



Leveraging Technology for Learning in India: Evidence, Challenges, and Policy Implications

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Abstract

India's educational system is undergoing a rapid transformation due to reforms in policy, the emergence of large-scale digital platforms, and innovations in the private sector. This paper reviews empirical evidence on technology-enabled learning in India, including national surveys, evaluations of government programmes, and private EdTech interventions. It also identifies structural constraints, such as infrastructure, teacher capacity, and equity, and proposes evidence-based recommendations. The aim is to assess when and how educational technology (EdTech) can produce sustained learning improvements in Indian contexts.

Key words: NEP, LMICs, ASER, SWAYAM

1. Introduction

The National Education Policy (NEP) 2020 of India emphasizes the integration of technology in education to improve quality, equity, and inclusion (Ministry of Education, Government of India, 2020). Concurrently, the COVID-19 pandemic accelerated dependence on digital, broadcast, and online learning modalities. The objective is to convert this enthusiasm into programs supported by evidence and producing quantifiable learning results.

Key research questions addressed in this paper:

1. What is the empirical evidence on the effectiveness of EdTech in India?
2. What are the structural challenges limiting its impact?
3. What best practices and policy recommendations emerge from studies and program evaluations?

2. Evidence on Technology-Supported Learning: India and Beyond

2.1 Meta-Analytical Evidence from LMICs

Major, Francis, & Tsapali (2021) conducted a meta-analysis of 16 randomized controlled trials in low- and middle-income countries (LMICs) involving 53,029 learners aged 6–15. They found that technology-supported personalized learning has a modest positive effect (effect size = 0.18, $p = .001$) on mathematics and literacy. More adaptive personalization (i.e., systems that adjust content and pace to the learner's level) produced larger effect sizes (~ 0.35) compared to simpler personalization, i.e., feedback or interest alignment.

2.2 National Survey and Reports from India

- **ASER 2023 (“Beyond Basics”)**: Four areas were studied in this statewide study of rural India's youth, ages 14 to 18: life goals, digital access and skills, educational and career routes, and foundational abilities. The poll reveals notable deficiencies in reading comprehension, digital literacy, and basic arithmetic, particularly among girls and disadvantaged groups. (ASER Centre, 2024, *Annual Status of Education Report (Rural) 2023: Beyond Basics*)
- **EdTech for India: Leveraging Technology to Bridge Learning Gaps** (Gupta & Sarin, 2022): A Central Square Foundation paper examines the importance of infrastructure, connection, content quality, and capability as key pillars for successful EdTech initiatives in India.

2.3 Studies of Adoption, Perception, and Industry Trends

- Miglani & Burch (2018) examined how educators in Indian government schools perceive and interpret EdTech. They also discovered that inconsistent translation into classroom practice is occurring despite significant investments.
- Aaradhi & Chakraborty (2024) surveyed 513 Indian users to examine EdTech adoption behaviour using the Theory of Consumption Values. They discovered that the adoption of EdTech apps was strongly impacted by functional, social, conditional, and epistemic factors.
- Gnana Kumar & Baby (2023) Analyse customer reviews to determine the sentiment and success/failure characteristics of EdTech companies in India (2020–2022). They discover that important predictors of user retention include factors such as cost, credibility, user experience, and content quality.
- Mishra (2023) in “Covid-19 and school education in India: A critical spatial and ‘meritocratic’ appraisal of emerging EdTech” (SAGE) explains how EdTech grew quickly during COVID-19 but cautions that if access and support are not addressed, disparities will only worsen.

3. Constraints and Challenges in the Indian Context

From the evidence above, several persistent barriers have emerged:

- **Digital divide & connectivity**: Electricity, reliable internet connectivity, and device ownership vary greatly, especially in rural or underserved areas. ASER 2023 shows regional and gender disparities in digital readiness.
- **Teacher capacity & classroom integration**: Teachers frequently receive training that is primarily focused on curriculum, but they rarely receive assistance in integrating technology into their lessons. Miglani & Burch (2018) demonstrate how institutional limitations and teachers' sense-making frequently prevent EdTech from being used in a transformational way.
- **Quality of content & alignment with curriculum**: The usefulness of many technologies in enhancing deeper learning outcomes is diminished because they are either not completely in line with classroom objectives or do not adequately scaffold learning. This is discussed in the *EdTech for India* report.
- **Equity issues**: According to ASER data, girls are less proficient in digital skills, and caste and socioeconomic background also contribute to unequal access. If EdTech is not intentionally created for inclusiveness, there is a chance that it will worsen already-existing disparities.

- **Evidence & evaluation gaps:** Few thorough long-term randomized or quasi-experimental studies measuring learning gain, retention, and scalability in various Indian states are available, despite the abundance of data on use, adoption, and engagement. Major et al.'s meta-analysis offers evidence from around the world, but there aren't many RCTs specifically conducted in India.

4. Policy and Practice Recommendations

Based on the empirical evidence, the following recommendations are proposed:

1. **Hybrid delivery models:** Using a combination of offline resources, internet tools, and broadcast (radio/TV), particularly in places with poor connectivity. This is best demonstrated by government programs like PM eVIDYA.
2. **Sustained teacher development and support:** Peer learning, mentoring, and an explicit connection to classroom practice should all be a part of ongoing training. This is where tools like SWAYAM and DIKSHA should be used.
3. **Promote adaptive, personalized learning tools:** These typically exhibit more potent effects. Priority should be given to adopting and assessing programs that adapt to the skill levels of learners (such as mastery-based practice).
4. **Ensure measurement of learning outcomes:** Interventions should be evaluated via rigorous evaluation designs (RCTs or strong quasi-experiments), including pre- and post-tests, follow-ups to measure retention, and disaggregate results by gender, region, caste, etc.
5. **Target inclusion and equity:** Socioeconomic marginalization, gender hurdles, connection, and device access must all be addressed by policy. For girls, rural locations, and underprivileged castes, special initiatives could be required.
6. **Encourage localization and quality of content:** Resources ought to conform to state curricula and be modified for regional languages and cultural contexts. Promising are open standards or platforms that support localization, such as DIKSHA modules

5. Case Example: Andhra Pradesh's PAL Program

In comparison to peers who did not attend PAL schools, students who participated in Andhra Pradesh's Personalised Adaptive Learning (PAL) program gained over 1.9 years of learning in just 17 months, according to a recent evaluation (news story). This offers convincing proof of what large-scale EdTech with robust control and adaptation can accomplish, even though complete data and a peer-reviewed publication are still pending. [The Times of India](#)

6. Conclusion

India is well-positioned to use technology for education thanks to a combination of private innovation, broad digital platform usage, and national governmental backing. Significant learning improvements can be achieved through supported teacher capacity, adaptive, individualized learning, and hybrid delivery, according to empirical data. However, to prevent a "digital divide" from becoming a "learning divide," uniformity in execution, fair access, and thorough assessment are crucial. Building dependable infrastructure, expanding top-notch local content, and funding impact-driven and longitudinal research should be the main priorities of future efforts.

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