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BRIDGING THE GENDER GAP IN EDUCATION THROUGH AI

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RESEARCH ARTICLE

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Abstract

Education is one of the most effective tools, not only for the progress of a nation but also for ushering social equity. However, in India, gender inequality in education is widely prevalent, and especially aggravated, among the socio economically marginalized sections. The reasons for this are multifaceted- primary being the premium placed on marriage of girls, making the family invest in her dowry rather than education. Moreover, domestic duties are considered the primary duty of women, hence parents prefer the daughter to utilize her time in learning them rather than studying. Another major challenge is the lack of functional washrooms for girls leading girls to drop out of school with the onset of menstruation. Lack of adequate infrastructure coupled with wide spread gender-based violence make the commute to school a daily challenge which most families can't navigate. As a result of this, enrolment in schools, participation in STEM education, and access to higher education continue to be glaringly unequal. The AI technologies in education offer a promising solution to these challenges. In my research, I would be discussing the present state of women's education in India highlighting how even after initiatives like the Right to Education Act, education still remains an elusive dream for many women, analysing the various social and cultural barriers to it. I would then analyse how AI can be harnessed for facilitating education for women and what are the diverse AI-driven solutions available. Finally, I will look at the possibilities of misuse inherent in the technology proceeding to evaluate means to strengthen the system to make it more potent and inclusive. I would evaluate AI-driven insights that can guide policy framing and implementation for ensuring targeted education. Finally, I would discuss the future scope of AI-driven education to assure gender-inclusive learning and enhancing national development.

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Introduction

Various studies have conclusively demonstrated the potential of education in improving the quality of life of individuals as well as spurring changes which can lead to a more egalitarian society. However, in India the quality and coverage in aspects related to it are still sadly deficient, and in spite of education being a top driver of social progress – a goal etched in the Constitution of India, the road to achieving gender equity in education has a long way to go.

I would begin by analyzing the ground reality as regards the status of education, focusing on the gender disparity in spite of several remarkable legal and policy initiatives. I would examine the various challenges and problems – cultural, economic and societal, crippling access and participation of women in education. The shift to womanhood marked by menstruation becomes a daunting mountain for girls, leading to considerable dropout affecting educational achievement.

Another disturbing fact which emerges in this discourse is the stark gender difference when it comes to enrolment of girls in STEM related educational options – the reason for girls shying from technological education range from the longer gestation period- with most courses ranging from 4-6 years rather than the three year period of traditional courses, to the exorbitant costs of education and preparation for the highly competitive entrance exams to the patriarchal mindset envisioning women in traditional careers.

It is critical to acknowledge these barriers, in order to create sound solutions – integrating artificial intelligence (AI) into education frameworks, being one of them. AI can become one of the most potent transformers of traditional education – as well as a possible solution to many of its failings. AI powered education solutions can be a boon for marginalized girls in rural areas, where traditional systems of schooling are either inaccessible or inadequate. AI can also aid in creating safe and equitable digital

spaces for young people – by monitoring online abuse and providing the necessary moderation, so that female learners can engage in learning without fear of harassment or exclusion.

AI-driven learning tools, including adaptive learning technologies and intelligent tutorship systems can tailor educational experiences, enabling students to overcome obstacles such as language, accessibility and learning speed including those that can foster safe, inclusive digital learning environments and sustain the participation of female students. Incorporating AI into educational curricula will pave the way to an equitable system that empowers women, increases their economic prospects, and contributes to broader national development (Anilkumar, 2024).

While AI can be a game changer, it is imperative to assess and minimize the possible breach of privacy and other potential misuse of the technology. I would put forth a few suggestions for strengthening and popularizing the various AI techniques for a wider acceptance enabling maximum women to reap its benefits.

Existing Status of Women's Education

Although education is a fundamental right enshrined in the Constitution of India, women continue to face challenges in obtaining quality education. While female literacy has improved, significant disparities remain in rural areas and underprivileged communities. According to the National Statistical Office (NSO) 2021 report, the female literacy rate in India stands at 70.3%, significantly lower than the male literacy rate of 84.7% (Nath, 2023). Despite government programs like Beti Bachao Beti Padhao, a wide proliferation of primary schools and various fellowships and scholarships for girls, dropout rates remain alarmingly high. UNICEF reports that nearly 39% of adolescent girls drop out before completing secondary education (UNICEF, n.d.). Women continue to face socio-economic barriers, including poverty, lack of infrastructure, and cultural prejudices. UNESCO (2021) estimates that 11 million girls in India are at risk of never returning to school post-pandemic, further exacerbating gender disparities (UNESCO).

In urban areas, access to education has improved, but gender gaps persist in higher education and professional fields. Women constitute only 48% of total enrolments in higher education. and account for just 29% of STEM graduates (Swarup, 2023). Deeply ingrained cultural norms often prioritize male education, reinforcing gender biases in learning environments. Safety concerns, lack of transport, and insufficient female-friendly facilities further hinder educational opportunities for women.

The Supreme Court in the year 2011 said that "It is imperative that all schools must provide toilet facilities; empirical researches have indicated that wherever toilet facilities are not provided in the schools, parents do not send their children (particularly girls) to schools." The bench stated that denial of the basic right to water and toilet facilities "clearly violates the right to free and compulsory education of children guaranteed under Article 21-A" (UNICEF, 2012).

According to Annual State of Education Report in India 90 percent of schools have toilet but only 50 percent of them are functional. These 50 percent washrooms were common for both boys and girls. In case where there were separate washrooms only 37 percent of all separate girls' washroom were functional (UNICEF, 2012).

In India among adolescent girls only 64.5 percent of girls have access to sanitary napkins. As a result, 23 million girls drop out of school every year in India (Pandey, 2023). Even though government and other companies have initiated many initiatives like Keep Girlsin School all these initiatives have been a failure (Roy, 2023).

Barriers in Accessing Education for Women

Women continue to face obstacles in pursuing education in India because of strong cultural, economic, systemic and social hindrances. Traditional cultural practices force girls to focus on domestic duties instead of pursuing education and even modern families hesitate to educate their daughters because they believe her future lies within the home. Existing misconceptions equate education with independence leading society to abhor education, fearing the girl would no more be malleable enough to adhere to the patriarchal setup which might jeopardize her chances of marriage and disrupt the existing setup. Many communities frown upon girls freely mixing with boys and would rather not send them to co-educational institutes.

Economic barriers aggravate these challenges as education expenses for daughters are seen as an unnecessary burden by low-income households. Parents choose education for sons as they expect boys to provide financial support to them in old age rather than daughters who would move to their husband's home. Further, given the ever-increasing menace of dowry, families are forced to forego education in favour of dowry if they cannot afford both.

Most schools in India lack proper sanitation facilities with either no toilets or dirty ones, often without water, which is the biggest cause of adolescent girls leaving school, that further aggravates educational imbalances between genders. Moreover, many girls specially from marginalized sections of society either do not have access to or cannot afford sanitary napkins and in several families menstruating girls are prohibited from stepping out, severely restricting their movement during menstruation and resultantly the educational outcome of girls is significantly crippled due to the absenteeism every month.

Most rural areas have limited facilities of roads or bridges coupled with a skeleton public transport system which is a major deterrent, given the pathetic safety scenario for women even in urban metropolises. In several parts of the country even adolescent girls are traditionally not allowed to move alone freely thus restricting their access to schools. Such continual obstacles restrict personal development while enhancing gender-based inequalities in educational skills and job opportunities for women. The Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) includes provisions for equitable education yet countries show irregularity in how they put these standards into practice (Right to Education, 1979).

Integrating AI into educational frameworks presents a possible solution to these barriers empowering women with the necessary skills for economic independence and social contribution. Addressing these disparities through technology not only promotes educational equity but also strengthens the nation's social fabric.

AI-Powered Learning Solutions

Despite increased efforts for educational equity in India, numerous barriers still prevent women from accessing schools and learning opportunities. New educational technologies based on AI can serve as transformative solutions to overcome the identified obstacles. Mobile AI education platforms integrate with personalized teaching systems and online classrooms to optimize education results by delivering economical and flexible learning opportunities for girls. AI-based technologies help create gender-sensitive teaching materials along with adaptable curriculum designs and knowledge programs which empower students to resist traditional social norms (Arora, 2023). India can use technological tools to build an education system which includes all students equally so that each girl receives learning opportunities and personal growth capabilities to contribute positively to society (Arora, 2023).

Personalized learning, where instruction is customized according to individual needs and learning paces, is one of AI-driven education's most significant benefits. Adaptive learning systems utilize AI algorithms to analyse students' strengths and weaknesses, offering personalized recommendations and interventions (Arora, 2023). This is particularly beneficial for marginalized girls who may not have access to qualified teachers or whose schooling is disrupted by domestic responsibilities and societal biases (Anilkumar, 2024).

Another challenge in education is India's linguistic diversity, particularly for rural students belonging to language groups different from the medium of instruction. AI-driven applications help bridge these gaps with multilingual content and instant translation, enabling girls to learn in their preferred language. This fosters a more inclusive and effective learning experience, reducing alienation and dropout rates due to language barriers.

AI plays a crucial role in overcoming gender-based challenges such as absenteeism due to menstruation. Many girls leave school or miss classes due to inadequate menstrual hygiene facilities and social stigma (Kalyanikar, 2025) Virtual classes, chatbots, and e-learning platforms powered by AI provide self-paced learning, ensuring continuity in education even when attending a physical classroom is not possible. These technologies enhance school retention and promote female education equality (Labadze, 2023).

Furthermore, AI delivers digital competence training, preparing women for modern technology-driven work environments. Through autonomous learning, AI enables women to engage more actively in professional life, contributing to economic and social development.

Case Studies: AI Empowering Women in Education

A. Mindspark in Rajasthan

Mindspark, an adaptive learning system powered by artificial intelligence and developed by Educational Initiatives, operates in Rajasthan to enhance the academic performance of disadvantaged students, with a strong focus on female learners. The platform provides customized math and language lessons, adjusting educational content according to each student's progress level (Poverty Action Lab). Studies confirm that teenage girls using Mindspark show remarkable learning improvements, as the AI tailors' instruction to individual needs, accommodating those who have missed school due to social obligations or menstruation-related issues.

B. Women in AI & Robotics Initiative in India

A collaborative effort between NGOs and tech companies, the Women in AI & Robotics initiative delivers AI-powered coding and digital literacy programs to young females across India. Women from disadvantaged backgrounds gain proficiency in data science, AI-based problem-solving, and machine learning through online platforms and mentorship programs. These training programs create employment opportunities in the technology sector, demonstrating AI-based learning systems' potential to drive economic growth and social advancement.

The success of AI-driven educational interventions depends on continuous innovation, accessibility, and inclusivity, which require prioritization from policymakers and other key stakeholders. Ethical processing standards, investments in digital infrastructure, and localized content generation are essential for AI to function as a tool for empowerment, eliminating existing inequalities.

AI's Role in Creating Secure and Inclusive Learning Environments

Digital education can change the course of women's lives, particularly in economically backward areas, however, to utilise it to its fullest potential it is imperative that digital learning environments must be safe, welcoming, and free from harassment or discrimination. Deeply entrenched cultural norms, societal expectations, and gender-based violence are among the challenges that women often face when seeking access to education, challenges that equally exist in online spaces too. AI can be harnessed to surpass this barrier and used to monitor and mitigate threats on the internet so that women can access digital education without fear.

AI supports identifying and filtering out hate speech, detecting cyberbullying, and flagging inappropriate engagement on online learning platforms. They incorporate natural language processing and machine learning algorithms, allowing the application or

tool to identify and elicit content that is known to disincentive women about participating in the digital learning process. In addition, AI generates data-driven insights that enable policymakers and educators to target interventions, aligning digital education with the particular needs of women.

Beyond security, inclusivity is another vital component of digital education. Culturally sensitive and gender-responsive curricula, accessible learning formats, and mentorship programs can help create an equitable learning environment. By fostering digital literacy and providing safe online communities, women can confidently engage in education without societal constraints. Ultimately, ensuring safety and inclusivity in digital education helps bridge the gender gap and creates pathways for women to actively participate in economic and social development. As women gain access to quality education in secure digital spaces, they are better equipped to break free from systemic barriers, contribute to the workforce, and drive positive change in their communities. By harnessing technology effectively, we can create a future where digital education serves as a powerful tool for women's empowerment.

Challenges in Using AI for Education

Engaging AI systems in education comes with its own set of challenges – AI relies on vast amounts of personal data, including students' academic records and learning habits, which raises concerns about data privacy and security. If this data is not adequately protected, it could be vulnerable to breaches, leading to unauthorized access or misuse, especially with regard to girls. To maintain trust, it is crucial to implement robust data protection measures and adhere to privacy regulations. AI algorithms also face challenges related to bias and if the data used to train these systems is biased, it can result in unfair outcomes, such as biased grading or unequal access to resources, disproportionately affecting certain demographic groups. Addressing bias requires careful data selection and ongoing monitoring to ensure fairness.

A concurrent thought which needs the engagement of decision makers is the scenario where AI replaces personalized teaching completely. It has to be remembered that schools are not merely temples of learning, they are also the first battle ground a child encounters- a place where he is exposed to various power dynamics, where he learns to work in a team, picks up the relevant skills to juggle multiple subjects with co-curricular activities, makes friends as well as learns how to deal with bullies. These are essential life skills which prepares a child to navigate the journey of life in adulthood and learning in isolated environment deprives the child of these ancillary skills which he unknowingly picks up in school. Education fosters social and emotional development and over-reliance on AI could reduce face-to-face interactions between students and teachers, which are essential for developing communication, empathy, and critical thinking. A balance between AI and human interaction is needed to maintain a well-rounded educational experience and use technology to complement and not replace, traditional educational methods.

Additionally, the integration of AI can also be costly, with significant investments in technology, infrastructure, and training, creating a potential digital divide between well-funded and underfunded schools. Ensuring equitable access to AI-powered tools is essential for providing all students with equal educational opportunities.

Resistance from educators is another challenge, as concerns about job displacement or lack of understanding of AI can hinder its adoption. Teachers require appropriate training to integrate AI effectively into their teaching methods.

AI's Impact on Educational Policies

AI enables real-time data collection and analysis with predictive modeling that makes making informed educational policy decisions easier. National policies have traditionally been based on static data which fails to capture the dynamic challenges of learning faced by marginalized populations. This is where AI-powered analytics come in, providing opportunities to examine trends over time and act before it becomes late.

For instance, AI-powered data collection systems can analyze dropout rates among girls and identify specific socio-cultural or economic factors contributing to the problem. Policymakers can then implement targeted solutions, such as menstrual hygiene programs, financial assistance schemes, or community awareness initiatives to address these issues. Additionally, AI tools can predict future education trends, helping governments to allocate resources efficiently and prioritize policies that have the highest impact on gender inclusivity.

AI also enhances policy implementation by providing automated feedback loops. Education departments can use AI to track the effectiveness of policies in real-time and make data-driven adjustments. For instance, if a policy aimed at increasing female enrollment in STEM fields is not yielding the desired results, AI can analyze engagement patterns and suggest modifications to improve outcomes.

How to Effectively Develop AI for the Future

To effectively tackle the deep-rooted gender gap in education, it is essential to harness the transformative power of technology, particularly artificial intelligence. As countries like India grapple with persistent educational inequalities, AI has emerged as an essential tool to promote inclusivity and accessibility of education for women.

A few sustained efforts can make the coverage of AI wider and more effective. As a first step government may initiate awareness campaigns to make families aware of the safety and benefits of AI driven solutions to motivate parents to enroll their daughters for the same. Efforts may be made to provide strong internet connections and smartphones to girls to seamlessly access the

classes, or alternatively government can develop educational kiosks at all villages with the requisite infrastructure where girls can safely study.

The importance of fostering a secure and inclusive digital education environment cannot be overstated, as AI monitoring capabilities can safeguard against online threats, encouraging greater participation from female learners, since violation of the privacy of girls is a decisive factor hampering their education.

Continuous investment in AI-driven educational initiatives for culturally and linguistically as well as individual centric programs can incrementally enhance the outcomes and lead to higher enrolment of girls. One possible area of advancement can be in STEM education- an arena which is going to be the driver of the economy in the global arena in the coming years, an area where more youngsters including girls need to contribute to enjoy its benefits.

Conclusion

Educational equity is essential for nation-building and promotion of social justice. In the Indian context, where entrenched gender disparities act as major barriers to education for women, novel solutions are necessary. In rural areas, where attitudes toward gender roles are deeply entrenched, cultural norms often dictate that household responsibilities take precedence for girls, limiting their ability to pursue education consistently and effectively.

Implementing AI technologies within the framework of education is a highly productive tool for solving these problems. Through personalized learning experiences, adaptive systems can cater to individual needs, allowing girls from diverse backgrounds to engage with tailored educational content. Furthermore, AI facilitates innovative pedagogical approaches, such as intelligent tutoring and bilingual support, significantly enhancing the learning experience for women who face linguistic barriers. Adaptive systems can break the long-established barriers to accessing knowledge that challenge female students, especially those from poor regions, while AI-enabled virtual classrooms can provide them with easy access to resources. In addition, smart tutoring systems themselves help boost language learning, while AI products that improve safety and inclusivity create positive learning environments.

By adopting a focused view on development of AI powered solutions coupled with strengthening the penetration of internet and smart phones with more awareness campaigns for its adoption, India can effectively harness this technology not only for education but for social equity. Studies show that empowered women will use technology to leverage on educational opportunities that can lead to their being economically independent, which positively affects the economy of a nation. Therefore, continuous innovation in AI-driven educational initiatives must remain a priority to ensure gender-inclusive opportunities in education. Education not only empowers women with essential skills but also serves as a catalyst for broader societal progress, reinforcing the pathway toward gender equity which in turn leads to development of both society and the nation.

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