looms between the rural and the urban students in terms of Internet infrastructure, language, caste hierarchy and environmental crisis, thereby confirming AI's paradoxical role in both promoting and defying sustainable and equitable education in India.

The paper has argued that social, environmental and economic sustainability and equity are not exclusive of one another, but are intertwined roots of policy-objectives. AI can accelerate progress across all three dimensions, but only when deployed within a governance framework that treats inclusion as a design requirement, not an aspiration.

The idea of AI in Indian education is powerful. The reality, as this paper has shown, is a work in progress. Closing the distance between the two is the defining educational policy challenge of this decade — and it will require not just better AI, but braver policy.

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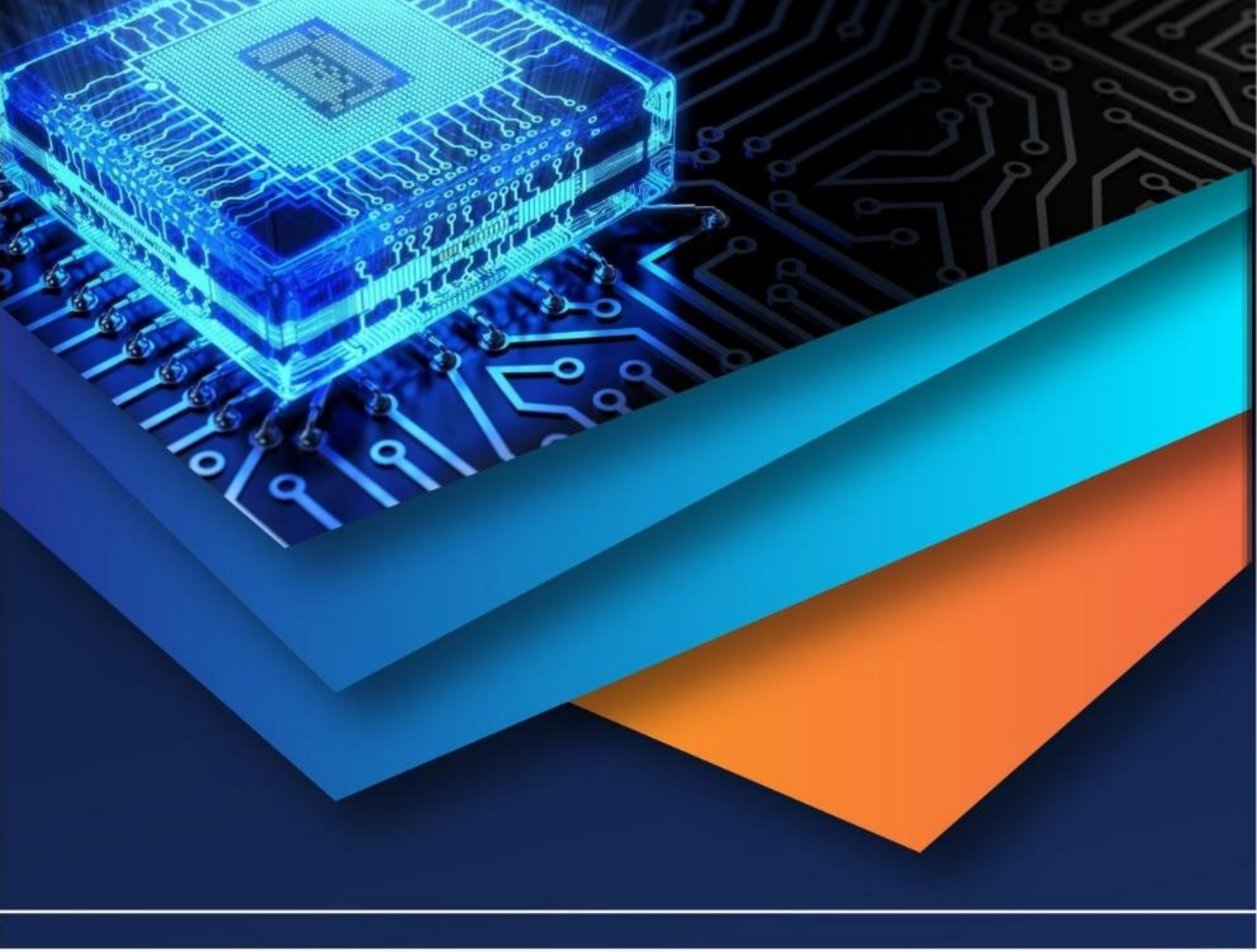

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