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# Digital Education Beyond Access: Reimagining Educational Justice in India's Digital Transformation Era

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**Abstract**

Digital education has become central to India's post-COVID transformation, catalysed by NEP 2020, the Digital India Mission and platforms such as SWAYAM, DIKSHA, PM eVidya and NDEAR. Yet national datasets on schools, households and higher education reveal that rapid digital expansion has unfolded over entrenched fault lines of class, gender, caste, tribe, region and language, leaving open the question of whether technology is narrowing or simply recoding educational inequalities. Existing research has largely examined digital infrastructure or learning outcomes in isolation, with limited attention to digital justice or to the emerging challenges of generative AI in unequal contexts.

This chapter addresses that gap by asking whether India's digital education push between 2018 and 2026 has reduced educational inequality or transformed old exclusions into digital form. Using secondary data from UDISE+, AISHE, NSS 75th Round, NFHS-5, TRAI, NITI Aayog and international sources (UNESCO, UNICEF, OECD, World Bank, ITU), it maps

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rural–urban, gender, caste and regional disparities in digital capital and educational access, and critically reviews government initiatives including SWAYAM, DIKSHA, PM eVidya, NDEAR and ePathshala. The analysis shows that digital infrastructure and enrolments have grown substantially, but benefits are concentrated among urban, better-off and dominant-group learners, while rural girls, tribal students, disabled learners and linguistic minorities face layered barriers of connectivity, affordability, skills, language and accessibility.

Building on Bourdieu, Sen, Bina Agarwal and Castells, the chapter proposes an original Educational Digital Justice Framework (EDJF) with six pillars—access, affordability, digital skills, inclusive content, ethical governance and AI readiness—to evaluate digital reforms in the AI era. It argues that the core policy challenge is no longer providing devices and platforms but institutionalising digital educational justice through universal broadband, equity-centred digital-literacy curricula, inclusive content ecosystems, rights-based data and AI governance, and targeted support for historically marginalised groups.

**Keywords:** Digital Education; Educational Justice; Digital Divide; Social Inequality; NEP 2020; Digital Inclusion.

## Introduction

India's rapid turn to digital education has become one of the most visible faces of its wider digital transformation, especially in the aftermath of the COVID-19 pandemic. When schools and universities shut down almost overnight in early 2020, online classes, learning apps, television lessons and WhatsApp-based assignments moved from being peripheral experiments to the dominant mode of educational delivery. Official narratives quickly framed this shift as an unprecedented opportunity to democratise quality education, align with the Sustainable Development Goals and fast-track the vision of "Digital India," even as families and teachers scrambled to convert homes, community spaces and mobile phones into

makeshift classrooms. Yet, beneath this rhetoric of "education for all," the everyday experiences of connectivity, device access, language, disability and care work revealed that digitalisation did not arrive on a level playing field but on deeply unequal social terrain.

The pandemic years catalysed a steep increase in digital access indicators that are often taken as proxies for educational inclusion. For instance, the Economic Survey drawing on ASER 2020 reported that the share of enrolled rural children living in households with a smartphone rose from 36.5 percent in 2018 to 61.8 percent in 2020, signalling a massive push towards handheld connectivity in a short span of time. Studies of higher education and school learners similarly show a marked intensification of digital learning practices, with students reporting increased use of platforms, apps and online resources during and after COVID-19 compared to the pre-pandemic period. At the same time, these aggregate gains obscure the uneven ways in which households negotiated device sharing, data costs, electricity cuts and gendered expectations around domestic labour and safety that shaped who could actually participate in online classes and who was left behind. The rise of digital education, therefore, is not simply a story of technological diffusion but of how crises harden or reconfigure long-standing educational hierarchies.

The Digital India Mission, launched in 2015, provides the broader infrastructural and policy frame within which educational digitalisation has unfolded. Its emphasis on universal broadband connectivity, digital public infrastructure and online service delivery has been operationalised through initiatives such as BharatNet and the National Broadband Mission, which seek to extend high-speed internet to all Gram Panchayats and rural institutions, including government schools and colleges. Recent policy communications stress that broadband to secondary schools and primary health centres in rural areas is expected to "redefine education, healthcare and governance" by bridging spatial divides and enabling e-education, e-health and other services. However, these ambitions sit alongside persistent

infrastructural gaps—patchy last-mile connectivity, inadequate devices in government schools and limited technical support—that shape the extent to which digital education can move beyond pilot projects and elite enclaves to become an everyday reality for marginalised learners.

Against this backdrop, the National Education Policy (NEP) 2020 imagines technology as both a cross-cutting enabler of quality and a domain requiring dedicated institutional architecture. The policy highlights the promotion and consolidation of platforms such as SWAYAM and DIKSHA, envisions the National Educational Technology Forum (NETF) as a hub for research and guidance on the pedagogical use of technology, and calls for the creation of robust digital infrastructure, content repositories and virtual labs for school and higher education. Importantly, NEP 2020 explicitly acknowledges the digital divide and calls for targeted measures to address differential access to devices, connectivity and digital skills, especially for disadvantaged groups. Yet its treatment of equity often remains framed in terms of access to hardware and platforms, leaving open critical questions about language hierarchies, epistemic justice, data governance and the ways in which digital systems may reproduce caste, gender and regional stratifications even when connectivity is in place.

PM eVidya, announced as part of the Atmanirbhar Bharat package in 2020, translates many of these aspirations into a flagship programme for "One Nation, One Digital Education Infrastructure." It brings together six components—DIKSHA as a "One Nation, One Digital Platform," SWAYAM and SWAYAM PRABHA channels under the "One Class, One TV Channel" model, community radio and podcasts, special e-content for children with disabilities, and online coaching for competitive examinations—into a unified umbrella for school education. The initiative explicitly seeks to ensure continuity of learning during and beyond the pandemic by integrating online, on-air and offline modes so that learners without internet can access televised or radio content, and content can be localised to state curricula

through DIKSHA. In policy discourse, PM eVidya thus appears as a powerful instrument for inclusion, promising that no child will be left behind for want of connectivity or devices; however, the realisation of this promise depends on how these channels intersect with the socio-linguistic and infrastructural realities of diverse regions.

At the level of higher and continuing education, SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) stands out as India's national MOOC platform and a central pillar of the digital equity agenda. Launched in 2017 under the Ministry of Education as part of the broader Digital India initiative, SWAYAM was explicitly designed to address constraints of institutional capacity, faculty shortage and geographical inequality by offering free or low-cost online courses from school to postgraduate level. By 2024, SWAYAM had recorded over 1.21 crore registered users, more than 11,800 completed courses and around 4.4 million certifications, with total enrolments crossing four crore and completion rates hovering around 10–13 percent. These numbers suggest that the platform has significantly expanded opportunities for flexible, self-paced learning, yet they also raise concerns about who is able to persist and succeed in MOOC environments, given barriers of language, digital literacies and time that may disproportionately affect first-generation, rural, working and women learners.

DIKSHA (Digital Infrastructure for Knowledge Sharing) represents a parallel, and in many ways more pervasive, transformation within school education. Developed by the Ministry of Education and NCERT, DIKSHA has been adopted by almost all States and Union Territories, with 35 state and national boards hosting their own "verticals" and content on the platform. It currently supports content in 36 Indian languages and offers a wide range of resources, from QR-coded textbook supplements and teacher professional development modules to assessment tools and dashboards for administrators. During the COVID-19 pandemic, DIKSHA witnessed unprecedented spikes in usage as states relied on it to deliver

curriculum-aligned digital content to students and teachers, underscoring its role as a de facto national public EdTech infrastructure. Yet DIKSHA's reliance on smartphones, data connectivity and a certain baseline of digital competence again raises questions about how "universal" its universality is, particularly for children with disabilities, learners in low-network zones and those navigating devices shared within the household.

The National Digital Education Architecture (NDEAR), launched in 2021, is intended to knit these disparate initiatives into a coherent, interoperable ecosystem. Often described as doing for education what the Unified Payments Interface (UPI) did for digital finance, NDEAR aims to provide a unifying, "super-connector" digital infrastructure that allows government agencies, private players and civil society organisations to build interoperable solutions on shared building blocks. Its guiding principles emphasise a federated architecture, inclusivity, an ecosystem approach, and privacy and security by design, with the goal of enabling innovative, contextual solutions across the continuum from pre-school to lifelong learning. In theory, this architecture could allow states, NGOs and start-ups to plug into common registries, content repositories and analytics tools while tailoring interventions to local needs, thereby scaling innovation without sacrificing diversity. In practice, it raises critical questions about datafication, platform governance and the balance between centralised standards and decentralised educational autonomy.

Taken together, Digital India, NEP 2020, PM eVidya, SWAYAM, DIKSHA and NDEAR constitute a dense policy and infrastructural assemblage through which digital education in India is being imagined and operationalised. On paper, these initiatives foreground inclusion, access and equity, frequently invoking the language of bridging the digital divide and reaching the "last mile." Empirically, however, the expansion of devices, platforms and broadband has unfolded alongside persistent and often deepening inequalities

of gender, caste, class, region, language and disability, as well as new forms of exclusion mediated by algorithms, authentication regimes and data-driven accountability. As smartphone ownership rises, it remains entangled with intra-household hierarchies over who controls devices, whose learning is prioritised and which forms of knowledge are legitimised within digital platforms.

This book chapter is situated within this tension between ambitious promises of "digital education for all" and the stubborn realities of social stratification and infrastructural unevenness. It asks a deceptively simple but normatively loaded question: has the rise of digital education in India reduced educational inequality, or has it primarily transformed old exclusions into new digital forms? Rather than treating access to connectivity or platforms as sufficient indicators of success, the chapter argues for an expanded notion of educational justice that attends to questions of participation, pedagogical care, cultural and linguistic recognition, data rights and the redistribution of risks and rewards within the digital education ecosystem. By bringing policy analysis into conversation with critical scholarship on digital infrastructures, intersectional inequality and epistemic justice, the chapter seeks to move the debate "beyond access" and towards a more nuanced understanding of what it would mean to reimagine educational justice in India's digital transformation era.

## Theoretical Framework

This section develops a composite theoretical framework that brings together Pierre Bourdieu's theory of capital, Amartya Sen's capability approach, Bina Agarwal's gendered access perspective, and Manuel Castells' network society thesis to explain how India's digital education turn can either deepen or disrupt educational inequalities. It uses the core dimensions of devices, connectivity and digital skills as forms of "digital capital" that shape students' educational opportunities within a wider digital knowledge economy structured by gendered power relations and networked infrastructures.

## From Capital to Digital Capital

Bourdieu's notion of capital conceptualises education as a field where actors compete for valued resources—economic, cultural, social and symbolic—that can be converted into status and advantage over time. In this view, educational success is not simply an outcome of individual merit but the result of unequally distributed capitals, such as educated parents, fluent language use or institutional recognition, which are accumulated and transmitted across generations. Contemporary scholarship extends this lens to "digital capital," defined as the combination of access to digital technologies and the competencies to use them, arguing that it functions analogously to cultural capital by existing in embodied forms (digital fluency, problem-solving habits) and objectified forms (devices, software, connectivity).

## Devices, Connectivity and Digital Skills as Digital Capital

Within this chapter, digital capital is operationalised through three analytically distinct but interrelated dimensions: devices (smartphones, tablets, laptops, televisions), connectivity (quality, stability and affordability of internet or broadcast access) and digital skills (from basic navigation to higher-order information, communication and content-creation competencies). Research on higher education shows that these elements combine to shape students' ability to log in regularly, participate in online classrooms, complete assessments and access supplementary resources, with deficits in any one dimension constraining the overall effectiveness of digital learning. Digital capital thus becomes a crucial mechanism through which existing socio-economic hierarchies are reproduced or challenged, as those with richer device ecologies, better connectivity and more advanced skills can convert digital education policies—SWAYAM courses, DIKSHA resources, NDEAR-linked dashboards—into recognised credentials and opportunities far more easily than those at the margins.

## Digital Capital in Bourdieu's Field of Education

Bourdieu's concept of "field" helps situate digital capital within the broader power relations of India's education system. Schools, universities and EdTech platforms can be seen as arenas where actors—students, parents, teachers, private companies, state agencies—struggle to define legitimate knowledge, valued credentials and appropriate pedagogies, using their existing economic, cultural and social capital to shape the "rules of the game." Digital capital becomes another stake in this field: institutions with better infrastructure and technical staff can design more sophisticated online offerings, teachers with higher digital fluency can experiment with blended pedagogies, and students with strong digital skills are better positioned to accumulate further capitals (e.g., internships, scholarships, global networks), thereby reinforcing the advantages of already privileged groups.

## Amartya Sen's Capability Approach: From Means to Ends

While the capital framework illuminates mechanisms of accumulation and reproduction, Amartya Sen's capability approach shifts attention to what people are actually able to be and do with the resources and technologies they possess. In the ICT4D and education literature, Sen's framework has been used to distinguish between technological "interventions" (devices, connectivity, platforms) and the capability sets they enable—such as the freedom to pursue higher education, engage in critical inquiry, or participate in public reasoning—depending on personal, social and environmental "conversion factors." This perspective is especially pertinent for digital education because it insists that equal provision of devices or platforms is not equivalent to equal opportunity; what matters is whether learners can convert digital inputs into valued functionings such as learning outcomes, confidence, employability and civic voice.

## Converting Digital Capital into Educational Capabilities

Bringing Bourdieu and Sen together, the framework conceptualises digital capital as a crucial input whose value depends on conversion factors that mediate whether it translates into expanded educational capabilities. Personal conversion factors include age, disability, language proficiency and baseline literacy; social factors include household support, gender norms, caste and class dynamics; environmental factors include electricity, safe study spaces and institutional policies. For example, a low-income student with a government-issued tablet but unstable electricity, limited quiet space and unsupportive school norms may possess some digital capital but still lack the capability to attend live classes regularly or complete MOOCs, whereas another student with similar hardware but stronger social support and institutional scaffolding can leverage the same device into valued credentials. The capability approach thereby prevents a reduction of digital inequality to hardware deficits and foregrounds the broader ecosystem within which digital capital is realised or wasted.

## Bina Agarwal and Gendered Access to Technology

Bina Agarwal's work on gender, property and productive resources offers a powerful lens for understanding the gendered distribution of digital capital in India. Across her analyses of land, credit, inputs and technology, Agarwal shows that women's disadvantaged position is rooted less in individual choices and more in structural barriers to owning and controlling assets, which in turn limit their bargaining power, access to information and ability to benefit from development interventions. Translating this to the digital domain, women and girls often lack independent control over devices, face constraints in accessing public or private spaces to use technology, and are constrained by safety concerns and norms that prioritise male educational and occupational trajectories, thereby restricting their participation in digital education even when household-level access indicators appear favourable.

## Gendered Digital Capital and Intra-Household Bargaining

Integrating Agarwal's perspective with the capital–capability nexus reframes "household access" to devices or connectivity as an insufficient metric: what matters is who within the household owns, controls and can reliably use digital resources. In many families, a single smartphone or broadband connection is effectively male-owned, with women and girls negotiating time-bound, supervised or conditional use that drastically limits their ability to attend synchronous classes, download large files or experiment with new platforms. Such patterns echo Agarwal's findings on land and agricultural technology, where women's lack of asset rights reduces their access to credit, information and productivity-enhancing innovations; by analogy, constrained digital capital undermines their educational capabilities, future labour market options and voice in the digital public sphere. This gendered intra-household politics of allocation and control is thus central to explaining why digital education can reproduce, rather than mitigate, gendered educational inequalities.

## Manuel Castells and the Network Society

At the macro level, Manuel Castells' theory of the network society situates the expansion of digital education within a broader transformation of social organisation, where information and communication technologies constitute the basic infrastructure of economic, political and cultural life. Castells argues that in the "informational" or "network" economy, flows of information, capital and culture traverse global networks at high speed, creating new forms of inclusion for those connected to key nodes and new forms of exclusion for those relegated to the periphery. Knowledge production and learning are increasingly organised through distributed networks—universities, corporations, platforms, state agencies—where power is exercised less through hierarchical commands and more through the ability to program, connect or disconnect nodes and to influence the codes, standards and protocols that govern digital infrastructures.

## Digital Knowledge Economy and Platformed Education

Applying Castells' insights to India's digital education ecosystem highlights how platforms such as SWAYAM, DIKSHA and NDEAR are not neutral delivery channels but strategic nodes in a broader digital knowledge economy. These platforms structure what counts as legitimate content, which languages and disciplines are prioritised, what data are collected and monetised, and how learners are sorted, certified and made visible to employers and the state. In a network society, educational advantage increasingly depends on being positioned at well-resourced nodes—elite institutions with robust digital infrastructures, high-bandwidth urban localities, or English-medium networks that intersect with global knowledge flows—while learners in poorly connected regions or vernacular ecosystems risk being locked into low-value segments of the knowledge economy. Thus, digital education policies must be examined not only for their local effects but also for how they plug learners into (or keep them at the margins of) transnational circuits of information, credentials and employment.

## An Integrated Framework for Educational Justice in Digital India

Taken together, these four strands yield an integrated theoretical framework for analysing educational justice in India's digital transformation era. Bourdieu and digital capital scholarship foreground how devices, connectivity and skills are unequally accumulated and converted into status and opportunity within educational fields, revealing pathways of social reproduction. Sen's capability approach insists that the normative benchmark is not equal provision of technology but equal freedom to achieve valued educational functionings, drawing attention to conversion factors that modulate the impact of digital capital. Agarwal's gendered access perspective embeds these processes in intra-household and community power relations, showing how women's constrained control over resources, including technology, undermines their capabilities even when aggregate

access appears to improve. Castells' network society thesis situates these micro and meso processes within the macro architecture of the digital knowledge economy, where inclusion and exclusion are structured by how educational actors are positioned within networked infrastructures and platforms.

Within this composite framework, the central question of the chapter—whether digital education in India reduces inequality or merely transforms old inequalities into digital forms—becomes an empirical question about

(a) who accumulates digital capital in the form of devices, connectivity and skills;

(b) which conversion factors enable or block its translation into substantive educational capabilities;

(c) how gendered access and bargaining shape the intra-household distribution and control of digital capital; and

(d) how learners are positioned within the hierarchies of the networked knowledge economy. Subsequent sections of the chapter use this framework to interpret qualitative and quantitative evidence from India's digital education initiatives, arguing that moving "beyond access" requires re-designing policies and platforms so that they redistribute digital capital, relax conversion constraints, transform gendered power relations and reposition marginalised learners as central rather than peripheral nodes in the emerging digital education order.

## Methodology

This chapter adopts a mixed-methods secondary data analysis design to examine whether India's digital education push between 2018 and 2026 has reduced or reconfigured inequalities in education - Built upon an assemblage of capital (digital, capability, gendered access and ownership) and networked society frameworks. The employed methodology triangulates nationally representative Indian datasets with internonal indicators on digital connectivity, education and equity. This design allows the chapter to situate India's digital

initiatives—such as SWAYAM, DIKSHA, PM eVidya and NDEAR—within broader structural shifts in access to devices, connectivity and schooling outcomes, while also benchmarking these trends against global patterns of digital inclusion and learning inequalities.

## Research Design and Strategy

The research is structured as a longitudinal, cross-sectional secondary data study covering the period 2018–2026. This timeframe captures the baseline just before the NSS 75th Round on education and ICT access (2017–2018), the pre-COVID configuration of schooling and higher education, the disruption of 2020–2021, and the subsequent expansion of digital education initiatives and broadband connectivity through to the post-pandemic consolidation phase. The design is explicitly comparative across social groups (gender, rural–urban location, caste and income where available), educational levels (school, secondary and higher education) and types of digital capital (devices, connectivity, digital skills), allowing us to track both absolute changes and distributional shifts in access and participation. Rather than treating any single dataset as definitive, the chapter uses a convergent design: patterns that recur across multiple sources are interpreted as robust signals of structural change, while discrepancies prompt closer scrutiny of measurement differences and blind spots.

## Indian Secondary Data Sources

For school education, the primary dataset is the Unified District Information System for Education Plus (UDISE+), using national and disaggregated indicators from 2018–19 through the most recent available rounds (2022–23 and provisional 2024–25) on enrolment, school infrastructure, ICT facilities and availability of electricity and internet in schools. These data shed light on how far the expansion of digital infrastructure in government and aided schools has kept pace with policy narratives of “digital classrooms” and “smart schools,” and enable analysis of inequalities by school management type, location and level.

For higher education, the chapter draws on successive All India Survey on Higher Education (AISHE) reports from 2018–19 onwards, focusing on trends in overall and gender-disaggregated enrolment, distance and online education, and institutional access to ICT facilities.

To capture household-level digital capital, the analysis uses the National Sample Survey (NSS) 75th Round on Household Social Consumption: Education (2017–18), which provides detailed information on household possession of computers and internet, and individual abilities to operate computers and use the internet among persons aged five and above. This is complemented by National Family Health Survey-5 (NFHS-5, 2019–21) indicators on mobile phone ownership and internet use among women and men aged 15–49, particularly the widely cited figures that only around one-third of women reported using the internet, with stark rural–urban and statewise gaps. Together, these surveys allow the chapter to analyse gendered and rural–urban differences in digital capital at the household and individual levels, and to track changes in women's digital access over time.

Telecom Regulatory Authority of India (TRAI) performance indicator reports and press releases between 2018 and 2024 provide additional macro-level statistics on the growth of internet and broadband subscriptions, mobile data usage and regional distribution of telecom services. These data help contextualise educational digitalisation in wider trends of connectivity and whether states/regions with faster telecom rollout are also showing greater gains of readiness for remote learning. The chapter uses policy and statistical documestical documents from the Ministry of Education and NITI Aayog—such as UDISE+ booklets, education status reports and strategy documents—to contextualise numerical trends within officially stated goals around digital education, equity and learning outcomes.

## International Data Sources

To place India's experience in global perspective, the chapter draws on international datasets and reports from multilateral organisations. UNESCO's education and ICT statistics, including recent analyses of global citizenship education and digital skills, provide comparative indicators on school connectivity, ICT use in education and regional digital divides, highlighting how India's progress and gaps align with broader trends in the Global South. UNICEF's flagship reports on remote learning during COVID-19—most notably the estimate that at least one-third of the world's schoolchildren could not access any form of remote learning when schools closed—offer a global benchmark for assessing the scale and social patterning of exclusion during school closures.

From the OECD, the chapter uses conceptual and empirical work on digital equity and inclusion in education to frame policy options and indicators that go "beyond access" by examining dimensions such as teacher preparedness, differentiated support and inclusive design. World Bank analyses of EdTech in low- and middle-income countries inform the discussion of how large-scale digital learning initiatives often risk widening learning gaps when underlying inequalities in access and support are not addressed. Finally, ICT statistics from the International Telecommunication Union (ITU) on internet penetration, usage gaps and affordability across income groups and regions are used to situate India's connectivity profile within global patterns of digital development.

## Analytical Procedures

The analysis proceeds in three steps. First, descriptive statistics from each dataset are compiled to map trends in access to schooling and higher education, availability of ICT infrastructure in institutions, and household-level digital capital between 2018 and 2026, with disaggregation by gender, region and rural–urban residence wherever possible. Second, these trends are read through the theoretical framework: variables such as device possession,

internet access and digital skills are interpreted as components of digital capital, while differences across groups are analysed in terms of capabilities and gendered access. For example, NFHS-5 indicators of women's mobile phone ownership and internet use are treated as proxies for gendered control over digital capital, and juxtaposed with UDISE+ data on girls' enrolment and retention. Third, India's trajectory is compared with global patterns reflected in UNESCO, UNICEF, OECD, World Bank and ITU reports to assess whether the country is converging towards, or diverging from, international benchmarks on digital inclusion and equitable learning.

Throughout, the chapter is attentive to the limitations of secondary data: differences in survey definitions, time lags, and the absence of certain variables (such as caste-disaggregated digital access in international datasets) mean that the analysis cannot capture all dimensions of inequality. These constraints are explicitly acknowledged, and quantitative findings are used not as precise causal estimates but as structured evidence to support a theoretically informed assessment of whether India's digital education reforms between 2018 and 2026 have narrowed or transformed educational inequalities.

## Mapping Digital Educational Inequalities in India

This section maps how India's digital turn in education has unfolded across sharp social and spatial fault lines, showing that the expansion of online and blended learning has been layered onto pre-existing rural–urban, gender, caste and regional inequalities rather than erasing them.

### Rural–Urban Digital Divide

The most basic layer of digital educational inequality remains the rural–urban gap in household connectivity and skills. The NSS 75th Round on Household Social Consumption (2017–18) found that only 24 percent of Indian households had any form of internet access, with a stark split between 15 percent of rural households and 42 percent of urban households.

Among youth aged 15–29, just 24 percent in rural areas versus 56 percent in urban areas could operate a computer, and only 25 percent of rural youth compared to 58 percent of urban youth had used the internet in the previous 30 days. These baseline figures, just before the policy push for digital education and the COVID-19 lockdowns, indicate that a majority of rural learners entered the "online schooling" moment without the basic digital capital needed to participate.

More recent telecom data show that while connectivity has expanded rapidly, rural India remains structurally disadvantaged. As of March 2024, overall internet tele-density in India stood at 68.19 internet subscribers per 100 population, but with 44.16 per 100 in rural areas and 111.75 per 100 in urban areas. This implies that the average urban resident is more than twice as likely as a rural resident to have an internet subscription, even before accounting for intra-household sharing and device quality. Studies of online learning during COVID-19 consistently report that schools in rural and remote areas struggled to sustain online classes or even WhatsApp-based assignment systems because of unstable networks, limited data packs and frequent electricity cuts. Thus, the rural–urban digital divide is not only a matter of physical connectivity but of systemic fragility that directly shapes the feasibility of digital pedagogy.

**Statewise Internet Penetration and Educational Readiness**

Telecom indicators also reveal pronounced state-level differentiation that maps closely onto educational opportunities. TRAI data on internet subscribers per 100 population (March 2024) show that southern states generally enjoy much higher tele-density than several northern and eastern states, both in rural and urban areas.

Table 1. Internet subscribers per 100 population, selected states (March 2024)

| State | Rural tele-density | Urban tele-density | Total tele-density |
|---|---|---|---|
| Kerala | 196.98sansad | 63.89sansad | 93.74sansad |
| Karnataka | 55.40sansad | 121.13sansad | 84.93sansad |
| Tamil Nadu | 48.74sansad | 105.35sansad | 79.41sansad |
| Rajasthan | 42.89sansad | 121.83sansad | 64.02sansad |
| Jharkhand | 37.26sansad | 81.94sansad | 49.04sansad |
| Bihar | 32.82sansad | 107.87sansad | 42.10sansad |

These figures suggest three patterns with direct implications for digital education. First, total tele-density in Kerala, Karnataka and Tamil Nadu substantially exceeds that in Bihar and Jharkhand, indicating a structurally more favourable environment for online learning in the southern states. Second, the rural–urban gap is especially large in Bihar and Jharkhand, where rural tele-density remains below 40 subscribers per 100 people despite very high urban penetration, implying that rural learners in these states are doubly disadvantaged: by state-level economic constraints and intra-state spatial disparities. Third, Rajasthan occupies an intermediate position with relatively high urban connectivity but modest rural coverage, which aligns with evidence that digital education initiatives there often depend on community centres, NGO partnerships and shared devices rather than ubiquitous household access.

The NSS-based analysis by Datta and Kingdon further shows that even by 2020—after accounting for growth in smartphone ownership—only around one-third of young people aged 10–24 nationally were estimated to have internet access at home, with substantial deficits in northern and eastern states such as Bihar, Jharkhand, Uttar Pradesh, Odisha and

Madhya Pradesh. Their state-level projections indicate that Kerala and Himachal Pradesh sit at the top of the distribution, while many central and eastern states fall well below the national average in access, ability and actual use of the internet among youth. From an educational justice perspective, this means that digital learning platforms like SWAYAM and DIKSHA are being layered onto landscapes where the baseline probability that a rural child in, say, Jharkhand or Bihar can log in regularly is structurally lower than that of a peer in Kerala or Karnataka.

**Gendered Digital Divide: Female Internet Users and Digital Literacy**

Within these spatial disparities, gender operates as a powerful axis of digital exclusion. NFHS-5 data, summarised in a parliamentary response, show that only 33.3 percent of women aged 15–49 in India reported ever using the internet, with usage rates of 51.8 percent among urban women and just 24.6 percent among rural women. This means that even within already disadvantaged rural populations, three out of four women of reproductive age had never used the internet as of 2019–21, just before or during the period when digital schooling became central for many children.

State-level NFHS-5 indicators and secondary analyses reveal even sharper gaps when men and women are compared. A Population Foundation of India review notes that in states such as Karnataka and Bihar, the proportion of men who have ever used the internet is roughly double that of women, signalling deep gendered inequalities in digital exposure and skills. NFHS-5 also shows wide variation in women's control over mobile phones: for example, 86.6 percent of women in Kerala, 74.6 percent in Tamil Nadu and 61.8 percent in Karnataka report having a mobile phone they themselves use, compared with around 51.4 percent in Bihar, 49.0 percent in Jharkhand and 50.2 percent in Rajasthan. These differences in device control echo Bina Agarwal's broader findings that women's limited ownership of

productive assets constrains their bargaining power and ability to benefit from development interventions.

Global evidence reinforces the concern that digital gender gaps translate directly into constrained educational opportunities. A UNESCO analysis emphasises that women and girls face multiple barriers—lack of digital skills, affordability constraints, restrictive social norms, low literacy and concerns about cyber-harassment—that limit their ability to access and meaningfully use digital tools for learning. In rural India, qualitative studies cited by UNESCO describe women who own mobile phones but can only answer calls, relying on male relatives to dial numbers or read messages due to limited literacy and numeracy. UNFPA's work on India similarly underlines how patriarchal norms and "male gatekeepers" restrict girls' and women's internet use, often framing the internet as a threat to traditional social order rather than as an educational resource.

When these gender norms intersect with the infrastructural and economic constraints documented earlier, the result is that girls and women are systematically less able to convert digital education policies into actual learning: they are less likely to control a device, more likely to be assigned domestic and care work during online class hours, and more vulnerable to being pulled out of schooling altogether when families prioritise sons' access to bandwidth and screen time.

## Caste-Based Digital Inequalities

Caste remains a critical, though often under-acknowledged, dimension of digital educational inequality. Using NSS 75th-round microdata for 2017–18, Datta and Kingdon show that among young people aged 10–24, those belonging to Scheduled Tribes (ST), Scheduled Castes (SC) and Other Backward Classes (OBC) have significantly lower internet access at home, lower ability to use the internet and lower actual usage compared to General-caste youth. Descriptive statistics in their study indicate that ability to use the

internet among youth is around 22 percent for STs, 28 percent for SCs and 34 percent for OBCs, compared to much higher rates among General caste individuals.

Their hurdle-model analysis, which controls for income, location, religion, school type and other factors, finds that being non-General caste (SC/ST/OBC) reduces the probability of having internet access at home by around 4–6 percentage points across age groups, even after accounting for these covariates. Importantly, once access and ability are controlled for, caste gaps in actual internet use largely disappear, suggesting that the primary barrier for SC/ST/OBC youth is infrastructural and skill-related rather than lack of demand or interest. In other words, when Dalit, Adivasi or OBC students do manage to secure access and learn to use digital tools, they are just as likely as General-caste peers to use them for online education, but they are structurally less likely to cross the initial thresholds of access and ability.

Complementary qualitative and policy analyses highlight how caste shapes the local ecologies in which digital education is implemented. Studies of Kerala's "First Bell" initiative during COVID-19 note that, despite the state's relatively advanced connectivity and social development, caste and class barriers still influenced which children could access televised or online lessons, with Dalit and coastal fishing communities facing particular challenges. Research on ICT infrastructure in rural schools in Jharkhand and Rajasthan similarly documents "sizable gaps" in the availability, adequacy and utilisation of ICT resources, especially in schools serving poorer and marginalised communities. A broader review of digital education in rural India finds that caste, class and gender barriers combined to exclude many students from online schooling, particularly those from SC, ST and OBC backgrounds and those in government schools.

From the perspective of educational justice, these findings imply that digital education policies that focus narrowly on platform rollout and content creation, without explicitly

targeting the infrastructural and skill deficits faced by SC/ST/OBC learners, risk reproducing caste hierarchies in new digital forms. For example, DIKSHA-based QR codes in textbooks may be more easily used by students in better-resourced schools and households, while children in under-resourced, caste-segregated settlements may see little practical change if devices, connectivity and supportive spaces remain scarce.

## Regional Contrasts: Kerala, Karnataka, Tamil Nadu Versus Bihar, Jharkhand, Rajasthan

The intersection of rural–urban, gender and caste divides produces particularly sharp regional contrasts, especially between southern states such as Kerala, Karnataka and Tamil Nadu and northern and eastern states such as Bihar, Jharkhand and Rajasthan. As shown in Table 1, total internet tele-density in Kerala, Karnataka and Tamil Nadu ranges from about 79 to 94 subscribers per 100 population, compared to 42 in Bihar, 49 in Jharkhand and 64 in Rajasthan. Kerala's rural tele-density—nearly 197 per 100 people, reflecting high device ownership and multiple subscriptions—is especially notable, indicating that even in rural areas, households are relatively well positioned to engage with digital platforms.

Educational and ICT-specific studies reinforce this picture. Analyses of NSS data and state education statistics show that Kerala combines high internet penetration with near-universal school attendance and relatively strong public provisioning, making it comparatively better placed to adopt blended or remote learning models, even though intra-state inequalities persist. In contrast, Bihar and Jharkhand have lower school attendance ratios, higher dropout rates and much weaker ICT infrastructure in both schools and households, which severely constrains the reach of digital initiatives. Rajasthan lies somewhere in between: UDISE+ and independent evaluations document increasing ICT infrastructure and DIKSHA integration in selected schools and districts, but also highlight persistent connectivity issues and content–language mismatches in tribal and desert regions.

Case-study work from Jharkhand and Rajasthan provides granular evidence of how these macro patterns play out on the ground. A 2024 study of ICT infrastructure in rural schools in Jharkhand documents limited availability of functional computers, projectors and internet connections, frequent electricity problems, and low levels of teacher training in ICT, all of which restrict meaningful use of digital resources even when hardware has been supplied. Another analysis of digital education initiatives in Kerala, Rajasthan and Jharkhand finds that while programmes such as Kerala's "First Bell," Rajasthan's community-driven initiatives and Jharkhand's DigiLEP created important footholds for digital learning, technological inequality, language barriers and socio-economic marginalisation continued to limit participation for many students.

Taken together, these patterns indicate that southern states with stronger welfare infrastructures and higher baseline literacy have been able to leverage digital platforms to a greater extent, whereas states like Bihar and Jharkhand are caught in a double bind of weaker schooling systems and thinner digital infrastructure. Rajasthan's experience underscores that even where political will and innovative NGO partnerships exist, structural constraints around connectivity, poverty and social exclusion impose hard limits on the reach of digital education.

**Global Benchmarks and The Scale of Exclusion**

Placing India within global debates further underlines the significance of these inequalities. A UNICEF report on remote learning during COVID-19 estimates that at least one-third of the world's schoolchildren—around 463 million children—were unable to access any form of remote learning when schools closed, largely due to lack of household connectivity, devices or broadcast access. UNESCO and OECD analyses emphasise that digital equity in education involves not only access to infrastructure but also affordable

connectivity, inclusive content, teacher preparedness and support systems for disadvantaged learners.

The Indian data discussed above suggest that, between 2018 and 2026, the country has moved from a situation of extremely low baseline digital access to one of rapidly expanding but deeply stratified connectivity. NSS and NFHS-5 evidence implies that large segments of rural households, women, and SC/ST/OBC youth continue to experience limited internet access and digital skills, even as tele-density statistics and platform usage numbers rise. Academic analyses warn that, under such conditions, large-scale EdTech and digitalisation initiatives risk exacerbating learning inequalities by disproportionately benefiting those already closer to the centre of the "network society"—urban, higher-income, higher-caste learners with stronger schooling and English-medium exposure.

## Implications for Mapping Digital Educational Justice

Mapping these inequalities makes visible the multiple layers through which digital education can reproduce or transform old hierarchies. The rural–urban divide captures how geography and infrastructure continue to mediate access to platforms and bandwidth; the gender divide reveals how patriarchal norms and asset ownership shape who controls devices and screen time; caste-based gaps highlight the structural exclusion of SC/ST/OBC communities from the material and skill prerequisites for digital participation; and regional contrasts demonstrate how state-level capacities and social policy traditions condition the outcomes of national digital initiatives.

For India's digital transformation in education to move "beyond access" towards substantive educational justice, policies must therefore be evaluated not by aggregate numbers of devices distributed or courses uploaded, but by their impact on these intersecting inequalities. This requires disaggregated monitoring of who is actually using digital platforms, in what ways, with what forms of support, and with what learning outcomes,

across rural and urban locations, gender, caste and region. It also demands targeted investments—such as public digital learning centres in low-connectivity areas, affirmative provisioning of devices and data for girls and SC/ST/OBC learners, and locally grounded content in multiple Indian languages—to ensure that digital education does not simply recode historical exclusions into new, data-driven forms.

## Government Digital Education Initiatives: Achievements and Gaps

India's digital education policy landscape is anchored in a cluster of flagship initiatives—SWAYAM, DIKSHA, PM eVidya, NDEAR and ePathshala—that together seek to create a multilayered digital public infrastructure for learning from pre-school to higher education. This section analyses their objectives, reach, achievements and persistent gaps, highlighting both their promise and their limits for advancing educational justice.

### SWAYAM

#### Objectives

SWAYAM (Study Webs of Active-Learning for Young Aspiring Minds) was launched to expand access to quality higher and school-level courses through Massive Open Online Courses (MOOCs), with a specific aim of overcoming constraints of physical capacity, geography and faculty shortages. It is designed as India's national MOOC platform offering free online courses with the possibility of low-cost certification and credit transfer, thereby aligning with NEP 2020's emphasis on flexible curricula and multiple entry–exit options.

#### Reach and Achievements

Parliamentary data show that as of January 2024, 3,295 unique MOOCs had been developed under SWAYAM, with 4.12 crore cumulative enrolments. A subsequent statement notes that by November 2024, cumulative enrolments had risen to 4.63 crore and 31.1 lakh certifications had been awarded, with 331 universities adopting SWAYAM courses for credit transfer. These figures indicate substantial scale: SWAYAM has become a major node in

India's higher-education ecosystem, especially for engineering, management and teacher-education courses, and has begun to influence institutional curricula and assessment practices.

### Challenges and Gaps

Despite impressive raw numbers, SWAYAM faces persistent challenges. Completion rates for MOOCs remain relatively low, hovering in the range typical of global MOOC platforms, with only a fraction of enrolled learners completing assessments and earning certificates. Evidence suggests that those who succeed are disproportionately drawn from urban, English-speaking and already advantaged groups with better digital capital, while first-generation, rural and working learners struggle with language barriers, limited bandwidth, lack of devices and competing time obligations. Moreover, course offerings are uneven across disciplines and languages, with STEM and English-medium courses dominating, which raises questions about whose knowledge and epistemologies are being privileged in the emerging digital university.

## DIKSHA

### Objectives

DIKSHA (Digital Infrastructure for Knowledge Sharing) is the national platform for school-education e-content, conceived as a "One Nation, One Digital Platform" that provides QR-coded "energised" textbooks, teacher professional development, assessment tools and analytics for all States/UTs. It is funded under the Samagra Shiksha scheme and managed by NCERT, with a federated architecture that allows each State/UT to host its own tenant and customise content and programmes.

### Reach and Achievements

As of July 2022, DIKSHA had recorded more than 495 crore learning sessions and hosted 2,91,168 e-contents, including textbooks, videos, interactive resources and

assessments. Around 15 crore cumulative course enrolments had taken place on the platform, with over 47 lakh teachers benefitting from NISHTHA and other continuous professional development courses delivered via DIKSHA. There are 35 States/UTs who have their own tenants on DIKSHA and most of them have uploaded their textbooks. There are 6,477 QR-coded textbooks available on DIKSHA which link print material to digital resources. DIKSHA has also developed substantial content for foundational literacy and numeracy, and for children with disabilities, including Indian Sign Language videos and audio books.

**Challenges and gaps**

The main limitations of DIKSHA lie not in platform features but in the underlying digital divide and uneven institutional capacity. Access to DIKSHA requires smartphones or tablets, stable data connectivity and a basic level of digital literacy, which many rural, low-income and marginalised students lack. Teachers' use of the platform varies widely across states, with some systems integrating DIKSHA into daily classroom practice and others using it only for mandatory training or not at all, due to workload, language and infrastructural constraints. There are also concerns about the quality and contextual relevance of some content, over-reliance on self-paced modules for teacher development, and limited mechanisms for community or learner feedback in content curation.

## PM eVidya

**Objectives**

PM eVidya, launched in 2020 as part of the Atmanirbhar Bharat package, is an umbrella initiative to ensure "multi-modal, equitable access" to education during and beyond the COVID-19 crisis. It integrates six components: (i) DIKSHA as the One Nation, One Digital Platform; (ii) "One Class, One Channel" DTH TV channels for classes 1–12; (iii) SWAYAM school-education MOOCs; (iv) community radio and podcasts; (v) e-content for children with disabilities; and (vi) IIT-PAL for competitive exam preparation. The core

objective is to reach learners who cannot access online platforms by leveraging television, radio and offline content alongside digital tools.

**Reach and Achievements**

Initially, 12 DTH TV channels were dedicated to school education under One Class, One Channel, broadcasting NCERT-aligned content for classes 1–12, 24×7. Union Budget announcements and policy documents later proposed expanding this bouquet to 200 channels to enable every state to broadcast content in its own language for all classes. PM eVidya thus significantly broadened the modalities through which curricular content could reach households, especially in regions where TV penetration is higher than internet access. Academic and policy reviews highlight the speed with which educational broadcasters, state departments and NCERT curated and aired content during school closures, particularly through the “eVidya” DTH channels and community radio.

**Challenges and gaps**

However, the actual educational value of televised or radio lessons is constrained by several factors. First, TV lessons are largely one-way, with limited scope for interaction, feedback or differentiated support, and they assume that children have both uninterrupted access to screens and a quiet space to watch—conditions often absent in crowded, low-income homes. Second, schedule constraints and gendered household labour mean that many girls and children engaged in domestic or farm work cannot consistently align their time with broadcast slots. Third, there is little systematic evidence on learning outcomes from PM eVidya modalities, and monitoring has focused more on hours of content produced and broadcast than on who actually watched, understood and benefited. Without such evidence, there is a risk that the programme is evaluated by supply-side metrics rather than its impact on learning gaps.

## National Digital Education Architecture (NDEAR)

### Objectives

NDEAR was launched on 29 July 2021 as a "unifying national digital infrastructure" for education, envisioned as a set of open, interoperable "building blocks" that ecosystem players can use to create diverse, contextual solutions, akin to how UPI transformed digital payments. It aims to support teaching–learning as well as educational planning, governance and administration, in line with NEP 2020's "digital-first" mindset. Key principles include a federated but interoperable architecture, privacy and security by design, inclusion, and support for innovation by government, civil society and the private sector.

### Reach and achievements

As a back-end infrastructure rather than a direct-to-learner platform, NDEAR's achievements are less visible but potentially far-reaching. Policy documents describe it as enabling common registries (for students, teachers, schools), digital credentials, analytics dashboards and content repositories that can be reused across states and platforms. The framework has informed the redesign and integration of platforms like DIKSHA, Unified District Information System for Education (UDISE+), Academic Bank of Credits and various state-level apps into a more interoperable ecosystem. By encouraging states and EdTech innovators to build on shared building blocks instead of creating siloed solutions, NDEAR aims to reduce costs, accelerate innovation and ensure that digital solutions can scale while remaining locally adaptable.

### Challenges and gaps

NDEAR's key challenges are governance-related rather than purely technical. First, its success depends on robust data-protection, consent and accountability frameworks, given that it facilitates large-scale data collection on students and teachers; civil-society actors have raised concerns about potential misuse of data and opaque algorithmic decision-making.

Second, the capacity of many state education departments to design, maintain and govern interoperable systems remains limited, raising the risk that vendors or central agencies may dominate the architecture in ways that constrain local autonomy. Third, while NDEAR emphasises inclusion, its benefits may accrue disproportionately to better-resourced systems that can rapidly adopt and adapt building blocks, unless deliberate support is directed towards least-developed regions. Finally, as an infrastructure project, it risks being evaluated by the sophistication of its technical stack rather than by measurable improvements in equity, participation and learning outcomes.

## ePathshala

### Objectives

ePathshala, developed by NCERT and launched before the pandemic, is a portal and mobile app that provides free access to digital textbooks, audio-video resources, and other open educational resources for teachers, students, parents and teacher-educators. Its core objective is to make curricular materials widely available in multiple formats and languages, thereby reducing costs for families and enabling flexible, anytime access to learning materials.

### Reach and achievements

The ePathshala app is available on Android, iOS and Windows platforms and hosts textbooks and resources in Hindi, English, Urdu and many other Indian languages. App store metadata indicate support for over 20 languages, including Assamese, Bengali, Gujarati, Kannada, Malayalam, Marathi, Tamil, Telugu, Punjabi, Odia, Sanskrit, Santali and others. The platform offers e-pub and flipbook versions of NCERT textbooks, audio-books and videos, which became particularly useful during COVID-19 when physical textbook distribution was disrupted. In policy narratives, ePathshala is presented as a key step towards

open educational resources and cost savings, as families can download textbooks for free rather than purchasing printed copies.

**Challenges and gaps**

Yet, ePathshala shares many of the same access constraints as other digital platforms: it assumes that learners have access to smartphones or tablets, sufficient storage and data, and the skills to download and navigate e-books. For younger children and those with low literacy, e-books may be less accessible than print unless combined with guided support from teachers or caregivers. Moreover, ePathshala primarily replicates textbook content in digital form; without complementary pedagogy, it risks reinforcing rote-learning structures rather than enabling more interactive or constructivist learning experiences. Accessibility for children with disabilities, while improving, still lags in comparison to the rich audio-visual and sign-language resources developed under DIKSHA and PM eVidya.

Table 2. Government digital education initiatives: Objectives, achievements and gaps

| **Initiative** | **Primary objectives** | **Key achievements (as of 2023–24)** | **Major challenges/gaps** |
|---|---|---|---|
| SWAYAM | National MOOC platform to expand access to quality higher and school-level courses; enable credit transfer and flexible learning. | 3,295–3,500+ unique MOOCs; 4.12–4.63 crore cumulative enrolments; 31.1 lakh certifications; 331 universities adopting courses for credit. | Low completion rates; participation skewed towards urban, English-speaking and already advantaged learners; uneven language and disciplinary coverage; limited support for first-generation and |

| Initiative | Primary objectives | Key achievements (as of 2023–24) | Major challenges/gaps |
|---|---|---|---|
| | | | working students. |
| DIKSHA | One Nation, One Digital Platform for school education; host textbooks, teacher training, assessments and analytics via a federated architecture.pib+1 | 495+ crore learning sessions; 2.91 lakh e-contents; 6,477 QR-coded textbooks; 15 crore course enrolments; 47+ lakh teachers trained; 35 States/UTs with their own tenants; significant FLN and disability-inclusive content. | Dependent on device access and connectivity; uneven teacher uptake and integration into classroom practice; variable content quality; limited mechanisms for participatory content governance; platform benefits concentrated where digital capital is higher. |
| PM eVidya | Umbrella scheme for multi-modal access to school education during and beyond COVID-19; integrates DIKSHA, DTH TV, | 12 dedicated DTH TV channels (One Class, One Channel) broadcasting NCERT-aligned content for classes 1–12; expansion plan to 200 | One-way, non-interactive pedagogy; dependence on TV ownership, electricity and quiet spaces; limited data on who watches and learns; gendered and |

| Initiative | Primary objectives | Key achievements (as of 2023–24) | Major challenges/gaps |
|---|---|---|---|
| | SWAYAM, radio, disability-inclusive content and IIT-PAL.ciet. | channels; rapid scaling of televised and radio lessons in multiple languages.ciet. | class-based constraints on watching scheduled broadcasts; risk of evaluating success by hours broadcast rather than learning outcomes. |
| NDEAR | Create a unifying, interoperable digital infrastructure for education and skilling; support teaching–learning, planning, governance and innovation across Centre and States. | Launch of NDEAR blueprint (2021); development of common building blocks for registries, credentials and analytics; alignment of platforms like DIKSHA and UDISE+ within an interoperable ecosystem; policy recognition as key NEP 2020 enabler. | Data-governance and privacy concerns; uneven state capacity to adopt and govern interoperable systems; risk of centralised or vendor-driven control; benefits may flow disproportionately to better-resourced states; outcomes hard to measure in terms of equity and learning rather than technical sophistication. |

| Initiative | Primary objectives | Key achievements (as of 2023–24) | Major challenges/gaps |
|---|---|---|---|
| ePathshala | Provide free, multilingual access to NCERT textbooks and audio-visual resources via web and mobile apps; reduce cost barriers for learners.epathshala. | Wide availability of textbooks and resources in 20+ Indian languages; multi-format materials (e-pub, flipbook, audio, video); cross-platform apps (Android, iOS, Windows); important backup during textbook distribution disruptions.epathshala. | Requires smartphones/devices, storage and data; limited interactive features; mainly replicates textbook pedagogy; accessibility for young children and learners with disabilities remains uneven; usage patterns skewed towards better-connected households and schools. |

**Digital Education and Social Justice**

Digital education in India is often narrated through the language of access, scale and innovation, yet questions of social justice—who gains, who loses, and whose knowledges are centred—remain far less visible in mainstream policy discourse. Digital platforms, MOOCs, DTH channels and public EdTech infrastructures have expanded dramatically, but they have grown on terrain marked by entrenched hierarchies of gender, caste, tribe, disability, language and region. Rather than treating "the learner" as a homogeneous subject, this section adopts an intersectional lens to ask: who benefits most from digital education, who

remains systematically excluded, and what this implies for educational justice in the digital era.

**Who benefits from digital education?**

Evidence from MOOCs, school platforms and household surveys suggests that the primary beneficiaries of digital education are learners already endowed with relatively high "digital capital" and cultural capital: urban, better-off, often upper-caste students with access to multiple devices, stable broadband, English or dominant-language proficiency, and supportive school and family environments. Analyses of internet access among youth show that, conditional on having connectivity and basic skills, differences in actual online use across social groups narrow, implying that those who cross the initial thresholds of access and ability can and do exploit digital opportunities.

Studies of digital-language gaps in rural schools similarly find that proficiency in dominant languages used in digital content (typically English and standard Hindi) significantly enhances students' agency over technology and their ability to accumulate further cultural and academic capital. Such students are better positioned to navigate national platforms like SWAYAM and DIKSHA, understand interface terminology, and convert online resources into credentials and improved performance. In effect, digital education currently consolidates the advantages of those who already sit near the centre of India's educational and socio-economic hierarchies.

**Who remains excluded?**

By contrast, a wide range of evidence shows that rural residents, women and girls, Scheduled Tribes (ST), many Scheduled Castes (SC) and Other Backward Classes (OBC), persons with disabilities and speakers of minoritised languages are significantly less likely to possess the devices, connectivity, skills and linguistic capital that digital learning presupposes. Research on the digital divide in India emphasises that these exclusions are not simply "technology

gaps" but manifestations of intersecting social, economic and cultural inequalities, where poverty, geography, gender norms and marginalisation interact to restrict access and agency in the digital sphere. Digital education thus risks reproducing what Fraser calls "maldistribution" and "misrecognition" in new formats: resources and recognition accrue to groups already privileged in the offline education system, while marginalised learners confront layered barriers in entering and benefiting from online spaces.

**Rural Girls: Gendered Digital Capital at the Margins**

Rural adolescent girls and young women stand at the intersection of gender, class and spatial disadvantage. NFHS-5 data indicate that only 33.3 percent of Indian women aged 15–49 have ever used the internet, compared with much higher proportions of men, and that rural women's internet use is barely 24.6 percent. These aggregate figures conceal even starker deprivation among poor and low-caste rural households, where mobile phones are often owned and controlled by male members and girls' use is heavily surveilled or restricted.

Qualitative studies on the gender digital divide emphasise how patriarchal norms, early marriage, fears around "immorality" online and the association of technology with masculinity combine to restrict rural girls' digital participation. Research focusing on rural and tribal women shows that low digital literacy, economic deprivation, lack of infrastructure and linguistic barriers together constrain women's engagement with digital technologies, including for education. Even when digital infrastructure is nominally available in a village, girls may be expected to prioritise domestic labour, sibling care or agricultural work during broadcast teaching hours, limiting their ability to attend TV lessons or live online classes.

Intersectionality helps clarify that the issue is not simply being "female" or "rural" but the combination of gender, locality, class and often caste. A Dalit or Adivasi girl in a remote settlement can be simultaneously constrained by lack of devices, patchy networks, patriarchal control over mobility and technology, and curricular content that ignores or stereotypes her

community. Digital education, in this context, may deepen feelings of exclusion if platforms showcase urban, English-speaking peers as normative learners while rendering her own lifeworld invisible.

## Tribal Students: Geography, Poverty and Cultural Erasure

Tribal communities face overlapping disadvantages in the digital age rooted in historical dispossession, geographic isolation and systemic neglect. A detailed review of the digital divide among Scheduled Tribes notes that only about 31 percent of tribal households owned a mobile phone as of the 2011 Census, and that broadband infrastructure in many tribal areas remains sparse or absent. Empirical evidence from different regions describes a "grim situation" in terms of internet access, with frequent network outages, slow speeds and in some conflict-affected regions, repeated internet shutdowns that disrupt any attempt at regular online classes.

Studies of online education in tribal higher-education contexts report that a majority of tribal students lack reliable computers, internet connections and quiet study spaces, and struggle with data costs and technical complexity. Surveys show that poor connectivity is often cited as the main problem, followed by difficulty concentrating and inability to clarify doubts in online settings; many students describe online learning as isolating and misaligned with their usual modes of interaction and support. In rural and tribal schools, research points to inadequate ICT infrastructure, low institutional digital literacy, and teachers' limited cultural capital in working with tribal students, all of which hinder meaningful technology adoption.

Importantly, tribal students' barriers are not only infrastructural but also linguistic and cultural. Analyses from Mizoram and other tribal states note that digital education content is overwhelmingly in English or dominant state languages, creating language barriers for students whose primary literacy is in tribal languages. These students often find platforms

alienating and struggle to see their histories, landscapes and epistemologies represented, reinforcing the sense that digital schooling is something done "from outside" rather than a medium for their own knowledge production.

**Disabled Learners: Accessibility Promises and Persistent Exclusions**

Government documents highlight a wide range of measures to make digital platforms accessible for children and young people with disabilities. DIKSHA is reported to comply with Web Content Accessibility Guidelines (WCAG) 2.0 Level AA, support screen-reader compatibility, and host thousands of audiobooks, Indian Sign Language (ISL) videos and an ISL dictionary. A parliamentary note lists 4,247 textbook-based ISL videos, 3,715 audiobook chapters and a 10,000-word ISL dictionary on DIKSHA, alongside regulations encouraging universities to convert materials into accessible formats and provide assistive devices to learners with disabilities. App descriptions also emphasise features such as text-to-speech, read-aloud functionality and accessibility plug-ins that allow users to adjust contrast, font size and other interface settings.

Yet independent assessments reveal substantial gaps between accessibility on paper and accessibility in practice. A 2020 study by the Vidhi Centre for Legal Policy, which evaluated digital education in four southern states, found that TV channels hosting educational content were largely inaccessible for students with physical and sensory disabilities, and that remote-learning modalities were seldom designed with universal design principles in mind. A systematic audit of e-textbooks and learning resources on DIKSHA discovered that 68.2 percent of sampled links were unusable with screen-reader software, and that 64 percent of NCERT and 95 percent of sampled SCERT textbooks were inaccessible to students with visual impairments.

For disabled learners, intersectionality operates along multiple axes. A visually impaired girl in a rural area, for instance, may confront not only inaccessible content and

interfaces but also poverty-related device constraints, unreliable connectivity and gendered limits on mobility and technology use. Similarly, a Deaf tribal student may find that even where sign-language videos exist, they are produced in ISL without sensitivity to local sign varieties, and embedded in curricular frameworks that marginalise tribal languages and knowledge. Without sustained collaboration with disabled people's organisations and attention to intersecting disadvantages, digital education risks reproducing ableist assumptions under the banner of "inclusion."

**Linguistic Minorities: Digital Monolingualism and Epistemic Injustice**

Linguistic diversity is central to India's constitutional and policy imagination, yet digital education often privileges a narrow band of dominant languages. NCERT-linked research on "bridging the digital-language gap" shows that proficiency in major languages used in educational content and technological interfaces—typically English, Hindi or the dominant state language—significantly enhances students' access to and agency over technology, while linguistic minority students struggle to engage with platforms that do not support their mother tongues.

A growing literature on multilingual education argues that NEP 2020's emphasis on mother-tongue-based education up to at least Grade 5 is difficult to realise in digital environments dominated by English interfaces and content. Analyses of AI and digital technologies note that e-commerce and payment platforms have made strides in offering Indian-language interfaces, but many EdTech applications lag considerably, remaining English-centric or limited to a small set of mainstream Indian languages. Only a handful of states, such as Odisha, have systematically integrated multilingual education for tribal children, and even there, digital content in tribal languages remains scarce.

For children from linguistic minorities—whether tribal, borderland or migrant communities—this creates a double exclusion: not only are devices and connectivity less

available in marginalised regions, but the content that does reach them often arrives in unfamiliar languages and cultural frames. In Mizoram, for instance, research documents how Mizo-speaking students experience digital education as misaligned with their linguistic and cultural contexts, particularly when platforms rely heavily on Hindi and English. This constitutes an epistemic injustice: learners are asked to align with dominant linguistic and knowledge regimes without reciprocal recognition of their own languages as legitimate mediums of digital learning.

## Intersectional Social Justice in Digital Education

Across these groups—rural girls, tribal students, disabled learners and linguistic minorities—a common pattern emerges: digital education amplifies existing hierarchies unless deliberate, intersectionally informed interventions are made. Rural girls face layered constraints of gender norms, economic precarity and connectivity gaps; tribal students encounter the combined weight of geographic isolation, poverty, caste-tribe marginalisation and linguistic erasure; disabled learners struggle with inaccessible interfaces and content, compounded by poverty and gender; and linguistic minorities confront both material exclusion and symbolic misrecognition in digital knowledge spaces.

An intersectional framework, drawing on feminist and critical race scholarship, insists that these are not separate "vulnerable groups" to be targeted with add-on schemes but configurations of power that shape who is imagined as the default user of digital education and whose needs are treated as peripheral. Instead of asking only how many students have logged into DIKSHA or enrolled in SWAYAM, social-justice-oriented evaluation would ask whose capabilities are actually being expanded: can a rural Dalit girl with a disability study in her language, interact with teachers, and pursue meaningful educational pathways through digital means? What forms of redistribution (devices, data, public access points), recognition (multilingual, culturally grounded content) and representation (participation of marginalised

communities in platform governance) are required to shift the underlying structures that produce digital inequality?

Digital education in India thus sits at a crossroads. On one path, it can entrench a two-tier system in which urban, upper-caste, able-bodied, dominant-language learners enjoy increasingly personalised, data-rich learning environments while marginalised groups are offered sporadic connectivity and generic broadcast content. On the other, it can become a lever for social justice if platforms, infrastructures and pedagogies are intentionally re-designed to redistribute digital capital, support diverse capabilities and centre the knowledges of those historically excluded from both education and technology. The choice between these futures will depend less on technological ingenuity than on whether intersectional justice becomes a non-negotiable principle in the design and governance of India's digital education landscape.

## Emerging Challenges in the AI Era

Generative artificial intelligence has arrived in Indian education at a moment when digitalisation is already reshaping access, pedagogy and governance, promising personalised tutoring, automated feedback and real-time diagnostics but also raising profound questions about power, privacy and inequality. Systems such as ChatGPT and other large language models are now embedded in student writing, exam preparation, coding practice and even teacher lesson planning, while AI-driven tutoring platforms and proctoring tools are marketed as solutions to chronic capacity gaps. This section foregrounds the social-justice stakes of this shift: who stands to benefit, who might be further marginalised, and how AI may transform—not simply enhance—existing digital education inequalities.

### Generative AI, ChatGPT and AI tutors

Generative AI tools such as ChatGPT can generate essays, explanations, code and exam answers in seconds, leading many educators to worry about plagiarism, academic

dishonesty and the erosion of students' capacity for original thought. Studies of generative AI in classrooms report that teachers fear over-reliance on tools like ChatGPT will undermine critical thinking, writing skills and deep engagement with course material, particularly when students use them to bypass rather than support learning. At the same time, these tools can lower barriers to accessing explanations, examples and practice questions, especially for students who lack access to high-quality tutoring or live teacher support, creating genuine opportunities for differentiated and on-demand help.

AI tutoring systems, which offer personalised feedback, adaptive problem sets and conversational guidance, are often presented as democratising one-to-one tutoring at scale. Critical analyses of AI tutors, however, warn that over-reliance on such systems can foster dependency, reduce learners' sense of agency and self-efficacy, and encourage conformity to the patterns and norms encoded in the system's design. These systems typically log fine-grained behavioural data—clickstreams, response times, error patterns—that can be used for learning analytics but also raise concerns about opaque data practices and limited student control over how their data is stored or reused. In unequal contexts like India, AI tutors risk deepening divides: students with devices, bandwidth and English proficiency can benefit disproportionately from sophisticated AI platforms, while those without these forms of digital capital are left further behind, even as policy discourse celebrates "personalised learning for all."

## AI in Assessment and Proctoring

AI is also transforming assessment, from automated grading of essays and short answers to remote proctoring systems that monitor students via webcams, microphones and keystroke data. Proponents argue that AI-based exam monitoring can deter cheating and support fairer evaluation in large-scale online examinations, especially in post-pandemic systems that have normalised remote testing. Yet empirical and ethical analyses highlight

significant concerns: constant audiovisual recording intrudes into students' homes, increases anxiety and normalises a culture of surveillance that may be disproportionate to the pedagogical benefits.

Technical limitations and bias further undermine claims of fairness. Case studies show that AI-driven proctoring and facial-recognition systems may misinterpret culturally diverse behaviours, fidgeting or neurodivergent traits as suspicious, and perform less accurately for students with darker skin tones, disabilities or poor lighting and connectivity, leading to false flags and unjust penalties. Automated scoring systems trained primarily on certain linguistic or socio-economic groups may systematically underrate the writing of students from other backgrounds, particularly those using non-standard dialects or translanguaging practices. For marginalised learners who already experience heightened scrutiny and stereotype threat, algorithmic suspicion can amplify feelings of exclusion and distrust in the education system.

## Data Privacy and Student Surveillance

AI-driven education relies on massive data collection, from interaction logs in tutoring systems to biometric and behavioural data in proctoring, raising fundamental questions about student privacy and consent. Analyses of AI in education point out that students and families often have little understanding of what data is collected, how long it is stored, or with whom it is shared, while AI vendors may repurpose performance metrics and behavioural profiles to train models or for commercial analytics. A 2025 review of AI-based educational tools describes how even supposedly anonymised data can be re-identified when multiple datapoints—such as reading level, attendance, location and socio-economic indicators—are combined, making claims of safe anonymisation misleading.

In India, the Digital Personal Data Protection Act (DPDPA) 2023 establishes a consent-driven framework and specific provisions regarding children's data, including

requirements for verifiable parental consent and prohibitions on processing data in ways detrimental to a child's well-being. Commentaries on the Act note that educational institutions, as "data fiduciaries," may process student data for educational activities and safety under certain exemptions, but must comply with principles of purpose limitation, lawful processing and minimal data collection. However, these safeguards remain largely untested in the context of AI systems that continuously harvest fine-grained behavioural data and infer emotional or psychological states, often through third-party vendors whose business models depend on data aggregation. Without robust enforcement, transparency and independent oversight, there is a risk that AI-enabled "personalisation" becomes a justification for pervasive student surveillance and data extraction.

## Learning Analytics and Digital Profiling

Learning analytics platforms promise to convert the "data exhaust" from AI tutors, learning management systems and assessment tools into actionable insights for teachers and administrators. Predictive models can identify students "at risk" of failure or dropout, highlight concept-level weaknesses and recommend targeted interventions, potentially supporting more timely and equitable support. Yet the same systems also generate digital profiles that can follow students across years and institutions, encoding early struggles or behavioural flags into long-term risk scores that may shape how teachers, schools and future gatekeepers perceive them.

Reports on AI and student privacy warn that, unless explicitly prohibited, data collected for educational support may later be repurposed for high-stakes decision-making such as college admissions, scholarship allocation or employability screening, turning formative analytics into tools of algorithmic gatekeeping. A 2025 UNESCO-cited analysis cautions that student data generated today could underpin tomorrow's profiling systems, fundamentally clashing with rights-based understandings of education as a space for growth

rather than fixed prediction. For students from marginalised groups, whose early educational trajectories may be shaped by structural disadvantage rather than ability alone, such profiling can entrench deficit narratives and close off opportunities precisely when more supportive environments might have enabled different futures.

## Algorithmic Inequality and Embedded Biases

AI systems used in education—whether for tutoring, assessment, recommendation or administrative decision-making—are trained on data that reflect social hierarchies and biases, making algorithmic inequality a central concern. Studies of large language models on Indian bias benchmarks show that models often exhibit stronger stereotypical biases in Indian languages than in English, and that bias scores for Indian languages exceed those for English across multiple architectures. Critical work on generative AI and representational bias in Indian contexts argues that these systems default to majoritarian perspectives, amplifying dominant narratives while erasing or misrepresenting minority communities.

More broadly, analyses of AI in K-12 and STEM education emphasise that AI-powered tools can perpetuate race, gender, caste or disability bias if training data and design processes are not explicitly equity-centred. For instance, predictive models used to identify high-potential students or allocate remedial resources may inadvertently encode historical patterns in which certain communities are under-represented in advanced tracks, leading to self-fulfilling prophecies. When such systems are adopted in contexts already marked by caste, gender and regional inequalities, algorithmic classifications can harden existing stratifications, even as platforms are marketed as objective or neutral.

## Language Exclusion and Digital Epistemic Divides

Language is a particularly salient dimension of algorithmic inequality in India's multilingual landscape. Research on multilingual AI finds that large models typically achieve their highest performance on English, with significantly lower accuracy and higher bias in

low-resource languages, including many Indian languages. A 2025 study from Johns Hopkins reports that multilingual AI tools like ChatGPT tend to default to information available in higher-resource languages such as English, amplifying their dominance and sidelining minority languages in what the authors term a "digital language divide." They document cases where queries in less-resourced languages are answered based primarily on English-language sources, potentially distorting local narratives and knowledge.

In education, this bias intersects with long-standing language hierarchies. If AI tutors, chatbots and assessment systems work best in English and a small set of dominant Indian languages, students who study in other languages or dialects encounter worse performance—more errors, less nuanced feedback, higher misclassification rates—even when tools are nominally multilingual. Content generation features may produce examples and explanations that reflect urban, upper-caste, majority-language contexts, marginalising the experiences and epistemologies of linguistic minorities and tribal communities. This linguistic imperialism within AI risks reinforcing the idea that legitimate knowledge is that which circulates in English or dominant languages, undermining efforts to promote mother-tongue-based education and epistemic justice in digital environments.

## Reframing AI in Education Through a Social-Justice Lens

Taken together, generative AI, AI tutors, AI-driven assessment, learning analytics and multilingual language models introduce a qualitatively new layer to digital education: one in which not only access to platforms but also the behaviour of algorithms becomes central to educational justice. The benefits of AI—scalable personalised support, rapid feedback, improved diagnostics—are real, but so are the risks of surveillance, profiling, bias and language-based exclusion, particularly for students already disadvantaged by gender, caste, tribe, disability, location or language.

A justice-oriented approach to AI in education demands at least four shifts. First, governance must move from tool-by-tool procurement to system-level regulation that enforces data-minimisation, purpose limitation, strong consent standards and explicit bans on harmful secondary uses of student data, building on but going beyond the DPDPA framework. Second, equity-centred design—including bias audits, participatory co-design with marginalised communities, and multilingual, culturally grounded content—must be treated as core technical requirements rather than afterthoughts. Third, human educators need support to understand AI's affordances and limits, so that they can use these tools critically rather than being displaced or subordinated to algorithmic logics. Finally, students should be educated about AI itself—its data practices, biases and political economy—so that they can act as informed agents rather than passive data sources within an expanding AI-driven education market.

Only if these social-justice questions are placed at the centre of AI adoption in education, rather than appended as ethical checklists, can India's emerging AI-intensive digital education ecosystem avoid deepening existing inequalities and instead contribute to more capacious and equitable forms of learning.

## Proposed Framework: Educational Digital Justice Framework (EDJF)

The Educational Digital Justice Framework (EDJF) is proposed as a normative and analytical framework for evaluating whether digital and AI-mediated reforms in India move the system towards educational justice rather than simply expanding digital access. It draws inspiration from global "just digital" work, which highlights fair access to digital infrastructure, capabilities and governance as prerequisites for equitable achievement of the SDGs, and from UNESCO's emerging six-pillar framework for human-centred digital transformation of education. However, EDJF re-works these ideas specifically for education

in unequal contexts such as India, foregrounding affordability, inclusive content and AI readiness as distinct justice pillars alongside access, skills and governance.

At its core, EDJF asks a simple but powerful question of any digital initiative, from SWAYAM courses to DIKSHA modules or AI tutors: does this intervention expand the real capabilities of historically marginalised learners (rural girls, SC/ST/OBC students, disabled learners, linguistic minorities), or does it primarily benefit those who already possess digital capital? By organising the analysis into six interdependent pillars—Access, Affordability, Digital Skills, Inclusive Content, Ethical Governance and AI Readiness—the framework enables a systematic diagnosis of where digital reforms succeed, where they reproduce inequalities, and where targeted policy correctives are most urgent.

**Pillar 1: Access**

The first pillar treats access as a multi-dimensional concept encompassing devices, connectivity, electricity, assistive technologies, safe physical spaces and institutional access to public digital learning centres. Global digital-transformation work emphasises that connectivity and infrastructure remain the "missing link" for realising the right to education in many contexts, but EDJF insists that access be measured intersectionally: which households control devices, which students enjoy uninterrupted time on task, and which communities have institutionally guaranteed access to digital spaces.

**Pillar 2: Affordability**

Building on digital-inclusion frameworks that highlight cost and sustainability as central pillars of equitable transformation, the second pillar foregrounds affordability as a justice issue in its own right. It includes direct costs (devices, data, repairs, assistive technologies), indirect costs (lost wages, travel to connectivity hubs) and social–psychological costs (stigma, indebtedness, punitive paywall models). In the Indian context, where prepaid data

and shared smartphones are common, EDJF argues that any digital-education reform that ignores affordability risks deepening stratification even as nominal access improves.

**Pillar 3: Digital Skills**

The third pillar conceptualises digital skills as layered capabilities rather than mere operational literacy. It synthesises international work on digital-competence frameworks and "digital skills for life and work," which distinguish basic technical skills from higher-order information, communication and critical literacies. EDJF specifies four tiers: foundational operational skills; information and media literacies; communicative and collaborative skills; and critical–generative literacies, including AI and data literacy. Crucially, it demands that digital-skills programmes be explicitly targeted towards those structurally excluded from informal digital learning—rural girls, SC/ST/OBC youth, disabled learners and speakers of minoritised languages.

**Pillar 4: Inclusive Content**

Inclusive Content addresses epistemic justice: whose languages, histories and knowledges are legitimised in digital curricula, platforms and AI systems. UNESCO's frameworks stress that digital transformation must respect linguistic and cultural diversity, but EDJF makes this a core pillar, not an add-on. It asks whether learners can access curriculum-aligned content in their home languages; whether materials reflect the lives and aspirations of marginalised communities; and whether content is produced and reviewed in accessible formats (captions, screen-reader compatible texts, sign language, audio books) to uphold the rights of learners with disabilities. Content audits and participatory curation mechanisms become key tools for assessing this pillar.

**Pillar 5: Ethical Governance**

The fifth pillar recognises that digital and AI-intensive education is governed by rules, contracts and institutional practices as much as by code. Building on UNESCO's

Recommendation on the Ethics of AI and its AI-in-education guidance, EDJF defines ethical governance through four principles: rights-based data practices (minimisation, purpose limitation, strong child protections), transparency and accountability for algorithms used in assessment or profiling, participatory governance with meaningful representation of marginalised groups, and a commitment to public-interest digital infrastructure over purely commercial logics. This pillar directly addresses risks of surveillance, profiling and opaque decision-making that accompany large-scale learning analytics and AI tools.

**Pillar 6: AI Readiness**

The final pillar extends the framework into the emerging AI era. Existing AI-readiness guides tend to emphasise infrastructure, skills and compliance, but EDJF redefines readiness in justice terms. Structurally, a system is AI-ready when AI deployments are built on equitable access and affordability, rather than functioning as premium layers for already privileged learners. Pedagogically, teachers and students must be equipped to use AI critically, understanding bias, data practices and limitations. Regulatorily, AI-specific rules must govern high-risk applications such as automated grading, proctoring and behavioural profiling, ensuring human oversight and alignment with human-rights standards. In short, AI Readiness under EDJF is less about "AI everywhere" and more about "AI that enhances, rather than erodes, educational justice."

Taken together, these six pillars provide a coherent lens to evaluate India's digital and AI-education reforms, revealing where technology is functioning as an equalising capability and where it risks becoming a new mechanism of exclusion.

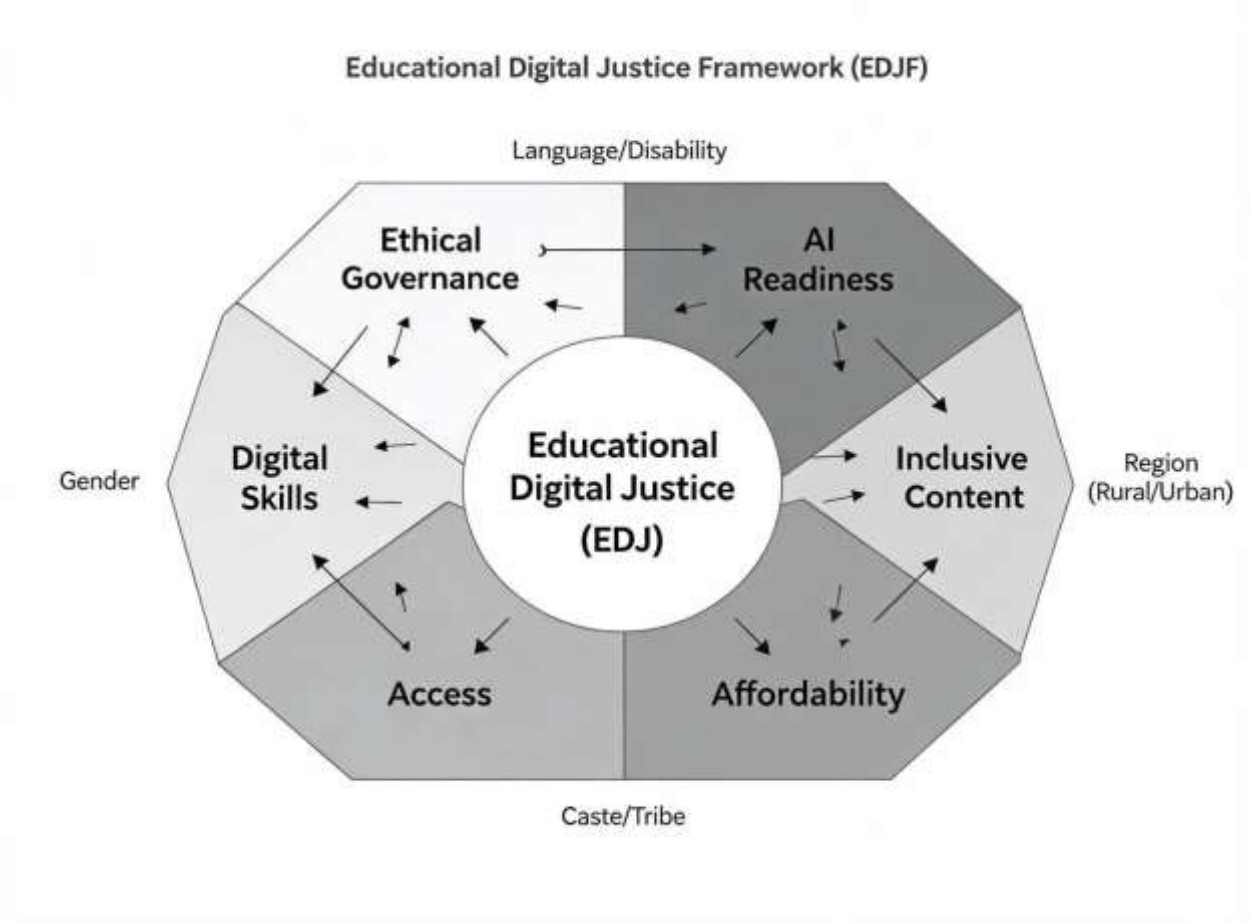


Fig:1 Conceptual model of the Educational Digital Justice Framework (EDJF) with six interdependent pillars

## Policy Recommendations

This section translates the Educational Digital Justice Framework into concrete policy directions for key actors—government, educational institutions, technology companies and international agencies—with a particular focus on broadband, affordability and AI governance. The aim is to move from platform-centric metrics (apps, enrolments, hours of content) to capability-centred outcomes for marginalised learners.

### Government: Universal Broadband and Rural Connectivity

National and state governments remain the primary stewards of the digital infrastructure on which all educational platforms, AI tools and private services depend. Global broadband commissions and UNESCO emphasise that equitable access to affordable,

high-quality broadband should be treated as a public good and a precondition for the right to education in the digital age.

**Key Recommendations**

Adopt and fund universal school-connectivity targets. Building on Broadband Commission targets and ITU advocacy, governments should enshrine in policy that all schools—especially government and rural schools—must reach a minimum broadband standard (e.g., sufficient for multiple simultaneous video streams) by specified dates, with ring-fenced funding and transparent progress reporting.

Prioritise last-mile rural and tribal connectivity. National broadband plans and Universal Service funds should explicitly target rural, tribal and conflict-affected regions, using a mix of fibre, satellite, community networks and innovative spectrum policies, rather than relying on market-driven rollout alone. This includes subsidised backhaul for rural schools and community learning centres, and incentives for local cooperatives or panchayats to run shared connectivity infrastructure.

Integrate broadband into education planning and financing. Following UNESCO's guidance, ministries of education should treat connectivity, devices and technical support as recurrent education expenditures, not one-off ICT projects, embedding them in school development plans and teacher-training budgets.

Scale public digital-literacy missions with an equity focus. Programmes like PMGDISHA and the National Digital Literacy Mission already aim to reach rural households with basic skills; these should be re-aligned with school and college curricula, prioritising girls, SC/ST/OBC youth and disabled learners, and including critical AI and data-literacy components.

## Educational Institutions: Curriculum, Capacity and Responsible AI Use

Schools, colleges and universities are where digital and AI policies become lived practice. UNESCO's AI-in-education guidance emphasises that teachers must remain central actors and that AI should support, not replace, human-centred pedagogy.

**Key Recommendations:**

Integrate digital and AI literacy across the curriculum. In line with NEP 2020's call for digital literacy, coding and computational thinking, institutions should embed progressive digital-skills and AI-literacy modules from upper primary onwards, focusing not only on tool use but also on data practices, bias, misinformation and ethical questions.

Invest in sustained teacher professional development. UNESCO and NCERT both stress that inclusive digital education depends on teachers' techno-pedagogical competencies. Institutions should provide ongoing, practice-based training on blended learning, accessible content creation, AI-supported assessment and classroom management, with time and incentives built into workloads rather than relying on voluntary or one-off workshops.

Develop institutional AI policies and inventories. Drawing on UNESCO's AI-governance guidance, institutions should catalogue all AI tools in use (tutors, proctoring, plagiarism detection, analytics) and adopt clear policies on acceptable uses, data handling, human oversight, and disclosure to students and parents. This includes banning high-risk uses (e.g., opaque behavioural profiling) and requiring human review of AI-generated assessment or recommendations.

Create inclusive digital-support structures on campus. Universities and colleges should maintain accessible computer labs, assistive-technology centres and student digital-help desks, with extended hours and targeted support for first-generation, rural and disabled students. Such structures operationalise EDJF pillars on access, skills and inclusive content at the institutional level.

### Technology Companies: Affordable, Inclusive and Accountable Design

Private EdTech firms, device manufacturers and AI developers are central actors in practice, shaping both hardware and software landscapes. Policy debates on digital inclusion and AI ethics increasingly stress that corporate actors bear responsibilities beyond basic compliance.

**Key Recommendations:**

Co-create affordable device ecosystems. Building on "Make in India" and similar initiatives, governments and firms should expand programmes that deliver low-cost, robust devices (including feature-rich basic phones, tablets and assistive devices) for students, with bundled educational data plans and strong repair ecosystems in rural and peri-urban areas. Public procurement can set affordability and repairability standards, while tax incentives can support open-hardware and local-manufacturing models.

Design for accessibility and multilingualism by default. Developers should adopt universal design principles, ensuring that platforms meet or exceed WCAG standards, work with screen-readers, support captioning and sign language, and function on low-bandwidth and low-spec devices. Multilingual interfaces and content—covering not just English and Hindi but a wide range of Indian languages—should be treated as baseline features, not premium add-ons, aligning with UNESCO's emphasis on linguistic diversity and local content.

Commit to algorithmic transparency and independent audits. EdTech and AI vendors should publish plain-language documentation of how their algorithms work, what data they collect and how they mitigate bias, conforming to UNESCO's AI-ethics recommendations on transparency, fairness and human oversight. Independent third-party audits for bias and disparate impact—especially regarding gender, caste, language and disability—should be prerequisites for large-scale adoption in public systems.

Prohibit exploitative data and business practices in education. Companies should commit not to monetise student data through targeted advertising or undisclosed third-party sharing, in line with UNESCO's and DPDPA's principles on data-minimisation and purpose limitation. Freemium models should be carefully designed so that essential learning features are available to all, and paywalls do not stratify educational opportunity.

### International Agencies: Funding, Partnerships and Norms

Multilateral organisations and international funders are influential in setting global norms and financing digital and AI initiatives in education. UNESCO, ITU, the Broadband Commission and the World Economic Forum all emphasise that cross-border collaboration is essential to close digital divides and govern AI responsibly.

**Key Recommendations**

Prioritise equity-centred financing for digital education. International agencies should channel grants and concessional finance towards projects that explicitly target marginalised learners and regions, such as rural connectivity for schools, community learning centres, and assistive-technology programmes, rather than primarily funding high-visibility pilots in already connected urban settings.

Support open, public digital infrastructure and resources. In line with UNESCO's promotion of open educational resources and public digital goods, funding should favour interoperable, open-source platforms and content that can be adapted by local actors, avoiding lock-in to proprietary ecosystems. This includes support for open-source AI models and tools tailored to low-resource languages and inclusive design.

Back capacity-building for AI governance. UNESCO's AI-ethics Recommendation and AI-in-education guidance call for extensive capacity-building for policymakers, regulators, educators and civil society on AI risks, regulation and human-rights impacts. International agencies can fund regional centres of excellence, training programmes and

peer-learning networks that help countries translate these standards into concrete regulatory frameworks, procurement guidelines and institutional policies.

Foster multi-stakeholder, Global South-led governance. Echoing UNESCO's emphasis on multi-stakeholder and adaptive governance, global bodies should ensure that teachers' unions, student groups, disability organisations, feminist and indigenous movements from the Global South have a seat at the table in shaping AI and digital-education norms. This includes supporting participatory research and co-design processes that feed into standard-setting, rather than relying solely on expert-driven or industry-led models.

**Cross-Cutting: Ethical AI in Education**

Across all actors, ethical AI in education should be anchored in existing international standards—particularly UNESCO's Recommendation on the Ethics of AI and its Guidance for Generative AI in education and research—which foreground human rights, fairness, data protection, transparency and human oversight. Concretely, this implies:

Treating AI tools as augmenting, not replacing, teachers and human relationships in education.

Mandating impact assessments and bias audits before deploying AI systems that influence grading, tracking or access to opportunities.

Setting clear age limits and usage conditions for generative-AI tools in classrooms, with age-appropriate safeguards and critical AI-literacy education for students.

Ensuring that no student is denied educational opportunities or subjected to punitive profiling solely on the basis of automated decision-making, in line with human-rights principles and data-protection norms.

If governments, institutions, companies and international agencies align their strategies with these justice-oriented recommendations—treating access, affordability, skills, inclusive content, ethical governance and AI readiness as co-equal priorities—India's digital

and AI-enabled education ecosystem can move closer to the Educational Digital Justice Framework and genuinely expand, rather than merely redistribute, educational opportunity.

## Conclusion

India's digital turn has already moved the country beyond the question of whether technology should be used in education; the unavoidable question now is on what terms, and for whose benefit. The COVID-19 experience, echoed globally, showed that simply shifting classes online left out hundreds of millions of learners who lacked devices, connectivity or safe learning spaces, with the poorest, rural and marginalised students most affected. International analyses now recognise that the right to education is increasingly intertwined with the right to meaningful connectivity, but they also warn that digitalisation introduces new risks around privacy, surveillance and unequal capabilities. In this context, the central challenge for the coming decade is no longer merely building digital infrastructure or expanding platform usage; it is ensuring digital educational justice—so that technology functions as a tool of empowerment rather than a fresh mechanism of exclusion.

A growing body of scholarship on digital equity and justice emphasises that fair access to digital infrastructure, capabilities and governance is essential for achieving the Sustainable Development Goals and preventing the "oppression of the disconnected." Justice-oriented frameworks argue that digital infrastructure must be accompanied by digital capabilities and inclusive governance if societies are to avoid reproducing inequality in the digital realm. Evidence from higher education systems across contexts similarly shows that behind the apparent openness of online courses lies deep inequality in students' ability to use them—driven by differences in devices, connectivity, quiet study spaces and digital literacy. These insights resonate powerfully in India, where national platforms like SWAYAM and DIKSHA coexist with stark rural–urban, gender, caste, tribal and linguistic divides in digital capital and educational opportunity.

Digital educational justice requires a fundamental shift in how success is measured. Instead of celebrating aggregate metrics—number of courses uploaded, sessions logged, or AI tools deployed—systems must ask whether marginalised learners are gaining real capabilities: to access and afford connectivity, to exercise agency in digital spaces, to learn in their own languages, to be represented fairly in algorithms and data, and to participate meaningfully in decisions about how technology is used in their education. UNESCO's recent calls for "appropriate technology use" and human-centred digital transformation insist that technology should serve pedagogical and social goals, not dictate them, and that governments must set clear benchmarks and governance frameworks aligned with equity and human rights. This implies that India's digital education agenda must be judged by its contribution to reducing learning gaps and expanding the capabilities of rural girls, tribal students, disabled learners and linguistic minorities, rather than by platform scale alone.

The Educational Digital Justice Framework proposed in this chapter provides one way to operationalise this shift. By organising policy and practice around six pillars—access, affordability, digital skills, inclusive content, ethical governance and AI readiness—it translates abstract commitments to equity into concrete, assessable conditions for just digital education. Its emphasis on affordability and AI readiness, alongside more familiar concerns about infrastructure and skills, reflects lessons from global frameworks and Indian experience: that high data costs, paywalled EdTech ecosystems and unregulated AI deployments can quickly turn "access" into a new form of stratification. Its focus on inclusive content and ethical governance responds to warnings that digital learning, if dominated by a narrow band of languages, epistemologies and corporate interests, can deepen cultural marginalisation and subject learners to opaque data practices and algorithmic profiling.

Crucially, digital educational justice is not a technocratic optimisation problem but a political and ethical project. It demands decisions about resource allocation (which regions

and groups are prioritised for connectivity and devices), about curriculum and language (whose knowledge is digitised and in what tongues), and about power and accountability (who designs, audits and governs AI systems in education). International declarations on connectivity and AI ethics underline that technology must be aligned with principles of justice, equity and respect for human rights, and that countries must set their own terms for digital transformation rather than passively adopting market-driven models. For India, this means centring the voices of students, teachers and communities who have experienced digital exclusion, and treating their experiences not as implementation glitches but as core evidence about what justice requires.

If these insights are taken seriously, the future of digital education in India—and in other unequal societies—will be judged by whether it narrows or widens the distance between privileged and marginalised learners. Universal broadband and AI-enhanced platforms will be necessary but insufficient; what will matter is whether rural girls can study without sacrificing safety, whether tribal students can learn in their languages with culturally relevant content, whether disabled learners can access materials in formats that respect their rights, and whether linguistic and social minorities are represented fairly in digital curricula and algorithms. In that sense, the next phase of policy and research must focus less on digitising education and more on democratising the digital within education.

The argument of this chapter is therefore simple but far-reaching: digital access is the starting line, not the finish line. Without deliberate attention to justice—understood as equitable access, capabilities, recognition and governance—technology will continue to mirror and magnify the inequalities it encounters. With such attention, however, digital tools can become part of a broader project of educational transformation, enabling new forms of participation, solidarity and knowledge creation that were previously difficult to imagine. The task ahead is to ensure that India's impressive digital infrastructure and AI innovation are

harnessed not merely to modernise schooling, but to realise digital educational justice for those who have historically been left at the margins.

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