

Evaluating the Potential of AI-Driven EdTech to Reduce Educational Inequality in Developing Contexts

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Research Question: To what extent can AI-driven EdTech platforms meaningfully reduce educational inequality in developing contexts such as India, given existing structural and digital divides?

Abstract

Artificial Intelligence (AI) has rapidly emerged as a transformative force within educational technology (EdTech), offering personalised learning experiences, adaptive assessments and increased accessibility for diverse learners. This paper investigates the extent to which AI-driven EdTech platforms can meaningfully reduce educational inequality in developing contexts, with a particular focus on India. Drawing on Human Capital Theory and Amartya Sen's Capability Approach, the paper evaluates education as both an economic investment and a fundamental human capability. It examines the structural causes of educational inequality before assessing how AI-powered tools, including personalised learning systems, intelligent tutoring systems, predictive analytics and assistive technologies, may enhance educational quality. The analysis finds that while AI has considerable potential to improve learning outcomes and individualise instruction, its effectiveness remains constrained by unequal access to digital technologies, affordability, infrastructure and institutional capacity. The paper concludes that AI should be viewed as a complementary tool for educational reform rather than a standalone solution to structural educational inequality.

Keywords: Artificial Intelligence (AI), Educational Technology (EdTech), Educational Inequality, Human Capital Theory, Capability Approach, India

Introduction

Can a single AI-powered application compensate for shortages in teachers, infrastructure and educational opportunities? Or does it primarily benefit those who already possess the digital access required to use it?

Education is the systematic process through which individuals acquire knowledge, skills and values that develop their intellectual and moral capacities. Beyond its private benefits, education generates significant positive externalities by strengthening human capital, i.e., the stock of skills, knowledge and experience that enhances individual productivity (Kolar, 2023). Consequently, education contributes to economic growth by fostering a more productive and efficient workforce (Radcliffe, 2024). That said, whilst global enrolment rates have

improved considerably in recent decades, learning outcomes remain highly uneven. This demonstrates that increased access to education has not necessarily translated into equal educational quality (Roser et al., 2023).

Educational inequality refers to disparities in educational access, quality and outcomes experienced by different social groups, often shaped by socioeconomic status, gender, geographic location and other structural factors. Such inequalities have far-reaching consequences because education is a key determinant of economic mobility, social cohesion and civic participation. Communities experiencing unequal educational opportunities are more likely to face persistent poverty, unemployment and social instability, limiting both individual life chances and broader societal development (Rholetter Purdy, 2021). These challenges are particularly pronounced in developing countries such as India, where research shows that access to higher education continues to vary significantly by household income, gender and social background (Tilak and Choudhury, 2021).

In response to these longstanding inequalities, artificial intelligence (AI)-enabled educational technology (EdTech) has increasingly been promoted as a means of delivering more personalised, accessible and scalable learning experiences. By adapting educational content to individual learning needs, AI has the potential to improve both learning efficiency and educational outcomes. Nevertheless, these technologies remain dependent upon reliable digital infrastructure, internet connectivity and technological literacy - resources that are themselves unequally distributed. Consequently, an important question arises: whether AI can genuinely reduce educational inequality or risk reinforcing existing structural disparities. This leads to the following research question: **To what extent can AI-driven EdTech platforms meaningfully reduce educational inequality in developing contexts such as India, given existing structural and digital divides?**

This paper argues that although AI-powered personalisation has considerable potential to improve learning quality and educational outcomes, its ability to reduce structural educational inequality ultimately depends upon equitable digital access, affordability and effective institutional implementation.

The Theoretical Value of Education

Education has long been recognised as both an economic investment and a fundamental driver of human development. A range of theoretical perspectives explains why educational access is closely linked to individual opportunity, national productivity and social equality. Among the most influential is Human Capital Theory, which views education as an investment that enhances individuals' productive capabilities and generates wider economic benefits. Human capital refers to the stock of knowledge, skills and characteristics that individuals possess, whether innate or acquired, which contribute to their productivity. As proposed by Becker and Schultz, investment in formal education increases labour productivity, raises lifetime earnings, improves health outcomes and strengthens social cohesion. These benefits become even greater when educational systems are aligned with labour market requirements and the development of socio-emotional skills (Dzhamilya et al., 2025). Supporting this perspective, panel regression evidence shows that a one-year increase in average schooling is associated with an 8.3% increase in GDP per worker, illustrating the substantial economic returns of educational investment.

However, Human Capital Theory also highlights an important limitation. Education may function as a positional good, whereby access to prestigious educational institutions provides advantages that extend beyond the acquisition of knowledge itself (OECD, 2024). Consequently, educational opportunities are not distributed

purely according to ability or merit but are often influenced by existing socioeconomic advantages. This unequal distribution of educational opportunity results in an inefficient allocation of talent, preventing many capable individuals from fully developing their potential and ultimately limiting inclusive economic growth. Therefore, the value of education depends not only upon its economic returns but also upon whether high-quality educational opportunities are distributed equitably across society.

Beyond its economic significance, education also plays a critical role in promoting social mobility. It is frequently described as the "great equaliser" because it offers individuals the opportunity to overcome inherited socioeconomic disadvantages and improve their long-term life outcomes (Thomas, 2025). Intergenerational inequality remains one of the most persistent challenges affecting both developed and developing societies, with educational attainment often determining future employment opportunities, income levels and overall quality of life. Nevertheless, disparities in educational quality, unequal access to learning resources and inadequate public policy mean that education alone cannot fully overcome structural inequality. Consequently, simply expanding educational access is insufficient if significant differences in educational quality persist.

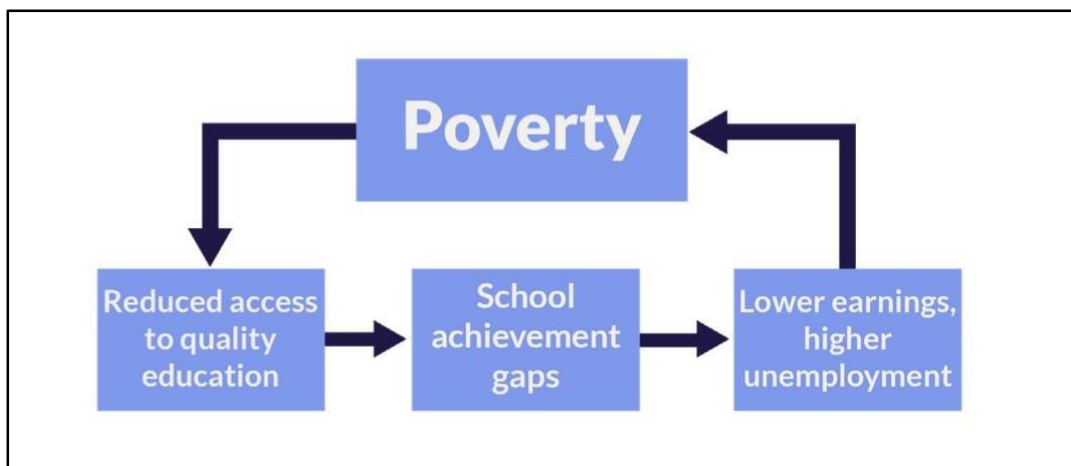


Figure 1: Conceptual Illustration of the Intergenerational Cycle Linking Poverty and Educational Disadvantage

The persistence of educational inequality also reinforces cycles of intergenerational poverty (as seen in Figure 1). Children from disadvantaged backgrounds frequently encounter barriers to accessing high-quality education, reducing their future employment prospects and limiting broader economic development. Evidence from the National Academies (2024), for example, demonstrates how these cycles remain particularly pronounced within historically marginalised communities. Such findings reinforce the importance of ensuring that educational systems promote genuine equality of opportunity rather than merely expanding enrolment.

While Human Capital Theory primarily emphasises education's contribution to economic productivity, Amartya Sen's Capability Approach (as shown in Figure 2) offers a broader understanding of educational value by focusing on human freedom and well-being. First articulated in the 1980s, the Capability Approach argues that development should be assessed by the capabilities individuals possess to lead lives they value, rather than solely by economic outcomes (Wells, 1999). Robeyns (2020) identifies two central principles of this framework: first, that the freedom to achieve well-being has intrinsic moral importance and second, that well-being should be evaluated in terms of individuals' capabilities and opportunities rather than material resources alone.

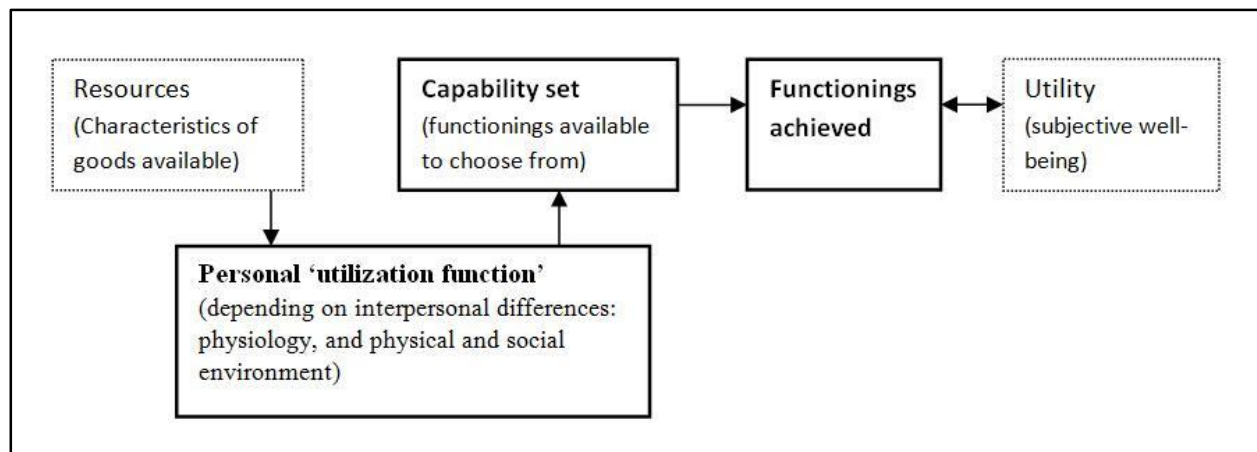


Figure 2: Amartya Sen's Capability Approach

Within this framework, education represents a fundamental capability because it expands individuals' freedoms, allowing them to make informed choices and participate more fully in society (Hoffmann, 2022). Rather than viewing education simply as a means of increasing productivity, Sen argues that education enhances individuals' ability to pursue lives they have reason to value. This perspective has significantly influenced contemporary approaches to educational quality, shifting attention away from enrolment statistics alone towards broader questions of capability development, individual agency and human flourishing (Tulsyan, 2025). Educational systems increasingly incorporate Sen's ideas by recognising that quality education should develop not only academic knowledge but also life skills, critical thinking and personal well-being (Tavanti, 2024).

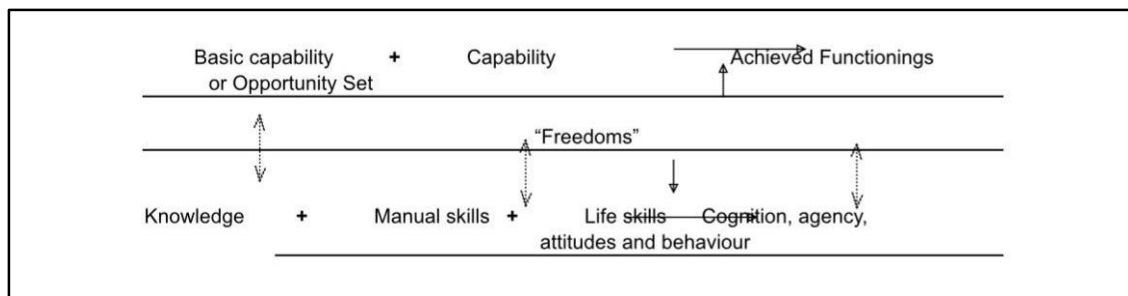


Figure 3: Potential Links Between Capability and Life Skills

Taken together, Human Capital Theory and the Capability Approach demonstrate that education is valuable for both economic and social reasons. While Human Capital Theory highlights education's contribution to productivity and economic growth, Sen's framework emphasises its role in expanding human freedom and reducing long-term social disadvantage. These complementary perspectives provide an important theoretical foundation for evaluating whether AI-driven EdTech can genuinely reduce educational inequality. If education is both an economic investment and a fundamental human capability, then improving educational access alone is insufficient; AI must also contribute to improving the quality, equity and inclusiveness of learning opportunities across different social groups.

Global Educational Inequality

Although significant progress has been made in expanding educational access over the past two decades, educational inequality remains one of the most pressing global development challenges. School enrolment rates have increased substantially, particularly for girls and the global primary school completion rate rose from 70%

in 2000 to 84% in 2018, with projections suggesting it could reach 89% by 2030 (United Nations, 2020). Despite these encouraging improvements, educational participation has not translated into universally positive learning outcomes. In 2018, approximately 258 million children and young people remained out of school, while around 773 million adults - two-thirds of whom were women - continued to lack basic literacy skills (United Nations, 2020). These figures demonstrate that expanding access to education alone is insufficient if the quality of learning and educational attainment remain unequal.

The persistence of educational inequality reflects deeper structural challenges that extend beyond school enrolment. Many developing countries continue to face shortages of qualified teachers, inadequate infrastructure, overcrowded classrooms and limited access to learning materials. Consequently, simply attending school does not necessarily guarantee meaningful educational outcomes. An educated workforce contributes directly to economic productivity, innovation and long-term development, with World Bank estimates suggesting that each additional year of schooling increases individual earnings by approximately 10% (Ikusika, 2024). However, when educational quality varies significantly across different communities, these economic benefits become unevenly distributed. Educational inequality therefore reinforces broader patterns of poverty, unemployment and social exclusion rather than acting as a pathway towards greater social mobility.

These inequalities are particularly evident across developing regions such as South Asia and Sub-Saharan Africa, where structural barriers continue to limit educational opportunities. Gender remains a significant source of disadvantage, with girls often experiencing lower school attendance and higher dropout rates because of early marriage, cultural expectations and gender-based violence. Such barriers restrict not only educational attainment but also future economic participation, further perpetuating cycles of poverty and inequality.

India illustrates many of these structural challenges despite the considerable expansion of its education system. Analysis of the National Sample Survey Office (NSSO) datasets from 2007-08 and 2013-14 demonstrates that inequality in access to higher education has increased substantially according to household income, despite improvements in overall gender equality (Tilak and Choudhury, 2021). The research further highlights widening disparities between wealthier and poorer households, significant regional differences in educational access and a decline in the relative contribution of public higher education. These findings suggest that educational opportunities continue to be shaped by socioeconomic background rather than academic ability alone.

Collectively, this evidence demonstrates that educational inequality is not simply the result of insufficient school enrolment but rather reflects broader structural disparities relating to income, geography, gender, infrastructure and institutional capacity. These persistent challenges have encouraged policymakers and researchers to explore technological innovations that can expand access to high-quality education. In this context, AI-driven educational technology has emerged as a potential means of addressing some of these longstanding inequalities. However, whether AI can overcome these structural barriers - or merely reproduce them in digital form - remains an important question.

The Potential of AI-Driven EdTech to Reduce Educational Inequality

The persistence of educational inequality has prompted growing interest in artificial intelligence (AI) to improve educational access, quality and inclusion. In education, AI has evolved from a supplementary technological tool to an increasingly integral component of modern EdTech platforms. Rather than delivering uniform educational content to every learner, AI enables learning experiences to be personalised according to individual abilities,

learning pace and educational needs. Consequently, AI-driven EdTech has been widely promoted as a potential solution to reduce educational disparities, particularly in developing countries where shortages of teachers, educational resources and infrastructure continue to constrain learning opportunities.

Educational equity, in this context, refers to the fair allocation of educational resources according to individual learning needs rather than the equal distribution of identical resources to every student (Melo-López et al., 2025). AI has significant potential to contribute towards this objective by enhancing accessibility, improving instructional quality and supporting more personalised educational experiences (Knox, 2025). Increasingly, AI-powered learning platforms, personalised study assistants and intelligent educational applications have become embedded within students' daily learning environments (Bhutoria, 2022; Klimova and Pikhart, 2025). Unlike earlier educational technologies that often required substantial institutional adaptation, contemporary AI systems integrate more seamlessly into existing educational practices while providing immediate feedback and measurable efficiency gains for both teachers and students.

One of AI's most significant contributions lies in its capacity to personalise learning. Rather than relying on a one-size-fits-all model, AI-driven platforms continuously analyse student performance and adjust lesson difficulty, pacing and instructional content to meet individual learning needs. Such adaptive learning environments provide immediate feedback, identify knowledge gaps and enable students to progress at their own pace (Kunjumammed, 2024; Rasheed et al., 2025). This level of individualisation is particularly valuable within educational systems characterised by overcrowded classrooms and limited teacher availability, where providing personalised support through traditional teaching methods is often impractical. Consequently, AI has the potential to improve both learning efficiency and academic outcomes by ensuring that students receive support tailored to their individual requirements.

Beyond personalisation, AI also enhances educational accessibility for students with diverse learning needs. Assistive technologies such as speech-to-text applications, AI tutors and real-time language translation allow students to engage with educational content in formats that were previously inaccessible (Saragih, 2024). These technologies can therefore reduce barriers faced by learners with disabilities or language differences, contributing towards more inclusive educational environments. By expanding access to high-quality educational resources regardless of physical location, AI also offers opportunities to narrow disparities between well-resourced urban schools and under-resourced rural institutions.

A further advantage of AI lies in its use of predictive analytics and intelligent tutoring systems (ITS). By combining machine learning, deep learning and natural language processing, these systems can predict student performance, identify learners at risk of falling behind and recommend personalised instructional interventions before academic difficulties become more severe (Raji, Iyer and Yaseen, 2026). Research further suggests that students using intelligent tutoring systems frequently outperform peers undertaking comparable problem-solving tasks, highlighting AI's potential to improve educational outcomes through continuous adaptation and targeted support. Such capabilities are particularly relevant within developing contexts where teacher shortages limit opportunities for regular individual assessment.

Despite these considerable advantages, the ability of AI-driven EdTech to reduce educational inequality should not be overstated. Most existing evidence demonstrates AI's effectiveness in improving the quality of learning for students who already have access to digital devices, reliable internet connectivity and appropriate

technological skills. However, these prerequisites remain unequally distributed across many developing societies. Consequently, AI may improve educational outcomes for connected learners while offering comparatively limited benefits to students who continue to face structural barriers to digital participation.

Furthermore, the growing integration of AI in education raises important ethical considerations regarding transparency, fairness, accountability and algorithmic bias (Holstein and Doroudi, 2021). As AI increasingly influences educational decision-making, ensuring that these technologies operate fairly across diverse student populations becomes essential. Without appropriate safeguards, AI systems risk reinforcing existing inequalities through biased data, unequal digital access or institutional disparities. Therefore, technological innovation alone cannot eliminate educational inequality without parallel investments in digital infrastructure, teacher training and equitable educational policy.

Overall, existing research demonstrates that AI has significant potential to improve the quality of learning through personalised instruction, assistive technologies, predictive analytics and intelligent tutoring systems. Nevertheless, these benefits should be understood as enhancing educational quality rather than automatically reducing educational inequality. The extent to which AI-driven EdTech can meaningfully promote educational equity ultimately depends upon whether its technological advantages are accompanied by broader structural improvements in affordability, digital access and institutional implementation. Consequently, AI should be viewed as an important component of educational reform rather than a complete solution to educational inequality.

Conclusion

Education is widely recognised as one of the most significant drivers of both economic development and social progress. As demonstrated through Human Capital Theory, education contributes to increased productivity, stronger labour markets and long-term economic growth by enhancing individuals' knowledge and skills. However, Amartya Sen's Capability Approach extends this understanding by arguing that education should also be viewed as a fundamental human capability that enables individuals to expand their freedoms, improve their quality of life and break cycles of intergenerational poverty. Together, these theoretical perspectives reinforce the importance of ensuring that high-quality education is accessible to all rather than only to those with existing social or economic advantages.

Despite substantial improvements in global school enrolment, educational inequality remains a persistent challenge. In many developing countries, including India, disparities in infrastructure, teacher availability, educational quality and socioeconomic status continue to limit learning opportunities for large sections of the population. These structural inequalities demonstrate that expanding access to education alone is insufficient if students do not receive an equitable quality of learning.

Within this context, AI-driven EdTech platforms offer considerable potential to improve educational quality. Through personalised learning pathways, intelligent tutoring systems, predictive analytics and assistive technologies, AI can provide more adaptive and accessible learning experiences while helping students receive support tailored to their individual needs. Such capabilities are particularly valuable in education systems facing teacher shortages and limited institutional resources, where personalised instruction is often difficult to deliver through conventional methods.

However, the evidence presented throughout this paper also demonstrates that AI is not, by itself, a complete solution to educational inequality. The effectiveness of AI-driven EdTech remains fundamentally dependent upon access to reliable internet connectivity, digital devices, technological literacy and supportive educational institutions. Where these conditions are absent, the benefits of AI are likely to remain concentrated among already advantaged learners, potentially reinforcing rather than reducing existing inequalities.

Therefore, this paper concludes that AI-driven EdTech can make a meaningful contribution towards reducing educational inequality, but only to a moderate extent. While AI substantially enhances the quality, efficiency and personalisation of learning, it cannot independently overcome the structural socioeconomic and digital barriers that continue to shape educational opportunities in developing contexts such as India. Consequently, AI should be viewed as an important complement to broader educational reform rather than a substitute for sustained investment in infrastructure, public education and digital inclusion policies. Only through the combined implementation of technological innovation and structural reform can AI fulfil its potential as a genuine driver of educational equity.

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