Ultimate Guide to Build

DIGITAL EQUITY IN EDUCATION

Bridging Learning Gaps in the Post-Pandemic Era

Dr. Amit Kumar Bhandari (Editor)

Digital Equity in Education

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Preface

The question of digital equity has moved from the margins of educational debate to its very centre. The COVID-19 pandemic did not create inequalities in education, but it exposed them with an intensity that could no longer be ignored. As classrooms shifted online and learning became mediated through screens, devices, and connectivity, deep structural divides surfaced across regions, institutions, and social groups. Access to technology emerged as a prerequisite for participation in education, while unequal access translated directly into unequal learning opportunities. In this context, digital equity is no longer a technical concern. It is a moral, social, and policy imperative.

This edited volume, *Digital Equity in Education: Bridging Learning Gaps in the Post-Pandemic Era*, is conceived as a critical response to these challenges. It brings together scholars, educators, and policy-oriented thinkers to examine how digital technologies intersect with questions of access, inclusion, justice, and educational quality in India. Rather than treating technology as a neutral solution, the volume interrogates the conditions under which digital tools can either widen or bridge learning gaps. It foregrounds the Indian context, where diversity of geography, language, socio-economic status, gender, and caste shapes the lived realities of learners and teachers.

The first theme rethinks digital equity beyond the narrow lens of access. The chapters question device-centric narratives and propose broader frameworks that account for pedagogy, policy, and learners' rights. Attention is given to rural and tribal education systems, as well as to the post-pandemic restructuring of learning environments. By situating digital rights within educational rights, this section lays the conceptual foundation for the volume.

The second theme deepens the discussion by linking technology with inclusion and social justice. The contributions examine how digital pedagogies can support marginalized learners, while also revealing the ways gender, caste, and class

continue to shape digital participation. Ethical concerns surrounding invisible inequities, data practices, and exclusionary design are critically analysed, reminding readers that inclusion requires sustained reflection and accountability.

The third theme focuses on capacity building and competence. It highlights teacher digital competence as central to educational equity and explores strategies for strengthening digital readiness in government and low-income schools. Community-based models of digital empowerment offer grounded insights, while discussions on digital literacy align closely with the vision of lifelong learning articulated in the National Education Policy 2020.

The final theme looks ahead. It engages with emerging innovations, policy frameworks, and future possibilities for equitable learning. From inclusive EdTech ecosystems to the implications of artificial intelligence and big data, the chapters encourage readers to think beyond immediate crises. The concluding discussions imagine classrooms of the future where technology supports, rather than substitutes, humane and inclusive education.

As editor, we hope this volume will serve as a reflective resource for academicians, researchers, teacher educators, policymakers, and practitioners. It seeks to contribute not only to scholarly discourse but also to informed action. Digital equity is not a destination but an ongoing process that demands collective responsibility. This book is an invitation to engage critically with that process and to work towards an educational future where no learner is left behind.

Editor

About the Editor

Dr. Amit Kumar Bhandari is an economist and academician with a PhD in Economics from the University of Kalyani. Currently serving as an Associate Professor at Rishi Bankim Chandra College (Evening), West Bengal State University, he also holds the position of Research Fellow at the Institute for the Study of Labour (IZA), University of Bonn, Germany. He has previously served as a Lecturer in Economics at the Indian Institute of Social Welfare and Business Management. Dr. Bhandari specializes in Development Economics, Financial Engineering, Labour Studies, and Applied Econometric Analysis. His extensive teaching experience spans Behavioural Economics, Environmental Economics, and Gender Studies. Dr. Bhandari has a rich publication record, with research interests in labour economics, education, health behaviours, inequality, and public economics. He has authored and co-authored several books, including *Microfinance, Risk-taking Behaviour and Rural Livelihood* (Springer, 2013) and *Women's Entrepreneurship and Microfinance* (Springer, 2017). His recent works focus on EdTech, vocational education, and digital transformations in business. With numerous journal publications in esteemed outlets like *Renewable Energy* and *Global Economic Review*, Dr. Bhandari has also contributed to policy research, securing grants from ICSSR and UGC. His consultancy roles include work with CAPART, Government of India.

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Beyond Access: A New Framework for Digital Equity in Indian Schools

Sukumar De

Abstract

The rapid digitisation of schooling in India, accelerated by the COVID-19 pandemic, has fundamentally altered the terrain of educational equity. While substantial progress has been made in expanding access to devices, connectivity, and digital platforms, persistent learning gaps reveal the limits of access-driven approaches. This chapter argues that digital equity must be reconceptualised as a multidimensional and systemic challenge shaped by social context, pedagogical practice, and governance structures. Drawing on post-pandemic trends and Indian educational realities, the chapter examines how home learning conditions, social capital, teacher capacity, platform design, language, and federal governance mediate the impact of digital initiatives. It highlights professional inequality among teachers, uneven platform effectiveness across regions, and the tension between national policy vision and local implementation. The analysis demonstrates that technology becomes transformative only when embedded within supportive learning environments, culturally and linguistically relevant content, and sustained institutional capacity. By proposing a future-oriented framework that integrates infrastructure with human and institutional development, the chapter contributes to broader debates on digital equity and learning recovery. It offers policy-relevant insights for building inclusive, resilient, and context-sensitive digital education systems in India's post-pandemic landscape.

Keywords: *Digital equity; Indian school education; Teacher capacity; Platform governance; Post-pandemic learning*

1. Introduction

The landscape of schooling in India has undergone dramatic shifts over the past decade, but nothing challenged the assumptions of educators, policymakers, and families quite like the COVID-19 pandemic. In a matter of days, classrooms closed, and formal learning shifted online, exposing stark gaps not only in physical infrastructure but also in access to meaningful digital learning. What began as an emergency response revealed deeper structural problems: millions of students lacked reliable devices, affordable connectivity, or quiet spaces to learn. Teachers, often with limited training in digital pedagogies, were asked to reinvent their practice overnight. The pandemic did not create digital inequity in Indian schools, but it amplified longstanding disparities and forced the education system to confront what equity really means in a digital age.

At the national level, the expansion of broadband connectivity and proliferation of low-cost smartphones suggested that India was on the path to narrowing the digital divide. Yet, connectivity statistics mask a more complex reality on the ground. In rural districts, intermittent power supply and weak network signals still undermine consistent learning. In urban low-income neighborhoods, shared devices and crowded homes make focused study difficult. Across states, the uneven distribution of resources and capacity means that two students with ostensibly similar access may experience digital learning very differently. The pandemic made it clear that "access" cannot be reduced to numbers of devices or subscription plans; equitable digital learning depends on the conditions in which students actually engage with technology.

Beyond infrastructure, the emergency shift to online platforms highlighted gaps in readiness and support. Many teachers embraced digital tools with creativity and resilience, but too often without systematic professional development or institutional encouragement. In some districts, innovative blended learning

models emerged, drawing on community radio, local language content, and peer support networks. In others, digital initiatives struggled to take root because teachers were unfamiliar with platform features or lacked confidence in integrating them with pedagogy. These variations underscore that digital equity is as much about human capacity and support systems as it is about hardware.

Indian students themselves experienced the digital transition unevenly. For children in affluent urban schools, online classes, interactive platforms, and digital assessments became part of everyday learning. For others, particularly girls and students from marginalized communities, the demands of household chores, caregiving responsibilities, and safety concerns often took precedence over schoolwork, compounding the barriers to sustained engagement. The focus on access to devices and connectivity during the pandemic, while necessary, obscured these lived realities and the deeper social factors that shape participation in digital learning.

This chapter argues that moving beyond access is essential to achieving genuine digital equity in Indian schools. Access is a starting point, not an endpoint. True equity requires asking tougher questions about what learning looks like when mediated by technology, who benefits from current digital policies, and how systemic inequalities intersect with digital opportunities. By reframing the conversation to include conditions of learning, teacher agency, content relevance, and governance, we can begin to envision a framework that supports not just access to technology, but equitable and meaningful use of digital tools for all learners.

2. Equity Beyond Devices

Access to digital devices and internet connectivity is only the most visible layer of digital equity. The experience of school closures during and after the pandemic demonstrated that learning is deeply

shaped by the conditions in which technology is used. For many Indian students, particularly those from low-income or rural households, a smartphone or tablet is shared among multiple family members and used intermittently. Limited electricity supply, unstable network connectivity, and the absence of a quiet space to study reduce the effectiveness of digital learning, even when devices are technically available. These everyday constraints explain why equal access does not produce equal educational outcomes.

Home environments play a decisive role in mediating digital learning. Students from households with educated caregivers or digitally literate adults are better positioned to navigate online platforms, follow schedules, and seek additional learning resources. In contrast, children from families with limited literacy or unfamiliarity with digital tools often struggle to sustain engagement. Language further compounds this challenge. A significant proportion of digital content remains oriented toward English or dominant regional languages, marginalising learners who rely on local dialects or minority languages. As a result, digital platforms that are uniform in design generate unequal learning experiences across social groups.

Gender norms within households also shape patterns of digital participation. Evidence from post-pandemic assessments indicates that boys are more likely to have uninterrupted access to devices, while girls frequently face restrictions linked to household responsibilities, safety concerns, or norms governing technology use. These constraints reduce not only instructional time but also opportunities for developing independent digital skills. Over time, such patterns reinforce gendered inequalities in confidence, competence, and future educational pathways, even when enrolment figures remain stable.

The relationship between home conditions and learning outcomes became especially visible during the recovery phase following

prolonged school closures. Students with stable routines, parental support, and access to supplementary learning materials demonstrated quicker academic recovery. Others, particularly those lacking structured home learning environments, experienced persistent learning gaps. This divergence highlights a critical limitation of device-centred interventions: without addressing the social and domestic context of learning, digital initiatives risk reproducing existing inequalities rather than reducing them.

Social capital functions as an important counterbalance to constrained home environments. Where teachers maintained regular contact with families, adapted materials to local contexts, and combined digital tools with low-tech solutions, students were more likely to remain engaged. Community-based responses such as shared learning spaces, local tutoring groups, radio lessons, and blended models that combine online and offline support helped mitigate some disadvantages. These examples demonstrate that learning ecosystems extend beyond the household and that collective support structures are central to digital equity.

Recent national-level data underline this disconnect between access and effective use. While internet penetration and mobile connectivity have expanded rapidly, disparities persist in how households experience and benefit from digital infrastructure.

Indicator	**Recent approximate value**
Total internet users in India	Over 750 million
Villages with mobile network coverage	Over 95 percent
Urban households with internet access	Around 90 percent
Rural households with internet access	Around 80 percent
Youth reporting regular personal smartphone access	Roughly two thirds, with lower access among girls

These figures suggest that India has made significant progress in expanding digital reach. Yet they also reveal why access alone is an insufficient measure of equity. Reliable learning depends on

time, space, support, and confidence—resources unevenly distributed across households and communities. Any meaningful framework for digital equity must therefore shift attention from devices to learning conditions, recognising that technology becomes transformative only when embedded within supportive social and domestic environments.

3. Teachers at the Centre

Teachers occupy a pivotal position in shaping how digital technologies are translated into classroom practice. The rapid expansion of online and blended learning during the pandemic revealed wide variations in teachers' digital capacity across regions, school systems, and levels of schooling. While many teachers demonstrated adaptability and commitment, the unevenness of preparedness highlighted a deeper issue: digital competence had not been systematically embedded within teacher education or in-service professional development. As a result, technology was often layered onto existing pedagogical routines rather than used to reimagine teaching and learning in more inclusive ways.

Digital capacity extends well beyond basic operational skills. It encompasses the ability to design interactive learning experiences, adapt content for diverse learners, assess progress in digital environments, and make informed choices about when technology adds value. In recent years, national and state-level platforms have expanded access to digital teaching resources and training modules, reaching millions of teachers. However, participation data suggest that completion rates and sustained classroom application vary significantly. Short, self-paced courses often improve familiarity with tools but have limited impact on instructional change unless reinforced through mentoring, collaborative practice, and institutional follow-up.

Professional inequality among teachers has become a defining feature of the digital transition. Teachers in urban or well-resourced private and government schools are more likely to have personal laptops, stable internet connections, and supportive peer networks. In contrast, many teachers in rural and remote areas continue to rely on smartphones with limited data plans and unstable connectivity. These differences shape not only access to professional learning but also confidence and experimentation in the classroom. Where teachers face infrastructural constraints and heavy administrative workloads, digital innovation is perceived as an added burden rather than a professional opportunity.

Policy initiatives have increasingly recognised the centrality of teachers in digital reform, yet implementation remains uneven. Large-scale digital platforms have standardised curricular content and lesson plans, offering consistency and scale. At the same time, overly centralised designs risk narrowing pedagogical choice and reducing teacher agency. Evidence from school-level implementation shows that when teachers are treated as co-creators—encouraged to adapt materials, translate content into local languages, and share practices within professional communities—digital tools are more likely to support inclusive learning. Conversely, prescriptive models that position teachers as passive users often lead to superficial adoption and limited student engagement.

Assessment practices present another area where teacher capacity directly affects equity. Many teachers reported difficulty in tracking student learning during remote and blended instruction, particularly for students with irregular attendance or limited connectivity. Where teachers received support in using formative digital assessments, analysing learner data, and designing targeted remediation, learning recovery efforts were more effective. This underscores the importance of integrating assessment literacy into

digital professional development rather than treating it as a separate technical skill.

4. Platforms, Content, and Language

Digital platforms now occupy a central role in school education. They deliver lessons, host assessments, and shape daily interactions between teachers and learners. In India, a mix of national platforms, state initiatives, and private edtech firms has created a dense ecosystem. This diversity has accelerated content availability. At the same time it has raised important questions about who sets curricular priorities and for whom these priorities serve.

Progress is visible. The proportion of schools equipped with computers and internet connections has risen substantially in recent years. More students can reach video lessons, interactive exercises, and supplementary materials outside school hours. Major private platforms have scaled rapidly and now reach millions of learners. State portals and national repositories have expanded resources in multiple subjects. Growth in regional-language content has also been notable, responding to the linguistic realities of India's classrooms.

Yet these gains conceal persistent tensions. Platform growth has not uniformly translated into pedagogical improvement. Many platforms favour content delivery designs that assume continuous, stable connectivity and the presence of individual devices. Such designs work reasonably well in well-resourced urban schools. They struggle in contexts where connectivity is intermittent, devices are shared, or household supports are weak. As a result, platform reach can be superficially broad while the depth of learning remains uneven across contexts.

Language is a critical axis of inclusion and exclusion. The recent surge in Indic-language internet use has altered the demand landscape. Learners increasingly expect and prefer materials in regional languages. Several platforms and state initiatives have

responded by producing multilingual content. Still, the quality and depth of regional-language resources vary considerably. Translation alone is not enough. Content must be culturally and pedagogically adapted to local contexts. Where adaptation is shallow, learners receive material that is linguistically accessible but pedagogically ill-fitting.

Commercial logics influence platform design and content priorities. Private providers often emphasise scalable video lessons, practice engines, and algorithmic personalisation. These features can improve engagement and provide useful diagnostics. They can also channel attention toward measurable short-term gains, such as test preparation, at the expense of broader curricular aims. Market-driven models may under-invest in costly activities like localisation, teacher co-creation, and long-term community engagement, which are essential for equitable learning but less attractive to short-term monetisation strategies.

Platform governance presents another governance challenge. Decisions about data collection, learner privacy, and content moderation are shaped by a mixture of institutional norms and commercial incentives. Many schools and districts lack clear policies on student data handling. Teachers often remain uncertain about how platform analytics should inform instruction. Without robust governance frameworks, the potential benefits of learning analytics and personalised pathways can be undermined by risks to privacy and professional autonomy.

There are promising hybrid models that suggest a way forward. Initiatives that position teachers as co-designers of content produce richer classroom fit. When platforms offer modular resources that teachers can adapt and recombine, they support local creativity. Blended models that combine offline materials, low-bandwidth formats, and community-supported learning help bridge urban–rural divides. Collaborative partnerships between public

institutions and mission-driven edtech providers can scale quality resources without relinquishing public control over curricular aims.

Finally, equitable design requires intentional policy choices. Expanding infrastructure and platform access is necessary but insufficient. Policies must prioritise multilingual content production, incentives for localisation, teacher-led content development, and transparent data governance. Financing models should reward long-term pedagogical investment rather than short-term user growth. Only by aligning platform incentives with the public purpose of schooling can digital tools contribute to inclusive learning at scale.

5. Policy, Governance, and Federal Realities

Digital equity in Indian school education is shaped as much by governance arrangements as by technology itself. Over the past decade, national policy has articulated an ambitious vision that links digital infrastructure, teacher capacity, and learner outcomes. This vision gained momentum during the pandemic, when central and state governments mobilised digital platforms, broadcast media, and emergency funding at unprecedented scale. The speed of response demonstrated institutional capacity. It also revealed the structural limits of centrally driven solutions in a federal education system marked by sharp regional variation.

India's federal structure creates a complex implementation landscape. Education is a shared responsibility, and states differ widely in fiscal capacity, administrative strength, and digital readiness. Some states have invested consistently in school connectivity, teacher training, and digital content ecosystems. Others continue to struggle with basic infrastructure and staffing gaps. These differences mean that uniform national initiatives often produce uneven outcomes. A platform that functions effectively in one state may remain underutilised in another due to connectivity

constraints, language barriers, or limited institutional follow-through.

Financing mechanisms play a decisive role in shaping these outcomes. Large capital investments in hardware and connectivity have expanded reach, but recurring expenditures receive less attention. Maintenance costs, device replacement cycles, data subsidies, and teacher support systems are frequently underfunded. Evidence from state audits and implementation reviews indicates that schools often receive equipment without long-term service plans, leading to rapid deterioration and reduced use. Sustainable digital equity requires predictable, multi-year financing models that account for operational realities rather than one-time procurement.

Governance capacity at the district and school level is another critical variable. District officials and school leaders serve as intermediaries between policy intent and classroom practice. Where leadership is stable and administrative roles are clearly defined, digital initiatives are more likely to be integrated into school routines. In contrast, high turnover, limited training in digital governance, and overlapping reporting requirements weaken implementation. Empirical observations from school system reviews show that the same policy framework can produce markedly different results depending on local leadership capacity and coordination.

Public–private partnerships have expanded rapidly in the digital education space. These collaborations have enabled scale, innovation, and speed, particularly in content delivery and platform development. At the same time, they raise questions about accountability, data ownership, and alignment with public educational goals. Without clear governance frameworks, partnerships risk privileging efficiency over equity. Emerging evidence suggests that partnerships are most effective when states retain curricular control, establish clear data safeguards, and embed independent evaluation mechanisms.

Data-driven governance is an emerging area with both promise and risk. Digital platforms generate large volumes of information on attendance, engagement, and assessment. In theory, such data can support targeted interventions and resource allocation. In practice, many systems lack the analytical capacity to translate data into action. Teachers and administrators often face dashboards without guidance on interpretation. Strengthening data literacy across governance levels is therefore essential if digital systems are to support equity rather than simply monitor compliance.

The experience of post-pandemic recovery offers a critical lesson. States that combined national guidance with local adaptation—blending digital tools with community-based outreach and school-level autonomy—showed stronger learning recovery trends. Those that relied primarily on centralised digital delivery struggled to reach the most marginalised learners. This pattern underscores the importance of subsidiarity: decisions should be taken as close as possible to the learners they affect, within a coherent national framework.

Aligning national vision with local implementation requires a recalibration of governance priorities. Policy must move beyond scale as the primary indicator of success. Greater attention is needed to institutional capacity, fiscal sustainability, and contextual adaptation. Digital equity will not be achieved through uniform solutions alone. It depends on governance systems that are flexible, accountable, and responsive to India's social and regional diversity.

6. Conclusion

This chapter has argued that digital equity in Indian schools cannot be reduced to questions of access alone. The post-pandemic expansion of devices, platforms, and connectivity has been significant, yet the evidence across sections points to a deeper reality: inequity persists through learning conditions, home environments, teacher capacity, content design, and governance

structures. Technology, when detached from these contexts, risks reinforcing the very divides it seeks to bridge.

By shifting attention beyond hardware, the chapter highlights how social capital, linguistic inclusion, and pedagogical agency shape students' digital learning experiences. Teachers emerge as central actors whose professional preparation, autonomy, and working conditions determine whether digital tools support meaningful learning. Similarly, platforms and content are shown to be value-laden spaces, where design choices influence who participates, who benefits, and whose knowledge is legitimised. Governance and policy frameworks, particularly within India's federal system, further mediate how national ambitions translate into classroom realities.

The core contribution of this chapter lies in reframing digital equity as a systemic and relational challenge rather than a technical one. It calls for a future-oriented framework that integrates infrastructure with sustained teacher development, locally relevant content, ethical platform governance, and responsive policy design. Such a framework aligns closely with the broader aim of this volume: to rethink digital equity in ways that address learning gaps while remaining attentive to social justice, diversity, and long-term educational transformation.

Looking ahead, the pursuit of digital equity in Indian schooling demands adaptive governance, investment in human capacity, and a renewed commitment to contextual relevance. The next phase of digital reform must move from expansion to consolidation, from access to agency, and from uniform solutions to inclusive systems. Only then can digital technologies fulfil their promise as instruments of educational equity in the post-pandemic era.

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Post-Pandemic Realities: How Digital Inequalities Reshaped Learning

Dr. Indranil Ghoshal

Abstract

The COVID-19 pandemic marked a critical turning point in India's educational landscape, accelerating the integration of digital technologies while simultaneously exposing deep-seated inequalities. This chapter examines how post-pandemic learning realities have been reshaped by uneven access to connectivity, devices, and institutional capacity. It argues that digital inequality in India extends beyond infrastructure to encompass pedagogy, teacher preparedness, learner agency, and wellbeing. Drawing on national trends, policy responses, and classroom-level experiences, the chapter demonstrates how differential access translated into divergent learning trajectories, with learners at the margins experiencing greater disruption and slower recovery. It also analyses how digital platforms and emergency policies, though effective in ensuring continuity at scale, produced uneven outcomes due to variations in implementation and contextual readiness. The chapter highlights the adaptive responses of teachers and institutions while critically assessing their limitations. It concludes by proposing a shift from access-driven models of digital inclusion toward holistic frameworks that integrate pedagogical quality, psychosocial support, and institutional governance.

Keywords: *Digital inequality; Post-pandemic education; Learning equity; Indian education system; Digital pedagogy*

1. Introduction

The COVID-19 pandemic did more than disrupt schooling for a brief period. It triggered an abrupt and comprehensive shift in how education is delivered, accessed and imagined. When classrooms closed in early 2020, millions of learners and educators in India were pushed toward online modes of teaching and learning with little preparation. What was initially framed as a temporary emergency response soon became a defining moment for the future of education. In the process, digital inequalities that had long existed beneath the surface of classroom walls were exposed in stark relief and, in many cases, widened significantly. This chapter begins with an examination of that post-pandemic reality and its implications for learning equity and inclusion.

At the height of pandemic closures, digital tools and platforms became the backbone of continuity in education. From nationally launched apps and televised lessons to social media groups and WhatsApp broadcasts, educators deployed a range of strategies to reach students. But the experience of this transition was far from uniform. For families with access to high-speed internet, personal devices and a quiet space to study, remote learning became a workable, if imperfect, alternative to in-person instruction. For many others, especially in rural areas and low-income communities, the promise of digital learning was seldom realized in practice. Only a fraction of Indian households had reliable internet access, and even fewer students had dedicated devices at home, making participation in synchronous online classes difficult if not impossible for large sections of the student population. These disparities mirrored and magnified existing socioeconomic inequalities, reinforcing a divide that could no longer be ignored in policy and practice.

Across states and districts, the uneven rollout of digital infrastructure and resources created differentiated learning experiences. While some schools and regions innovated rapidly,

others struggled with basic connectivity and digital readiness. In parts of Haryana and other states, government data show that government schools lag substantially behind private counterparts in terms of desktop availability and access to digital teaching tools, underlining how resource gaps intersect with institutional types. Elsewhere, urban schools often had better access to broadband and technical support, leaving rural learners at a continuing disadvantage. There were pockets of promising adaptation, such as digital hubs being set up in remote districts to provide offline educational content and solar-powered infrastructure for uninterrupted access, yet these remained exceptions rather than norms.

More importantly, the crisis revealed that digital inequality is not merely about devices and bandwidth. It encompasses disparities in digital skills among teachers, students and parents; variations in pedagogical readiness to integrate technology meaningfully; and broader questions about equitable opportunities to learn. Teachers in many contexts were asked to become instructional designers for online environments overnight, without systematic training or support. Students from underprivileged backgrounds navigated remote learning with limited guidance and often competing responsibilities at home. These experiences shaped not only what learning looked like during the pandemic but also how learners and educators now perceive the role of technology in education moving forward.

The post-pandemic period, therefore, offers a unique vantage point to reflect on how digital inequalities have reshaped learning realities in India. It invites us to look beyond access statistics and toward the lived experiences of learners and educators in diverse contexts. This chapter engages with these dynamics analytically, mapping the contours of digital inequality, interpreting how it has influenced learning outcomes and engagement, and suggesting pathways for rethinking digital equity in policy and practice. As

India continues to invest in digital education initiatives, it is essential to foreground not just technological expansion but the deeper structural and pedagogical dimensions of equitable learning.

2. The Unequal Digital Classroom: Access, Devices, and Connectivity

The rapid turn to online learning during the pandemic revealed that access to digital infrastructure in India is both expansive and uneven. By the early 2020s, the country had witnessed a sharp rise in internet users, driven largely by mobile connectivity and affordable data plans. Yet penetration levels remained uneven across regions and social groups. For many learners, especially in rural areas and urban informal settlements, connectivity was fragile, inconsistent, or shared among multiple users. As a result, digital participation often depended less on national averages and more on local conditions and household resources.

Connectivity coverage at the village level presents a similarly mixed picture. While most villages report some form of mobile network availability, the quality of service varies widely. Weak signals, frequent disruptions, and limited bandwidth constrained the feasibility of live online classes. In many locations, students relied on asynchronous materials sent via messaging platforms rather than interactive instruction. This reliance reduced opportunities for feedback, discussion, and sustained engagement, altering the nature of classroom interaction in ways that disproportionately affected already disadvantaged learners.

Device access emerged as the most immediate barrier to participation. A significant proportion of students did not own a personal digital device suitable for learning. Smartphones, where available, were commonly shared within households among siblings or with working adults, limiting study time and continuity. Larger devices such as laptops or tablets were far less common in low-income homes. This meant that participation in online classes

was often irregular, with students logging in sporadically or relying on recorded content that could be accessed at off-peak hours.

Affordability compounded these access challenges. Even where devices were distributed through government or institutional initiatives, recurring costs such as data recharges, repairs, and electricity created obstacles to sustained use. For families facing income insecurity during and after the pandemic, educational data usage competed with other essential expenditures. In several regions, initial gains from device distribution schemes weakened over time as support systems for maintenance and connectivity proved difficult to sustain.

These disparities had clear implications for learning continuity and outcomes. Students with stable internet access and personal devices were able to maintain instructional routines, interact regularly with teachers, and access supplementary resources. Others experienced fragmented learning, long periods of disengagement, or complete exclusion from formal instruction. Evidence from school assessments and state-level reviews indicates that learning losses during this period were deeper and more persistent among students facing digital access constraints, particularly at the foundational stage.

The scale of these inequalities can be illustrated through indicative national patterns observed during and after the pandemic:

Indicator	**Approximate national pattern**
Share of population with internet access	Slightly above half
Villages with basic mobile connectivity	Over nine-tenths
Students with regular access to a personal learning device	Roughly one-third
Households relying on shared devices for learning	A clear majority among low-income groups

Taken together, these patterns underscore that digital inequality in India is not defined solely by the presence or absence of connectivity. It is shaped by the quality, affordability, and usability of digital resources within everyday learning environments. Access, devices, and connectivity form the visible layer of inequality, but they also set the conditions under which deeper pedagogical and experiential divides emerge. The following section examines how these structural gaps influenced teaching practices and learning processes in the post-pandemic classroom.

3. Pedagogy in Transition

The shift to digital and hybrid modes of education fundamentally altered pedagogical routines in Indian classrooms. What began as an emergency response soon evolved into a prolonged experiment in remote teaching, compelling educators to rethink how learning is organized, delivered, and evaluated. Teachers were required to adapt lesson plans originally designed for physical classrooms to digital spaces marked by limited interaction, uneven student presence, and varying degrees of technological reliability. This transition highlighted that pedagogy, rather than technology alone, determines the quality of learning in digital environments.

Teacher preparedness emerged as a central determinant of pedagogical effectiveness. In the post-pandemic period, a large number of educators reported increased familiarity with digital tools, virtual classrooms, and online resources. National and state initiatives expanded access to online training modules, webinars, and digital repositories, contributing to a visible improvement in basic digital competence. However, the ability to operate platforms did not always translate into effective digital pedagogy. Many teachers struggled to redesign lessons for student interaction, inquiry, and feedback, especially in contexts where connectivity constraints limited real-time engagement. As a result, instructional practices in many settings remained teacher-centred and content-heavy.

Digital platforms increasingly shaped classroom practices and learning expectations. Learning management systems, national portals, and widely used messaging applications became central to curriculum delivery and communication. These platforms offered scalability and multilingual access, allowing teachers to reach students across geographical and institutional boundaries. At the same time, platform-driven instruction often prioritised standardised content and uniform pacing, reducing flexibility for local adaptation. For learners with limited access or shared devices, platform dependence sometimes narrowed learning to passive consumption rather than active participation.

Assessment practices also underwent significant change. The disruption of conventional examinations created space for alternative forms of evaluation, including online quizzes, project-based tasks, and continuous assessment. In classrooms where teachers were able to use digital tools creatively, assessment became more formative and responsive, enabling timely feedback and targeted support. Elsewhere, concerns about academic integrity and technical limitations led to simplified assessment formats that captured only surface-level learning. These uneven practices influenced how students engaged with learning tasks and how progress was monitored during recovery phases.

The transition to digital pedagogy further exposed structural inequalities within the teaching workforce. Teachers in well-resourced schools and urban institutions had greater access to devices, technical support, and peer networks, enabling experimentation and pedagogical innovation. In contrast, educators in under-resourced and rural settings often navigated digital teaching in isolation, with limited guidance and infrastructural support. This divergence contributed to uneven learning experiences across regions and school systems, reinforcing patterns of educational inequality.

In the post-pandemic context, pedagogy stands at a crossroads. Digital tools have expanded the possibilities for differentiated instruction, collaborative learning, and flexible assessment. Yet these possibilities remain unevenly realised without sustained investment in teacher professional development, curricular redesign, and institutional support. Rethinking pedagogy in the digital age requires recognising teachers as critical agents of change and ensuring that platforms serve pedagogical goals rather than dictate them. The way these transitions are managed will shape whether digital learning becomes a vehicle for equity or another layer of educational stratification.

4. Learners at the Margins

The pandemic reshaped the everyday learning conditions of millions of Indian students, with particularly deep consequences for those already at the margins. School closures shifted learning from structured classroom environments to homes marked by unequal resources and competing demands. For many learners, this transition reduced regular interaction with teachers and peers, weakening the sense of academic belonging. While a section of students adapted to self-directed and digitally mediated learning, others experienced declining motivation, fragmented engagement, and prolonged disengagement from formal instruction.

Recent national assessments indicate that learning recovery has been uneven. By 2022, average reading and numeracy levels showed signs of improvement in several states, yet children from economically disadvantaged backgrounds continued to lag behind pre-pandemic benchmarks. The gaps were most visible at the foundational stage, where early learning disruptions had lasting effects. Administrative data also point to modest overall enrolment recovery, alongside localized increases in irregular attendance and dropout, particularly in regions affected by migration and income loss. These trends suggest that access to schooling alone does not ensure effective re-engagement with learning.

Digital exclusion intensified less visible forms of marginalization. During the pandemic, only a minority of students had consistent access to personal digital devices and stable internet connections. In households without such access, learning often relied on shared phones, printed worksheets, or intermittent online sessions. These arrangements limited interaction and feedback, reducing students' ability to ask questions, clarify doubts, or participate actively. As a result, students at the margins were more likely to experience learning as a solitary and discontinuous process.

Social and gender dynamics within households further shaped learner agency. When devices were scarce, priority often went to older students, male children, or family members engaged in paid work. Many girls assumed increased domestic responsibilities, which reduced study time and continuity. First-generation learners faced additional barriers due to limited academic support at home. These patterns reveal how digital inequality intersects with entrenched social structures, producing layered exclusions that are not captured by connectivity indicators alone.

The pandemic also brought learner wellbeing into sharp focus. Surveys conducted during and after school closures reported increased levels of stress, anxiety, and emotional fatigue among children and adolescents. Prolonged isolation, uncertainty around examinations, and reduced peer interaction affected concentration and engagement. For many learners, emotional distress became a barrier to academic recovery. This underscores the need to view wellbeing not as a peripheral concern but as a central dimension of learning equity in the post-pandemic context.

Students with disabilities and those from linguistically diverse backgrounds encountered additional challenges. Remote learning environments rarely accommodated individualized support at scale, disrupting therapies and specialized instruction. Digital content was often unavailable in local or minority languages, limiting comprehension and participation. These learners faced cumulative

disadvantages, as instructional gaps compounded over time without targeted intervention.

The post-pandemic phase has also seen a risk of permanent disengagement for some learners. Economic pressures pushed a section of children into work or domestic responsibilities, particularly in communities affected by livelihood loss. Reconnecting these learners requires more than restoring digital access. It demands flexible re-enrolment pathways, remedial academic support, and sustained engagement with families and communities. Addressing the needs of learners at the margins therefore calls for integrated strategies that combine digital inclusion with social support, psychosocial care, and context-sensitive pedagogy.

5. Policy Responses and Institutional Adaptation in India

India's policy response to post-pandemic educational disruption has been marked by speed, scale, and ambition. National initiatives expanded digital platforms, broadcast-based learning, and open educational repositories to ensure continuity during prolonged school closures. These measures demonstrated the state's capacity to mobilize technology at scale and reach learners across diverse geographies. At the same time, the experience revealed that rapid expansion does not automatically translate into equitable learning outcomes, particularly where institutional capacity and local conditions vary sharply.

A central feature of post-pandemic policy has been the consolidation of national digital education platforms. These platforms enabled standardized content delivery, multilingual resources, and teacher training modules, supporting a degree of system-wide coherence. Usage data show sharp increases in teacher registrations and content consumption during and after the pandemic years. However, engagement patterns were uneven. Schools with reliable connectivity and trained staff integrated these

platforms more effectively, while others used them sporadically or as repositories rather than interactive learning environments. This divergence highlights the limits of platform-led solutions when institutional readiness is uneven.

State governments and local administrations played a critical role in adaptation. Several states experimented with blended learning models, community learning centres, and offline digital solutions such as preloaded devices and local servers. In districts with strong administrative coordination, these approaches helped mitigate access gaps and supported learning recovery. Elsewhere, implementation was constrained by staffing shortages, limited monitoring capacity, and fiscal pressures. The variation across states underscores the importance of contextual flexibility within national policy frameworks.

Institutional adaptation at the school and college level revealed both resilience and structural constraints. Many institutions redesigned timetables, assessment practices, and academic calendars to accommodate hybrid learning. Teachers formed informal peer networks to share resources and strategies, compensating for gaps in formal training. Yet these adaptive practices were often dependent on individual initiative rather than systemic support. Institutions with weak digital infrastructure or high teacher workloads struggled to sustain innovation once emergency conditions eased, raising concerns about long-term viability.

Evidence from learning recovery programs suggests that targeted, data-informed interventions yield better outcomes than uniform approaches. Remedial instruction focused on foundational skills, extended instructional time, and small-group support showed measurable gains where implemented consistently. However, scaling such interventions remains challenging in systems facing teacher shortages and high pupil–teacher ratios. Policy efforts that prioritize enrolment recovery without parallel investment in instructional quality risk masking deeper learning deficits.

The post-pandemic period has also prompted renewed debate on governance and accountability in digital education. Questions of data privacy, platform dependence, and quality assurance have gained prominence as digital tools become embedded in routine schooling. Institutional mechanisms for monitoring learning outcomes in blended environments are still evolving, and many systems lack reliable indicators beyond participation metrics. Strengthening governance frameworks is therefore essential to ensure that digital expansion aligns with educational goals rather than substituting them.

6. Conclusion

The post-pandemic phase has made one reality unmistakably clear. Digital technologies did not create educational inequality in India, but they exposed, intensified, and reshaped it in visible and lasting ways. Access to devices and connectivity determined who could remain connected to schooling. Pedagogical capacity shaped whether digital tools enabled learning or merely transmitted content. Learner wellbeing and agency influenced how far students could engage with disrupted systems. Taken together, these dimensions show that digital inequality functions as a layered and systemic challenge rather than a single infrastructural deficit.

This chapter has highlighted both progress and constraint within India's educational response. Rapid policy action and platform expansion ensured continuity at scale. Teachers and institutions demonstrated resilience and adaptability under difficult conditions. At the same time, uneven access, variable pedagogical readiness, and hidden exclusions limited the reach and effectiveness of these efforts. Learning recovery has been partial and uneven, particularly for learners at the margins, underscoring the limits of technology-led interventions that operate in isolation from social and institutional realities.

Future directions for digital equity require a clear shift in emphasis. Priority must move beyond emergency access toward sustained capability and inclusion. This entails investment in teacher professional development, learner wellbeing, curriculum redesign, and institutional governance alongside digital infrastructure. Digital systems should support interaction, flexibility, and contextual relevance rather than uniform delivery. Equity must guide design and implementation, not appear as an afterthought.

By situating post-pandemic learning within India's diverse and unequal contexts, this chapter advances the broader aim of the volume to rethink digital equity in education. It demonstrates that bridging learning gaps demands integrated approaches that connect technology with pedagogy, policy with practice, and access with learner agency. Such alignment will determine whether digital education contributes to long-term educational justice or reinforces existing divides in new forms.

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3

Bridging the Digital Divide in Rural and Tribal Education Systems

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Abstract

The rapid expansion of digital education in India following the Covid-19 pandemic has intensified debates around equity, access, and learning quality, particularly in rural and tribal contexts. This chapter examines the digital divide as a multidimensional challenge shaped by infrastructure reliability, device availability, socio-cultural conditions, and institutional capacity. Moving beyond access-based narratives, it analyses how uneven connectivity, shared device use, and low-bandwidth environments limit meaningful engagement with digital learning. The chapter highlights the critical role of teachers, communities, and local mediators in transforming digital provision into educational opportunity, demonstrating that human facilitation and contextual adaptation are central to inclusive outcomes. It also evaluates major policy initiatives and platform-based interventions, identifying both their potential to scale learning resources and their limitations in addressing local diversity, sustainability, and learning impact. It concludes by outlining future directions that emphasise low-bandwidth design, multilingual content, learning-centred metrics, and institutionalised local support as essential for building resilient and equitable digital education systems in India.

Keywords: *Digital equity; Rural and tribal education; Post-pandemic learning; Educational technology policy; Inclusive digital pedagogy*

1. Introduction

The Covid-19 pandemic brought unprecedented disruption to educational systems around the world. In India, where millions of students depend on public schools, the sudden shift to remote learning exposed deep and persistent inequalities in access to technology and digital resources. Overnight, classrooms moved to online platforms, educational television broadcasts, and mobile-based learning apps. For many urban learners with stable internet and personal devices, the transition was challenging but manageable. For learners in rural and tribal regions, however, the reality was starkly different. The digital divide—long acknowledged in policy discourse—became a lived barrier to learning, threatening to widen existing gaps in educational attainment and opportunity.

Recent trends reveal a complex picture. On one hand, India has made remarkable strides in expanding digital infrastructure. Government initiatives such as BharatNet aim to extend broadband connectivity to gram panchayats, and the proliferation of low-cost smartphones has deepened digital penetration in many underserved areas. Digital public goods like DIKSHA and SWAYAM have enriched the educational landscape with free learning content. Yet, these advances mask uneven implementation. In many rural districts, internet speeds remain slow or intermittent, uninterruptible power supply is unreliable, and access to personal learning devices is limited. Tribal regions, often marked by difficult terrain and linguistic diversity, face additional challenges that simple connectivity improvements alone cannot resolve.

What makes the digital divide particularly consequential in the Indian context is its intersection with social and economic inequalities. Students from low-income households often share a single mobile device among siblings. Girls in conservative communities may have restricted access to digital tools compared to boys. Scheduled Tribe and Scheduled Caste learners frequently

contend with barriers that include not only limited infrastructure but also lower school retention and fewer local learning supports. In states such as Bihar, Odisha, and parts of the Northeast, these factors have compounded, leading to significant learning loss during extended school closures.

At the same time, there are promising examples of localized innovation. Community learning centers in parts of Madhya Pradesh have paired offline digital content with guided instruction by trained facilitators. In tribal districts of Gujarat, mobile vans equipped with tablets and solar chargers bring curated digital lessons to villages that lack electricity. These cases illustrate the potential to reimagine digital education beyond a narrow focus on connectivity, foregrounding community engagement, contextualized content, and adaptive delivery mechanisms.

The relevance of digital equity in education is not only immediate but long-term. As India pursues its goals of universal schooling and skills development for a 21st-century economy, ensuring that rural and tribal learners can participate fully in digital learning ecosystems is imperative. The challenge is not merely technical but pedagogical, cultural, and institutional. Addressing it requires a comprehensive understanding of how digital tools interact with diverse socio-economic realities on the ground.

This chapter explores these dynamics in depth. It begins by situating rural and tribal education ecosystems within broader structural constraints, then examines the nature of access and engagement with digital resources. It considers the roles of teachers and communities as mediators of digital learning, and critically appraises policy initiatives aimed at bridging the divide. Finally, it offers future-oriented insights to guide equitable and sustainable digital inclusion in India's education system. Through an evidence-informed and context-sensitive lens, this chapter argues that narrowing the digital divide is essential not only for closing current

learning gaps but also for unlocking the full potential of India's diverse learner population in a rapidly digitizing world.

2. Rural and Tribal Education Ecosystems

Rural and tribal education ecosystems in India are shaped by long-standing structural inequalities, geographical isolation, and distinctive socio-cultural practices. Schools in these regions often function as multi-purpose institutions, supporting nutrition, health awareness, and community cohesion alongside formal instruction. However, they operate within contexts marked by household poverty, seasonal migration, limited local employment, and lower parental educational attainment. These factors directly influence attendance, continuity of learning, and the ability of families to support digitally mediated education. As a result, digital interventions encounter realities that differ sharply from urban assumptions of stable infrastructure and individual device ownership.

Infrastructure expansion over the past decade has improved the physical reach of digital networks, but reliability remains uneven. Many rural schools experience fluctuating electricity supply, weak mobile signals, and limited technical support. Connectivity may exist in principle yet fail during peak usage hours or adverse weather conditions. In tribal areas, terrain-related challenges further complicate last-mile access. These constraints affect the feasibility of live online classes and push schools toward asynchronous, low-bandwidth solutions. The quality of access, rather than mere availability, thus becomes the defining factor in shaping digital learning experiences.

Device access reflects similar patterns of uneven capacity. Smartphone penetration has increased substantially across rural India, but devices are commonly shared within households. Children often rely on a single phone used by parents for work or communication, restricting learning time and consistency. Younger

learners are especially disadvantaged when digital access depends on adult availability. Data costs, limited storage space, and battery constraints further reduce the educational value of shared devices. Consequently, the presence of a device does not automatically translate into meaningful engagement with digital content.

The scale of access disparities becomes clearer when viewed through aggregate subscription data, which highlights both progress and persistent divides.

Indicator	Approximate Number
Total internet subscribers in India	970 million
Urban internet subscribers	565 million
Rural internet subscribers	405 million

These figures suggest a substantial rural user base, yet they also point to a significant population with limited or inconsistent connectivity. For education systems, this means that digital strategies must be designed for partial access rather than universal connectivity.

Cultural and linguistic diversity adds another layer of complexity in tribal education contexts. Many tribal learners speak mother tongues that differ from the dominant language of instruction used in digital platforms. Standardised content often fails to reflect local knowledge systems, ecological contexts, or everyday realities of learners' lives. At the same time, these communities possess strong oral traditions, collective learning practices, and place-based knowledge that can enrich digital pedagogy when thoughtfully integrated. Multilingual and culturally responsive digital materials have shown potential to improve comprehension and learner confidence, particularly at the foundational stage.

Community-level capacities play a critical role in mediating digital inclusion. In several regions, community learning centres, local volunteers, and non-governmental organisations have stepped in to bridge gaps left by formal systems. These actors combine offline

digital resources, facilitator-led sessions, and shared infrastructure such as solar-powered devices to sustain learning continuity. Such models demonstrate that human mediation is as important as technological provision, especially where formal school capacity is stretched.

Teacher capacity remains a decisive factor in transforming digital access into learning outcomes. Rural and tribal teachers often work under demanding conditions, managing multi-grade classrooms with limited institutional support. While many have shown adaptability and commitment, gaps persist in digital pedagogical skills, content adaptation, and collaborative planning. Strengthening teacher capacity through ongoing, context-specific professional learning is essential for sustaining blended and hybrid models of education.

3. Access Is Not Enough: Devices, Connectivity, and the Quality of Digital Engagement

Expanding access to devices and connectivity has been a central focus of India's digital education agenda in recent years. Smartphone ownership and basic internet subscriptions have grown rapidly across both urban and rural regions, creating an impression of narrowing digital gaps. Yet access alone does not ensure meaningful learning. For many students, particularly in rural and tribal areas, digital access is fragmented, time-bound, and constrained by household dynamics. A single smartphone is often shared among multiple family members, limiting dedicated study time. Connectivity may be available but unstable, with slow speeds that undermine interactive or real-time instruction. These conditions reveal a critical distinction between nominal access and functional access to digital learning.

School-level infrastructure reflects a similar pattern. The proportion of schools reporting computers and internet facilities has increased significantly since the pandemic, driven by targeted investments

and policy emphasis on digital readiness. However, the presence of hardware does not automatically translate into effective classroom use. In many schools, limited device-to-student ratios, irregular electricity supply, and the absence of technical support restrict sustained integration into teaching practice. Digital tools may be reserved for administrative purposes or occasional demonstrations rather than embedded within daily pedagogy. As a result, infrastructure expansion has often outpaced institutional capacity to use technology for learning improvement.

A snapshot of recent trends highlights both progress and continuing gaps.

Indicator	2019–20	2023–24
Schools with computers	38.5%	57.2%
Schools with internet access	22.3%	53.9%

These figures point to a substantial rise in provisioning, but they also underline the distance between infrastructure availability and high-quality digital engagement. The quality of engagement depends on how devices, content, and pedagogy intersect within real learning environments.

Quality digital engagement involves sustained attention, opportunities for practice, feedback, and alignment with learners' linguistic and cultural contexts. During the pandemic, many digital interventions relied heavily on video lectures, messaging apps, or broadcast-based instruction. While these approaches helped maintain a minimum connection with schooling, they often resulted in passive consumption rather than active learning. Learners without guidance or structured routines struggled to translate content exposure into skill development, particularly in foundational literacy and numeracy. Learning recovery experiences have since shown that guided interaction and structured practice are far more effective than unmediated access to digital content.

Economic and material constraints further shape engagement. Data costs accumulate quickly for families relying on prepaid plans, making continuous streaming financially unsustainable. Battery life and charging remain persistent challenges in areas with unreliable electricity. Small screen sizes limit reading comfort and reduce the effectiveness of complex learning tasks. These constraints make a strong case for low-bandwidth and offline-first approaches that prioritize essential learning outcomes over technologically intensive features. When digital content is designed for intermittent access, local storage, and short interaction cycles, it aligns more closely with the realities of rural and tribal learners.

Human mediation plays a decisive role in converting access into learning outcomes. Where teachers, community facilitators, or local organizations actively guide digital use, learners show greater consistency and engagement. Community learning centres, mobile digital labs, and school-led blended models have demonstrated how shared devices can be effectively scheduled, maintained, and used for collaborative learning. These arrangements also provide social structure, accountability, and emotional support, which are often absent in purely home-based digital learning. Such experiences highlight that digital tools function best when embedded within supportive learning ecosystems rather than deployed in isolation.

At the policy level, a growing recognition has emerged that success cannot be measured solely through counts of devices distributed or connections established. Metrics of meaningful engagement—such as time spent on curriculum-aligned learning, teacher integration of digital resources, and learner progression—are increasingly important. Bridging the digital divide therefore requires a shift from a supply-driven model to a systems-oriented approach. Devices and connectivity must be complemented by pedagogical design, teacher capacity, community support, and contextual relevance. Only then can digital education move beyond access and become a genuine instrument of equity and learning transformation.

4. Teachers, Communities, and Local Mediators in Digital Inclusion

Teachers are central to translating digital access into learning. They mediate between technology and pedagogy. In rural and tribal settings, their role extends beyond instruction to include facilitation, adaptation, and support. During the pandemic, many teachers demonstrated resilience. They adopted messaging apps, shared voice notes, and organized catch-up sessions. Their efforts helped sustain learning where infrastructure was weak. However, these adaptations often occurred without formal training. Surveys show that only a minority of rural teachers have received sustained professional development in digital pedagogy. Most training remains short, transactional, and focused on tool usage rather than instructional design. This gap limits teachers' ability to integrate digital resources effectively.

Communities matter deeply in rural and tribal education ecosystems. Parents, elders, and local leaders influence how families perceive digital learning. In areas with strong community cohesion, collective support has helped maintain study routines. Community learning centres emerged as important spaces where students gather around shared devices. In some districts, volunteer facilitators coordinate access, manage charging points, and support parents in using educational content. These centres also act as information hubs. They help families navigate government schemes and connect with school leadership. Yet community engagement is uneven. In many villages, caregivers juggle subsistence work and have limited time to support children's schooling. Where adult literacy rates are low, understanding digital content and its learning value poses additional challenges.

The intersection of teacher capacity and community support can create powerful synergies. In locations where teachers collaborate with local mediators, blended models of learning have emerged. These combine in-person guidance with curated digital lessons.

Students benefit from structured schedules, peer interaction, and scaffolded content. Such models have shown improved attendance and engagement metrics compared to remote learning alone. Still, these successes are isolated and not widespread. Scaling them requires deliberate investment in training, facilitation, and community outreach. It also requires recognition of teachers' workloads and time constraints. Many educators report burnout, as digital coordination adds to existing responsibilities without commensurate support.

Local mediators, including youth volunteers and non-governmental organisations, play complementary roles. They often bridge logistical gaps by helping with device distribution, troubleshooting connectivity issues, and translating content into local languages. In tribal areas, where mother-tongue instruction enhances comprehension, mediators help contextualise digital lessons. These efforts increase participation and reduce dropouts. However, they are typically project-based and short-term. Sustainability remains a concern. When programme funding ends, so do many support structures. Institutionalising these roles within formal education systems is still in early stages.

Data from recent district assessments indicate that schools with active community support report higher levels of device usage and student engagement. Conversely, isolated schools with minimal local involvement struggle to maintain momentum. These patterns underline the importance of systemic collaboration. Teachers cannot alone compensate for lack of infrastructure or community support. Equally, digital tools cannot replace the relational work of educators and facilitators.

Policy frameworks increasingly acknowledge the importance of capacity building at multiple levels. State initiatives now include modules on blended learning and community engagement in teacher training curricula. Pilot programmes also incorporate community mediators into school plans. Yet implementation

quality varies across regions. In some states, bureaucratic delays and resource shortages hinder effective rollout. In others, progressive districts demonstrate how cross-sector partnerships can mobilise local assets for sustained learning.

5. Policy Initiatives and Platform-Based Interventions

India's policy response to digital education in the post-pandemic period has been expansive and ambitious. Public investment in school ICT infrastructure has increased, and a growing proportion of schools now report access to computers and internet facilities. These efforts signal a strong commitment to digital inclusion and create a foundational layer for technology-enabled learning. At the same time, scale has often been prioritised over depth. Infrastructure expansion, while necessary, does not automatically translate into pedagogical change or equitable learning outcomes.

National connectivity initiatives have significantly extended broadband reach into rural administrative units. Thousands of gram panchayats are now technically connected, improving the potential for digital service delivery and educational access. However, the promise of backbone connectivity frequently weakens at the last mile. In many villages, inconsistent bandwidth, power interruptions, and limited local network management reduce usability. Schools may technically be "connected" but remain unable to support regular digital instruction. This gap between availability and reliability highlights the need for policy attention to operational sustainability, not just coverage.

Platform-based interventions have played a central role in shaping India's digital education landscape. Large-scale platforms offering curriculum-aligned content, teacher resources, and student learning materials have enabled continuity during school disruptions and expanded access to standardized learning resources. Their strength lies in scale, cost efficiency, and ease of distribution. Yet platform reach does not guarantee engagement or learning impact. Learners

in rural and tribal areas often encounter content that does not reflect local languages, contexts, or learning levels. When platforms are designed primarily for uniform delivery, they risk reproducing inequities rather than addressing them.

Recent policy thinking has moved toward interoperable digital education architectures. These frameworks aim to create shared digital building blocks for content delivery, assessment, credentials, and data systems. In principle, such architectures reduce duplication and allow innovation at the local level. In practice, they introduce new challenges. Data governance, privacy protection, and institutional capacity for managing complex digital systems remain uneven across states and districts. Without clear accountability and safeguards, interoperability can create vulnerabilities alongside efficiencies.

Another persistent limitation lies in the emphasis on inputs rather than outcomes. Policy monitoring systems frequently track devices distributed, platforms launched, or connections established. Less attention is given to indicators of meaningful use, such as instructional time supported by digital tools, teacher integration into lesson planning, or learner progress in foundational skills. Evidence from school reviews suggests that devices often remain underutilised due to lack of maintenance, technical support, or teacher confidence. This pattern underscores the importance of shifting evaluation frameworks toward learning-centred metrics.

Public private partnerships and philanthropic initiatives have introduced innovation and flexibility into the system. These collaborations have piloted low-bandwidth solutions, offline content delivery, and multilingual resources, often responding more quickly to local needs than formal programmes. They generate valuable implementation knowledge. However, many such initiatives remain project-based and time-bound. When external funding ends, support structures frequently dissolve. The absence

of clear pathways for institutionalisation limits the long-term impact of otherwise effective interventions.

Policy design has also struggled with contextual diversity. Rural and tribal education systems differ widely in language ecology, migration patterns, school size, and community capacity. Uniform digital solutions rarely accommodate this variation. Interventions that allow modular adaptation—such as offline access, mother-tongue content, community facilitation, and alternative power arrangements—show greater resilience. Policies that incentivise local content creation and participatory feedback mechanisms are better aligned with these realities.

6. Conclusion

This chapter has examined digital equity in rural and tribal education as a systemic challenge rather than a narrow problem of access. The analysis shows that while India has made measurable progress in expanding connectivity, devices, and digital platforms, these gains remain uneven in their educational impact. Structural constraints related to infrastructure reliability, shared device use, linguistic diversity, and institutional capacity continue to shape how digital resources are experienced by learners on the ground. Access, by itself, does not guarantee learning. Quality of engagement, human mediation, and contextual relevance determine outcomes.

A central insight emerging from the discussion is the decisive role of teachers, communities, and local mediators in bridging digital gaps. Where technology is supported by trained teachers, community facilitation, and culturally responsive content, digital tools contribute to continuity, inclusion, and learner confidence. Where such support is absent, digital initiatives risk reinforcing existing inequalities. Policy interventions and platform-based solutions have created scale and visibility, but their effectiveness

depends on sustained investment in professional learning, maintenance, governance, and locally adaptive design.

The chapter also highlights the need for a shift in policy orientation. Future strategies must move beyond input-driven metrics toward learning-centred measures that capture engagement, progression, and equity. Low-bandwidth, offline-first, and multilingual approaches should be treated not as interim solutions but as integral components of inclusive digital systems. Strengthening local capacity, institutionalising successful community models, and aligning platforms with classroom practice are critical for long-term sustainability.

In contributing to the broader theme of this volume, the chapter underscores that digital equity is foundational to closing post-pandemic learning gaps. Bridging the digital divide in rural and tribal education is essential not only for recovery but for reimagining education systems that are resilient, inclusive, and responsive to diversity. A future-oriented approach to digital equity must therefore combine technological innovation with social investment, ensuring that digital transformation serves as a pathway to educational justice rather than a new line of exclusion.

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4

Digital Rights as Educational Rights: A Policy Perspective

Shoubhik De

Abstract

The rapid digitalisation of education in the aftermath of the COVID-19 pandemic has fundamentally altered the conditions under which learning takes place in India. This chapter argues that in such a context, digital access can no longer be treated as a supplementary resource but must be understood as an integral component of the right to education. Drawing on recent policy developments, institutional practices, and empirical trends, the chapter examines how India's digital education landscape has evolved from welfare-oriented interventions toward system-level integration, while remaining constrained by deep structural inequalities. It highlights how uneven infrastructure, socio-economic disparities, and regional variation continue to shape access to digital learning, often reinforcing existing educational hierarchies. The analysis further extends the notion of educational rights to include data protection, privacy, and student agency within platform-based learning environments, areas that remain underdeveloped in current policy frameworks. It concludes that bridging post-pandemic learning gaps requires moving beyond technological expansion toward policies grounded in equity, accountability, and democratic responsibility.

Keywords:
Digital equity; Educational rights; Education policy in India; Platform-based learning; Data privacy

1. Introduction

The COVID-19 pandemic brought into sharp relief the integral link between digital connectivity and meaningful participation in education. When schools and colleges across India closed their doors in early 2020, educators and learners turned to online platforms in unprecedented numbers. What was once a supplementary mode of learning became the primary pathway for instruction, collaboration, and assessment almost overnight. This shift exposed both the promise and the fragility of digital integration in education. For millions of students in urban centres with reliable Internet and device access, the transition was disruptive but navigable. For many others, especially in rural and remote regions, education became uncertain, intermittent, or altogether inaccessible.

In urban neighbourhoods and well-resourced private schools, families with multiple devices and high-speed data could engage with virtual classrooms and e-learning resources with relative ease. In contrast, students in underserved areas often contended with shared mobile phones, erratic connectivity, or no Internet access at all. In states with lower infrastructure penetration, entire cohorts of learners were effectively excluded from formal instruction for extended periods. These sharp disparities underscored the reality that digital access is no longer a luxury but a core condition for participation in contemporary learning environments. In India, where the school-going population exceeds 260 million, the stakes of digital exclusion are substantial and enduring.

Even as schools have reopened and blended learning models take shape, digital access continues to shape educational opportunity and outcomes. Government initiatives like the National Education Policy's emphasis on technology, expanded online learning platforms, and central and state-level digital literacy drives signify a growing policy recognition of digital engagement. Yet the persistence of access gaps, combined with uneven support for

teachers and learners, highlights a deeper structural challenge: the absence of a coherent rights framework that situates digital participation as fundamental to education itself. Without such a framework, digital resources may expand, but inequities will persist beneath the surface, quietly reproducing existing disparities in learning, achievement, and social mobility.

This chapter begins from the premise that digital rights are educational rights. In an era where learning is mediated through screens, networks, and platforms, the ability to access, navigate, and benefit from digital environments must be anchored in policy as a matter of equity, justice, and developmental priority. The argument advances beyond connectivity and devices to encompass digital literacies, inclusive design, data privacy, and institutional accountability. In the Indian context, this requires tracing the contours of policy intent and practice, unpacking the lived experiences of exclusion, and envisioning a rights-based approach that aligns with constitutional values and educational goals.

The following sections will explore how Indian policy currently frames digital access in education, where significant gaps remain, and how a rights perspective can recalibrate policy and practice. By linking the urgency of digital inclusion to broader questions of educational justice, this chapter seeks to provide a grounded yet forward-looking analysis that speaks to policymakers, researchers, and practitioners committed to rethinking digital equity in Indian education.

2. The Indian Policy Landscape: From Welfare to Rights-Based Digital Education

India's digital education policy environment has evolved rapidly over the last decade, spurred by the twin pressures of technological change and societal demand for equitable learning. The National Education Policy 2020 (NEP 2020) marked a watershed moment by explicitly acknowledging the role of technology in expanding

access, enhancing learning quality, and modernising governance in education. Under NEP 2020, digital learning is positioned not as an optional enhancement but as an integral enabler of quality education, with strategic emphasis on digital content, application, and infrastructure across all levels of schooling. The policy's vision includes the creation of a National Educational Technology Forum (NETF) to steward research, innovation, and deployment of digital tools across the sector. The policy reflects a broader national priority to integrate technology with pedagogy, teacher development, and assessment systems, signalling a shift from ad-hoc digital initiatives to system-level thinking.

Despite this ambitious policy framework, the on-ground reality reveals uneven progress. Recent school infrastructure data shows that access to computers and internet connectivity has increased in the past few years, yet a significant portion of schools still lack these essential resources. According to the latest national statistics, the share of schools equipped with computers has risen above 50 percent, and over half now report internet access, up markedly from earlier years. However, large disparities remain across states and school types, with rural government schools often trailing behind better-resourced urban counterparts. In some states, only a fraction of schools have basic digital tools or functional smart classrooms, underscoring the gap between policy ambition and implementation capacity. These gaps extend beyond physical infrastructure, reflecting deeper issues in teacher preparedness, digital literacy, and sustained resource allocation.

To clarify the scale of current infrastructure trends, the following table summarises national figures on digital readiness in schools:

Table 1: Selected Indicators of School Digital Readiness (India, Recent National Data)

Indicator	Approximate Percentage of Schools
Schools with Computers	~57-65%
Schools with Internet Connectivity	~54-64%

These figures illustrate that while more than half of Indian schools have some level of digital infrastructure, a substantial minority remain disconnected from the digital ecosystem that modern learning increasingly assumes. What this numeric snapshot obscures, however, are the qualitative dimensions of access: in many cases, equipment lies unused because of power issues, weak connectivity, or lack of trained educators who can integrate technology into everyday teaching.

In addition to NEP 2020, a suite of central initiatives seeks to broaden digital engagement. Programmes such as PM eVidya unify online, on-air, and digital resources to reach learners across diverse contexts, offering curricular content and teacher support through multi-modal channels. Platforms like DIKSHA serve as national learning infrastructures, hosting open educational resources in multiple Indian languages and supporting large-scale teacher professional development. Yet the provision of content and platforms is only one side of the equation; policy implementation must contend with entrenched inequities in access, skills, and institutional capacity that shape who benefits from digital education.

The Indian policy landscape thus reflects a gradual transition from welfare-oriented interventions — such as device distribution or one-off digital campaigns — toward a more systemic recognition of digital access as a condition for educational equity. Nonetheless, the absence of an explicit rights framework means that digital access is often treated as an aspirational goal rather than an

enforceable entitlement. Bridging this gap requires not only scaling infrastructure and platforms, but embedding principles of inclusion, accountability, and learner empowerment into the core of educational governance. In the next sections, this chapter will unpack how these policy trajectories intersect with lived realities of learners and educators, and how a rights-based perspective can sharpen India's digital education agenda.

3. Inequality, Exclusion, and the Uneven Geography of Digital Learning

The expansion of digital learning in India has unfolded across a landscape marked by deep and persistent inequalities. While national indicators suggest steady growth in internet penetration, device availability, and school-level digital infrastructure, these averages conceal sharp spatial and social contrasts. Access to digital learning remains unevenly distributed across regions, school systems, and social groups. Students' educational experiences continue to be shaped decisively by whether they live in urban or rural areas, attend private or government schools, and belong to households with stable income and connectivity. Digital learning, rather than flattening disparities, has often mirrored and amplified pre-existing educational divides.

Geography plays a central role in structuring digital opportunity. Urban and semi-urban districts generally benefit from stronger broadband infrastructure, more reliable electricity, and denser networks of private schools with greater financial capacity. In contrast, many rural and remote regions face unstable connectivity, limited bandwidth, and infrastructural fragility that disrupts sustained digital engagement. Even where schools possess computers or smart classroom equipment, these resources are frequently underutilised due to power interruptions, maintenance gaps, or the absence of trained personnel. As a result, digital readiness varies not only between states but also within districts,

producing uneven educational ecosystems that disadvantage already marginalised communities.

Household-level access further complicates this picture. Recent surveys indicate rising levels of smartphone ownership and internet use across India, yet access is often partial and precarious. Many learners rely on a single shared mobile device within the household, typically prioritised for adult work or older siblings' studies. Data affordability, network instability, and limited screen time constrain students' ability to participate meaningfully in digital learning. For these learners, online education is fragmented and episodic, insufficient to replicate the continuity of classroom instruction or support deeper engagement with curricular content.

Digital exclusion also intersects with gender, language, and disability. In certain social contexts, girls face restricted access to devices or are expected to prioritise domestic responsibilities, limiting their participation in online learning. Students from linguistically diverse backgrounds encounter platforms and content that do not adequately reflect regional languages or local knowledge systems. Learners with disabilities are often marginalised by platforms that lack assistive features, adaptive interfaces, or inclusive design principles. These layered exclusions demonstrate that digital inequality is not merely technical but deeply social and cultural in nature.

The pandemic period revealed the cumulative impact of these disparities with stark clarity. Prolonged school closures resulted in significant learning discontinuities, particularly for students without reliable digital access. While some learners adapted to virtual classrooms and digital resources, others experienced extended disengagement from formal education. These uneven experiences translated into differential learning losses that continue to shape classroom dynamics and achievement patterns even after schools reopened. Digital inequality thus emerged not as a

temporary disruption but as a structural challenge with long-term implications.

Policy interventions and grassroots innovations have attempted to address these gaps through mobile learning units, community digital centres, offline content distribution, and teacher-led local solutions. Such initiatives illustrate the potential of context-sensitive approaches that combine technology with human support and institutional commitment. However, their reach remains uneven and often dependent on short-term funding or local leadership rather than systemic guarantees. Without a coordinated and equity-driven framework, these efforts struggle to scale or sustain impact.

The uneven geography of digital learning raises fundamental questions about educational justice in a digitally mediated system. As assessments, resources, and pedagogic practices increasingly rely on digital platforms, unequal access risks becoming a gatekeeper to opportunity itself. Addressing this challenge requires policy approaches that move beyond infrastructure expansion to recognise digital access, usability, and inclusion as core educational entitlements. Only by confronting the spatial and social dimensions of digital inequality can India advance toward a more equitable and resilient education system in the digital age.

4. Data, Privacy, and Student Agency in Platform-Based Education

The rapid adoption of educational platforms has transformed how learning is delivered and monitored in India. Government and private platforms now host millions of learners. These platforms collect vast quantities of student data. This includes activity logs, assessment results, interaction patterns, and device metadata. The scale of data collection is unprecedented in the history of the Indian education system.

There is clear educational value in these data. Aggregated learning analytics can reveal patterns of student engagement. They can highlight areas of conceptual difficulty. They can inform personalised feedback and adaptive content delivery. Where thoughtfully applied, data insights can strengthen instructional practice and learning outcomes. Some Indian platforms are beginning to integrate dashboards for teachers. These tools can help educators identify students at risk of disengagement and tailor interventions.

Yet the expanding data footprint raises serious privacy concerns. In many cases, students and parents have limited visibility into what data are collected, why they are collected, and how they are used. Platform terms of service tend to be long and complex. Few learners or caregivers read or understand these agreements. This asymmetry undermines informed consent. It also concentrates power in the hands of platform owners and sponsors.

Recent figures suggest that millions of unique learner profiles are stored on national and private education platforms. A substantial proportion of these profiles include sensitive identifiers. Yet clear standards for data minimisation, storage duration, and third-party sharing remain underdeveloped. In a context where digital identity systems intersect with educational accounts, the risks of function creep—using data for unintended purposes—are real. For example, performance data intended for classroom feedback could be repurposed for profiling or high-stakes decisions outside the original context.

Student agency is central to the debate on data rights. True agency means that learners have autonomy over their data footprints. It means meaningful choices about what is shared, with whom, and for what purposes. It also means accessible recourse mechanisms when data are misused. At present, most Indian educational platforms do not offer granular consent controls or clear pathways for students to review, export, or delete their data. Without such

mechanisms, student agency remains aspirational rather than actual.

Progress is visible in the emergence of policy conversations around data protection. National discussions are increasingly recognising personal data as an extension of individual rights in the digital era. Draft frameworks emphasise user consent, purpose limitation, and individual access rights. These conversations are important steps toward aligning educational data practices with broader digital rights standards. However, in the absence of binding, sector-specific norms for education, progress remains uneven.

There are also technological solutions that can advance both privacy and pedagogic value. Techniques such as data anonymisation, differential privacy, and federated learning hold promise. They can enable platforms to extract insights while limiting individual exposure. Some experimental implementations are underway in research settings. Yet integrating these solutions at scale requires investment, technical capacity, and regulatory clarity.

5. Global Norms and Local Realities

Global conversations on digital education increasingly frame access, safety, and participation as matters of rights rather than convenience. International frameworks now recognise that when learning is mediated through digital platforms, the right to education cannot be separated from rights related to connectivity, data protection, accessibility, and learner agency. This shift reflects a broader understanding that digital environments shape not only how students learn, but also how they are monitored, assessed, and governed. Education systems across the world are therefore rethinking digital policy as part of democratic and social responsibility.

Several regions have translated these normative ideas into concrete regulatory and institutional practices. In many advanced education systems, digital education policies operate alongside strong data

protection regimes that apply explicitly to children and students. Schools and universities are required to define clear purposes for data collection, limit unnecessary data retention, and provide transparency to learners and parents. These systems also emphasise institutional accountability, ensuring that responsibility for protecting learners does not rest solely with technology providers. Evidence from these contexts suggests that when governance structures are clear, trust in digital education increases and adoption becomes more sustainable.

At the same time, international experience shows that regulation alone is insufficient. Countries that have made progress in equitable digital education combine legal safeguards with investments in teacher capacity, inclusive content design, and digital literacy for learners. Policy evaluations indicate that systems focusing only on devices and platforms struggle to reduce inequality, while those integrating pedagogy, governance, and capacity building demonstrate more balanced outcomes. This integrated approach highlights an important lesson: digital rights in education must be operationalised through everyday institutional practices, not treated as abstract principles.

Emerging global guidance also places growing emphasis on child-centred and learner-sensitive design. This includes adapting platforms for diverse linguistic contexts, embedding accessibility features for learners with disabilities, and recognising the developmental needs of children and adolescents. Empirical observations suggest that platforms designed without these considerations tend to exclude marginalised learners, even when access to devices exists. Conversely, systems that prioritise inclusion from the design stage show higher levels of engagement and retention among disadvantaged groups.

For India, the relevance of international frameworks lies less in replication and more in adaptation. India's education system operates at an unparalleled scale, marked by linguistic diversity,

federal governance, and wide infrastructural variation across states and districts. Global models offer useful design principles, such as rights-based governance, sector-specific data norms, and accountability mechanisms, but these must be reshaped to align with Indian realities. This includes embedding safeguards within public procurement processes, developing simple and enforceable standards for schools, and strengthening state and district capacities to oversee digital education responsibly.

6. Conclusion

What the rapid digitalisation of education in India has ultimately revealed is not only a capacity for technological adaptation, but a deeper set of questions about fairness, responsibility, and the meaning of educational access in the twenty-first century. Digital platforms have expanded the reach of learning in unprecedented ways, yet they have also made visible the structural conditions that determine who can participate fully and who remains at the margins. In this context, treating digital access as peripheral to education is no longer tenable.

The chapter has shown that India's policy response has been energetic and ambitious, but uneven in its outcomes. National platforms and programmes have scaled quickly, while regional disparities, institutional constraints, and social inequalities continue to shape learners' experiences. Access to devices and connectivity has improved, but without a clearly articulated rights framework, these gains remain fragile and unevenly distributed. Digital equity, therefore, cannot be reduced to infrastructure alone; it must encompass inclusion, institutional accountability, and the protection of learners' autonomy and data.

A central implication of this analysis is that educational rights in a digital era extend beyond entry into the system. They include the right to safe participation, meaningful engagement, and protection from exploitation within platform-based environments. As data-

driven governance becomes more embedded in education, questions of privacy, consent, and agency become inseparable from questions of learning quality and justice. Addressing these dimensions is essential to prevent digital systems from reinforcing existing hierarchies under the guise of innovation.

By situating the Indian experience alongside global policy thinking, the chapter contributes to the volume's broader aim of reimagining digital equity in the post-pandemic period. It suggests that the future of digital education lies in rights-centred governance that is sensitive to local realities while aligned with international norms. Such an approach can help ensure that digital transformation strengthens, rather than undermines, the promise of education as a public good. In doing so, the chapter reinforces the book's central argument: that bridging learning gaps in the digital age requires not only technology, but a renewed commitment to equity, dignity, and democratic values in education.

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5

Digital Pedagogies for Marginalized Learners: A Path to Equity

Munna Biswas

Abstract

Across India's education system, digital technologies have become embedded in everyday teaching and learning at an unprecedented pace. This transformation has created new opportunities for reach, flexibility, and innovation, while simultaneously revealing persistent and often deepening inequalities. Focusing on marginalized learners, this chapter examines how digital pedagogies can either reproduce exclusion or function as instruments of equity, depending on how they are designed, mediated, and governed. The discussion moves beyond access-based narratives to analyse pedagogy, teacher practice, and platform governance as interconnected dimensions shaping learning outcomes. Drawing on post-pandemic developments in India, the chapter highlights the importance of learner agency, multilingual and culturally responsive design, and formative assessment in addressing learning gaps. It positions teachers as central mediators who adapt digital tools to local contexts and learner needs, while also critically examining the power dynamics embedded in large-scale platforms and policy frameworks.

Keywords: *Digital pedagogy, social justice in education, marginalized learners, teacher mediation, digital governance*

1. Introduction

The COVID-19 pandemic triggered a rapid and largely unplanned expansion of digital education across India. With prolonged school closures, learning shifted from classrooms to homes almost overnight. This transition revealed technology's dual character. In contexts where devices, connectivity, and adult support were available, teachers and students adapted with notable resilience. In many other settings, especially among rural, tribal, and urban-poor communities, learning was severely disrupted. Evidence emerging in the post-pandemic period points to significant setbacks in foundational literacy and numeracy, highlighting that the crisis did not merely pause learning but deepened pre-existing inequalities. These disruptions have brought questions of equity to the centre of digital education debates.

At the same time, India has witnessed a remarkable expansion of its digital ecosystem. Increased mobile penetration, affordable data plans, and national platforms for school and teacher education have reshaped how learning resources are produced and accessed. During the pandemic, platforms such as DIKSHA and various state-led initiatives reached millions of learners and teachers, demonstrating the scale at which digital systems can operate. This expansion presents an important opportunity. Digital pedagogies can support continuity, flexibility, and personalization, and can connect learners in remote areas with high-quality content and instructional support. Yet scale alone does not guarantee inclusion. Patterns of use show uneven engagement shaped by language barriers, device sharing within households, digital literacy, and the nature of pedagogical design.

For marginalized learners, the challenges of digital education extend well beyond access. Students from low-income families, first-generation learners, girls facing restrictive social norms, learners with disabilities, and children in linguistically diverse regions often encounter platforms and instructional models that do

not reflect their realities. Much of the emergency digital teaching during the pandemic relied on standardized content delivery, passive video consumption, and uniform assessment practices. Such approaches frequently overlooked local contexts, caregiving responsibilities, and the need for interaction and feedback. As a result, many learners remained formally enrolled in digital systems while being substantively excluded from meaningful learning.

The rapid digitalisation of education has also raised concerns related to governance, ethics, and power. Large-scale platforms increasingly mediate what is taught, how learning is measured, and how students and teachers are represented through data. Decisions about language options, accessibility features, assessment algorithms, and data use carry significant implications for inclusion and exclusion. Without careful design and accountability, digital systems risk reproducing social hierarchies in new forms, creating a digital layer over existing educational inequities rather than dismantling them.

Against this backdrop, this chapter examines digital pedagogies as a potential pathway to educational equity for marginalized learners in India. It argues that the question is no longer whether technology should be used in education, but how it is pedagogically framed, governed, and situated within learners' social contexts. Moving beyond a narrow focus on devices and connectivity, the chapter foregrounds pedagogy, teacher agency, platform design, and policy choices as interconnected elements. By engaging with Indian experiences and global insights, the chapter seeks to chart a more just and inclusive digital future, one in which technology supports learning with dignity, relevance, and opportunity for those who have historically been left at the margins.

2. Marginalized Learners in India's Digital Education Landscape

The expansion of digital education in India has unfolded unevenly, revealing deep structural asymmetries in who benefits and how. Post-pandemic assessments indicate that learning recovery has been slower and more fragile among students from economically weaker households, rural regions, and historically disadvantaged communities. These learners were more likely to experience prolonged disengagement during school closures and faced greater difficulty re-entering structured learning environments. Digital education, rather than acting as a leveller, often mirrored existing social hierarchies, reinforcing the understanding that marginalization in education is cumulative and multidimensional.

At the infrastructure level, India has made significant progress. Mobile network coverage now extends to most villages, and internet subscriptions have grown rapidly. However, household-level access remains unequal. Many families rely on a single smartphone shared among multiple members, limiting sustained engagement with learning platforms. For children in low-income households, digital learning frequently competes with domestic responsibilities and informal work. Connectivity quality, data affordability, and access to quiet learning spaces further shape the effectiveness of digital participation. As a result, nominal access does not consistently translate into meaningful learning time.

Gender continues to be a critical axis of exclusion in the digital education landscape. Girls, particularly in rural and semi-urban settings, often face restricted access to devices due to prevailing social norms and safety concerns. When devices are shared, boys are frequently prioritised for educational use. These constraints reduce girls' exposure to online learning opportunities, weaken continuity, and limit skill development. The digital gender gap thus intersects with educational disadvantage, making it harder for girls

to recover lost learning or participate fully in emerging blended models of education.

Language and cultural context present another layer of marginalization. While internet use in Indian languages has grown substantially, educational platforms still struggle to provide consistent, high-quality multilingual content across subjects and grade levels. Many digital resources remain anchored in dominant languages and urban-centric examples. For learners from tribal, minority-language, or first-generation backgrounds, this lack of linguistic and cultural alignment creates cognitive distance from the curriculum. Even when content is technically accessible, it may not resonate with learners' lived experiences or prior knowledge, reducing engagement and comprehension.

Learners with disabilities face distinct and often overlooked challenges in digital environments. Accessibility features such as screen readers, captions, flexible navigation, and adaptive assessments are unevenly integrated across platforms. In the absence of assistive technologies and trained support, digital learning can intensify exclusion for students with visual, hearing, cognitive, or motor impairments. The rapid scale-up of platforms during the pandemic left limited space for inclusive design, and these gaps continue to affect participation and learning outcomes.

The table below highlights selected national indicators that help frame the scale and limits of India's digital education landscape:

Indicator	Approximate Figure	Interpretation
Internet users (2024)	750–760 million	Indicates large national reach, but not uniform educational access
Village mobile network coverage	About 95%	Infrastructure availability does not ensure household readiness

Total internet connections	Around 970 million	High subscription numbers mask device sharing and usage gaps
Female internet use	About one third of women	Reflects persistent gender-based digital exclusion
Scale of national learning platforms	Millions of users, very high usage volumes	Demonstrates reach, not necessarily depth or equity of learning

These patterns point to a complex landscape in which digital marginalization emerges through the interaction of social position, household conditions, pedagogical design, and institutional support. Learners who are poor, female, linguistically marginal, or disabled often encounter multiple barriers simultaneously, limiting the transformative potential of digital tools.

Recognising these layered realities is essential for designing equitable digital pedagogies. The challenge is not merely to extend platforms to marginalized learners, but to reimagine digital education in ways that acknowledge diversity, support learner agency, and respond to local contexts. The next sections build on this understanding by examining how pedagogical design and teacher practice can begin to address these inequities and create more inclusive digital learning pathways.

3. Pedagogical Design for Inclusion: From Content Delivery to Learning Agency

Pedagogical design for digital inclusion requires a clear shift in orientation, from delivering content at scale to enabling learners to participate actively in the learning process. The rapid adoption of digital instruction during school closures relied heavily on video lectures and one-way transmission models. While such approaches ensured continuity, they often failed to support comprehension, practice, or motivation among learners who lacked stable home learning environments. For marginalized students, meaningful learning depends on opportunities to interact with content, receive

feedback, and connect new ideas to familiar contexts. Inclusive digital pedagogy therefore begins with designing learning pathways rather than simply distributing materials.

Recent learning recovery initiatives in India indicate that targeted, level-appropriate instruction produces stronger gains than uniform grade-level teaching. Digital platforms can support this approach by integrating simple diagnostics that help teachers identify learners' current competencies and assign appropriate tasks. Short learning modules, embedded practice, and immediate feedback enable learners to progress incrementally, even when access is intermittent or devices are shared. When digital tools are aligned with offline activities and community-based support, they help sustain learning continuity for students who face irregular connectivity and competing household demands.

Language plays a decisive role in shaping learning agency. Although internet usage in Indian languages has grown rapidly, educational content often remains uneven in quality and coverage across languages and subjects. Pedagogical design that foregrounds inclusion must allow learners to enter through their home language, gradually bridging to the school language of instruction. This can be achieved through bilingual explanations, localized examples, and opportunities for teachers to adapt content to regional and cultural contexts. When learners encounter familiar references and linguistic cues, they are more likely to engage, ask questions, and persist with challenging material.

Assessment practices in digital environments also require rethinking. High-stakes, summative tests delivered online offer limited insight into how marginalized learners are progressing. In contrast, low-stakes formative assessments embedded within lessons help teachers identify misconceptions early and adjust instruction accordingly. Simple quizzes, oral responses, short projects, and reflective tasks can be designed to work in both online and blended settings. Such assessments support learning agency by

making progress visible to learners themselves, rather than positioning assessment solely as an external judgement.

Accessibility is another core dimension of inclusive pedagogical design. Learners with disabilities often encounter digital platforms that are not built with diverse needs in mind. Inclusive design principles call for multiple modes of representation, such as audio support, captions, flexible text formats, and intuitive navigation. Equally important is equipping teachers with strategies to modify digital activities for different learners, using available resources creatively. When accessibility is treated as integral rather than supplementary, digital pedagogy expands participation and affirms learner dignity.

Teachers remain central to transforming digital tools into inclusive learning experiences. Effective pedagogical design recognises teachers as mediators who interpret learner needs, contextualise content, and orchestrate interaction. Professional development that focuses on pedagogical strategies, rather than technical skills alone, enables teachers to use data thoughtfully, manage blended classrooms, and engage caregivers as partners in learning. Peer learning networks and collaborative spaces further support teachers in adapting digital resources to local realities.

4. Teachers as Mediators of Digital Equity

Teachers play a decisive role in shaping how digital initiatives affect learning equity. Their everyday instructional choices determine whether technology expands opportunity or reinforces exclusion. Where teachers are confident and supported, digital tools can help reach learners who were previously disengaged. Where support is weak, platforms often remain peripheral to classroom practice.

India has made measurable progress in expanding school connectivity and teacher participation in digital systems. A large proportion of government school teachers are now registered on

national and state platforms, and enrolment in online professional development programmes has increased sharply since the pandemic. This growth signals openness to digital modes of teaching and learning. Yet participation figures alone do not reflect classroom impact. Many teachers continue to work in schools with limited devices, unstable connectivity, and high student–teacher ratios, which restrict the scope for sustained digital integration.

Digital pedagogy requires more than operational familiarity with platforms. Teachers must interpret learner data, adjust pacing, and design activities that work across online and offline settings. Surveys and field reports suggest that while many teachers have acquired basic technical skills, fewer feel confident in using digital tools to personalise instruction or support struggling learners. Training programmes that emphasise tool usage without linking it to subject-specific pedagogy often fail to influence practice meaningfully.

Contextual and gendered constraints further shape teachers' capacity to act as mediators of digital equity. Female teachers, especially in rural areas, frequently balance professional responsibilities with significant domestic workloads, limiting time for self-directed professional learning. Teachers in multilingual classrooms face additional challenges in adapting digital content to local languages and cultural references. In low-resource schools, teachers must design lessons that function with minimal or shared devices, requiring improvisation and careful planning.

There are, however, encouraging examples of teacher-led innovation. In several states, teachers have used simple diagnostics to form small learning groups and assign targeted digital or blended activities. Peer learning circles and informal mentoring networks have enabled rapid sharing of practical strategies, such as using short audio explanations or community-based practice sessions. Where school leaders prioritise instructional support over

administrative compliance, teachers are more willing to experiment and refine inclusive digital practices.

Recent learning recovery efforts indicate that teacher-mediated interventions can significantly accelerate progress when they are well targeted. Programmes that combine brief training, ongoing coaching, and classroom-level feedback report higher levels of instructional change than one-off online courses. At the same time, many teachers note that without alignment between professional development, curriculum expectations, and assessment practices, new approaches are difficult to sustain.

Policy responses must therefore recognise teachers as central agents of digital equity. Investment is needed in continuous, context-sensitive professional development that foregrounds pedagogy rather than technology alone. Teachers require protected time for planning and collaboration, realistic expectations of digital use, and accountability frameworks that value inclusive practices. Technology can support equity only when teachers are enabled to interpret, adapt, and humanise it for learners at the margins.

Equally important is localised evaluation of teacher practice. Monitoring systems should examine whether digital tools help re-engage previously excluded learners, support multilingual instruction, and inform small-group teaching. When evaluation focuses on pedagogical impact rather than platform usage alone, teachers and systems can learn what works and refine digital education as a sustained pathway toward equity.

5. Platforms, Policies, and Power: Governance Challenges in Digital Education

Digital education in India is increasingly shaped by large-scale platforms and policy frameworks that determine what learning looks like, who participates, and whose knowledge is prioritised. National and state platforms now mediate curriculum delivery, teacher training, assessment, and data flows at an unprecedented

scale. This expansion has improved reach and coordination, but it has also concentrated power in a small number of technological and administrative systems. Governance choices made at this level have deep pedagogical and equity implications.

One major governance challenge lies in the tension between scale and diversity. Platforms are designed to serve millions of users efficiently, which often leads to standardised content, uniform assessment formats, and centralised decision-making. While this supports consistency, it risks marginalising learners whose linguistic, cultural, or learning needs fall outside dominant templates. Empirical reviews of platform usage patterns show that engagement drops when content lacks local relevance or assumes uninterrupted connectivity. Equity-oriented governance must therefore balance national coherence with meaningful decentralisation.

Data governance has emerged as another critical concern. Digital education systems now collect extensive data on students and teachers, including attendance, performance, and behavioural patterns. These data are used to inform policy decisions and programme monitoring. However, uneven digital literacy among users means that many learners and teachers have limited awareness of how their data are stored, shared, or analysed. Incidents of data exposure in recent years have underscored the vulnerability of low-visibility populations who lack institutional voice or legal recourse. Strong safeguards, transparency, and clear accountability mechanisms are essential to prevent new forms of exclusion and surveillance.

Public–private partnerships have accelerated innovation but have also reshaped power relations in education. Private edtech providers contribute technical expertise, rapid deployment, and user-friendly design. At the same time, reliance on proprietary platforms raises questions about long-term sustainability, content control, and public ownership of educational infrastructure.

Evidence from state-level implementations suggests that when public systems lack negotiation capacity, pedagogical priorities can be driven by platform features rather than educational need. Governance frameworks must therefore clarify roles, protect public interest, and ensure alignment with equity goals.

Language policy within digital platforms illustrates how governance decisions affect inclusion. Although policy documents emphasise multilingual education, implementation often lags behind intent. Platform interfaces may support multiple languages, yet subject content, assessments, and teacher resources remain unevenly distributed across them. Usage data from several states indicate higher engagement when learners can navigate platforms fully in their home language. Governance mechanisms that incentivise content creation and review in regional languages can significantly broaden participation.

Policy coherence across sectors remains uneven. Education policies increasingly reference digital innovation, but alignment with policies on connectivity, disability inclusion, child protection, and data governance is still evolving. Fragmented implementation can place additional burdens on schools and teachers, who must navigate multiple systems with differing requirements. Integrated governance structures that coordinate across ministries and levels of administration are more likely to support sustained and equitable digital education.

Emerging governance models point toward more participatory approaches. Some state initiatives now incorporate teacher feedback, community consultation, and iterative platform design based on classroom realities. Early evidence suggests that when users have channels to influence design and implementation, adoption improves and unintended exclusions are reduced. Such models challenge top-down assumptions and recognise that equity is not an automatic outcome of technology deployment.

Governance in digital education is ultimately a question of power and accountability. Platforms and policies shape whose voices are heard, whose needs are prioritised, and how success is defined. An equity-oriented approach requires transparent decision-making, robust public oversight, and continuous attention to the lived experiences of marginalized learners. Without these safeguards, digital education risks becoming efficient but unjust. With them, it can evolve into a public good that supports inclusion, dignity, and democratic learning futures.

6. Conclusion

Digital education does not automatically translate into educational equity. Its effects are shaped by the interaction of pedagogy, teachers, platforms, and policy within deeply unequal social contexts. The post-pandemic expansion of digital learning in India has widened access and visibility, yet it has also revealed persistent barriers linked to poverty, gender, language, disability, and institutional capacity. These realities underline that equity cannot be achieved through infrastructure or platforms alone, but must be intentionally designed into educational processes.

A key insight emerging from this discussion is the centrality of pedagogy. Digital tools contribute to inclusion only when they support learning agency, enable feedback, and allow adaptation to local contexts. Teachers remain pivotal in translating technology into meaningful learning experiences. Their professional judgement, contextual knowledge, and capacity to mediate between learners and digital systems determine whether marginalised students are supported or further excluded. Strengthening teacher preparation and providing sustained instructional support are therefore foundational to any equitable digital strategy.

Governance and policy choices also shape the distribution of benefits in digital education. Decisions related to platform design, language provision, data use, and public–private collaboration

influence whose knowledge is valued and whose needs are prioritised. Equity-oriented governance requires transparency, public accountability, and mechanisms that allow educators and communities to shape digital systems rather than merely adopt them.

Future directions point toward integrated and socially grounded models of digital education. Blended approaches that connect digital resources with classroom practice and community engagement offer greater potential for inclusion than fully centralised or platform-driven solutions. Emphasis on multilingual design, formative assessment, and ethical data practices will be critical in sustaining learner participation and trust. By centring marginalised learners and aligning digital innovation with social justice principles, the chapter reinforces the volume's broader commitment to bridging learning gaps and advancing digital equity in the post-pandemic era.

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6

Gender, Technology, and Learning
Breaking Barriers in Digital Spaces

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Abstract

Digital learning has become a defining feature of contemporary education in India, reshaping how knowledge is accessed, mediated, and assessed. This shift has generated new opportunities for flexible and expanded learning, while also bringing long-standing gender inequalities into sharper focus. The chapter explores how gender influences access, participation, and agency within digital learning environments, emphasizing that technology does not operate in isolation from social and institutional contexts. Through an examination of post-pandemic educational practices, the discussion highlights how digital platforms can reinforce existing hierarchies or serve as sites of inclusion, depending on how they are designed and governed. Particular attention is given to the role of teachers, the pedagogical use of technology, and the implications of surveillance and online safety for women and girls. Grounded in the Indian context, the chapter argues that digital equity requires more than infrastructure; it demands gender-responsive pedagogy, ethical governance, and sustained institutional commitment. By situating gender at the centre of digital education debates, the chapter advances a nuanced understanding of how learning gaps can be addressed alongside broader goals of social justice.

Keywords: *Gender and Education; Digital Pedagogy; Digital Equity; Technology and Social Justice; Indian Education*

1. Introduction

The rapid expansion of digital technology has fundamentally altered the landscape of education in India. What began as an emergency response during the pandemic has now evolved into a more permanent restructuring of teaching and learning across schools, colleges, and universities. Online platforms, virtual classrooms, and mobile-based learning have extended educational reach and introduced new forms of flexibility. At the same time, these shifts have exposed longstanding inequalities that shape who can access, navigate, and benefit from digital learning environments.

Gender has emerged as a critical axis of this inequality. While internet connectivity and smartphone use have increased across regions, women and girls continue to face disproportionate barriers to digital access. In many households, devices are shared or prioritised for male members, limiting women's ability to participate consistently in online learning. Constraints related to affordability, digital skills, and social norms further restrict engagement, particularly for learners in rural areas and among first-generation students. These patterns reveal that digital access is not simply a technical issue but a deeply social one, embedded in everyday power relations.

The educational consequences of these disparities are increasingly visible. Limited access to devices and stable connectivity reduces participation in online classes, constrains exposure to digital resources, and weakens learning continuity. For adolescent girls and young women, digital exclusion often intersects with expectations around domestic responsibilities and mobility, narrowing their educational trajectories. Even when platforms are technically available, unequal confidence, fear of online surveillance, and concerns about safety shape how learners engage with digital spaces.

Yet the digital turn in education has also opened new possibilities. Community-based digital learning initiatives, women-led technology collectives, and public digital platforms have demonstrated how targeted interventions can expand access and build confidence among girls and women learners. In several regions, digital tools have enabled flexible learning schedules, access to high-quality content, and new forms of peer support that were previously unavailable. These experiences suggest that technology, when designed and implemented with sensitivity to gendered realities, can act as a powerful enabler rather than a barrier.

Understanding the relationship between gender, technology, and learning therefore requires moving beyond narratives of access alone. Attention must be given to how digital environments are structured, who feels welcome within them, and whose voices are amplified or silenced. By situating digital learning within India's social and cultural contexts, the discussion that follows examines the conditions under which technology can either reinforce inequality or contribute meaningfully to educational equity in the post-pandemic era.

2. The Gendered Digital Divide in India: Access, Agency, and Aspirations

The gendered digital divide in India is most often discussed in terms of access, yet access itself remains uneven and layered. India's internet user base has expanded rapidly in recent years, reaching hundreds of millions across urban and rural regions. This growth has created new possibilities for digital learning, especially through mobile-based platforms. However, women and girls continue to be less likely than men to own personal devices or enjoy uninterrupted internet access, particularly in low-income and rural households.

Recent national-level data reveal persistent gender gaps in digital access and device ownership. While overall connectivity has

improved, women's engagement with mobile internet and smartphones remains significantly lower than that of men. A brief overview of key indicators helps illustrate the scale of this imbalance.

Indicator (India, recent estimates)	Approximate Value
Total active internet users	Around 880–900 million
Women using mobile internet	About one-third of women
Gender gap in mobile phone ownership	Around 8 percent
Gender gap in smartphone ownership	Around 13–14 percent

These figures point to a structural problem that goes beyond infrastructure. In many households, access is shared rather than individual. Phones are often controlled by male members, and women's use is restricted by time, domestic responsibilities, or concerns about cost. For students, this translates into irregular participation in online classes, difficulty completing assignments on time, and limited engagement with interactive learning platforms. The quality of access, rather than mere availability, shapes learning outcomes.

Agency forms the second, less visible dimension of the divide. Agency refers to the ability to make independent decisions about how technology is used. Even when devices are available, girls and women frequently experience lower confidence in navigating digital tools, platforms, and online learning systems. Concerns about privacy, online harassment, and constant monitoring further constrain participation. In educational settings, this can result in reduced visibility, reluctance to speak in virtual classrooms, and limited experimentation with advanced digital skills.

Aspirations connect access and agency to future possibilities. For many girls, the perceived value of digital learning is shaped by social expectations and economic realities. When technology is seen primarily as entertainment or as a potential moral risk, families may discourage sustained engagement. By contrast, when digital

skills are clearly linked to education, employment, or entrepreneurship, aspirations shift. Programmes that showcase women using technology for teaching, creative work, or income generation often have a measurable impact on how girls and their families view digital learning.

Geographical and social inequalities intensify these patterns. Rural learners face challenges related to connectivity and institutional support, while first-generation learners often lack guidance on navigating digital academic spaces. Caste, class, and language further mediate digital participation, creating overlapping forms of exclusion. As a result, national averages can mask sharp regional and community-level disparities.

Addressing the gendered digital divide therefore requires a broader lens. Expanding access remains essential, but it must be accompanied by efforts to strengthen agency and nurture aspirations. Digital literacy initiatives, safe learning environments, mentorship, and community engagement play a critical role in transforming devices into tools for learning and empowerment. When access, agency, and aspirations are addressed together, digital education holds greater promise for reducing gender-based inequities rather than reproducing them.

3. Learning Spaces and Power Relations in Digital Environments

Digital learning environments are not neutral or value-free spaces. They are shaped by social norms, institutional priorities, and technological design choices that influence how power circulates within them. In India's post-pandemic educational landscape, the rapid expansion of online classrooms and platform-based learning has altered traditional teacher–student relationships while also reproducing familiar hierarchies. Access to stable connectivity, private learning spaces, and uninterrupted time continues to

determine who can participate fully, speak confidently, and remain visible in digital classrooms.

The structure of digital platforms plays a significant role in shaping participation. Synchronous online sessions often privilege learners who can remain continuously connected and attentive, a condition not equally available to all students. Many girls and women navigate online learning alongside domestic responsibilities, shared devices, and fluctuating data access. These constraints push them toward passive modes of engagement, such as watching recorded lectures rather than participating in live discussions. Over time, such patterns can reinforce silence and marginality, even when formal enrollment and attendance appear satisfactory.

Language and interface design further mediate power relations. Learning platforms and digital content are frequently dominated by English, technical jargon, and fast-paced instructional formats. For learners who rely on regional languages or who are new to digital academic spaces, this creates an additional cognitive and emotional burden. The assumption that learners can independently navigate complex interfaces or engage in self-directed learning overlooks gendered differences in prior exposure and digital confidence. As a result, technological design choices intersect with social hierarchies to shape unequal learning experiences.

Digital environments also reconfigure authority and surveillance. Tools used for monitoring attendance, tracking engagement, and conducting online assessments introduce new forms of oversight. While intended to ensure accountability and academic integrity, these mechanisms can heighten anxiety and discourage experimentation. Learners who lack private spaces or stable connectivity are more likely to be flagged as irregular or disengaged, reinforcing deficit narratives. For women learners, concerns about being observed or recorded in domestic settings further limit active participation, particularly in video-based interactions.

At the same time, digital spaces hold the potential to challenge traditional hierarchies when thoughtfully designed. Discussion forums, collaborative documents, and peer-based learning activities can offer alternative avenues for expression beyond oral participation. When educators intentionally create multiple modes of engagement, students who might remain silent in physical classrooms often find new ways to contribute. Such practices can redistribute voice and foster confidence, especially for learners who are hesitant to speak in public or mixed-gender settings.

Institutional choices strongly influence whether digital learning spaces reproduce or disrupt power imbalances. Decisions regarding platform selection, teacher training, content localization, and student support systems shape everyday learning realities. Institutions that prioritise scale without addressing pedagogy and inclusion risk deepening inequalities. In contrast, those that invest in gender-sensitive instructional design, teacher capacity-building, and learner support mechanisms create conditions for more equitable participation.

4. Teachers, Pedagogy, and Gender-Responsive Use of Technology

Teachers are central to shaping how technology affects learning. Their decisions determine whether digital tools reinforce existing patterns or open space for greater inclusion. In India, teacher engagement with digital pedagogies expanded sharply during and after the pandemic. Many educators adopted new platforms, experimented with blended instruction, and learned to use multimedia resources. For some, this shift increased flexibility and responsiveness. Students who struggled in traditional settings found alternative ways to engage. Yet the pace of change has not been uniform across regions or levels of education.

A significant challenge lies in **teacher readiness**. Data from recent surveys show that while a large proportion of teachers report basic

familiarity with digital tools, far fewer feel confident in integrating technology into pedagogical planning. Confidence gaps are higher among teachers in rural and resource-constrained settings. In these contexts, access to reliable internet and institutional support for professional learning remain limited. Without sustained training and mentoring, teachers default to using technology as a substitute for traditional lecturing rather than as a way to enhance interaction or differentiate instruction.

Gender-responsive pedagogy requires more than technical skill. It requires teachers to see how gender norms shape participation, communication, and self-efficacy in digital spaces. For example, girls may hesitate to unmute or turn on their cameras due to privacy concerns or social norms. Without intentional facilitation, such silence may be misinterpreted as disengagement. Effective teachers recognise these patterns. They use multiple modes of participation, such as polls, chat functions, and small-group breakout activities. These strategies can reduce performance pressure and increase participation for learners who might otherwise remain on the margins.

Professional development programs that focus on gender and technology show early signs of impact where they are implemented systematically. Workshops that combine technical skills with reflective practice help teachers examine their own assumptions about learners. Where training explicitly addresses issues of equity and inclusion, teachers are better positioned to adapt content, structure activities thoughtfully, and monitor participation with sensitivity. Still, these programs are unevenly distributed. Urban districts and private schools are more likely to offer ongoing, structured professional learning. In contrast, many government schools rely on one-off training events with limited follow-up.

Curriculum materials and platform design also interact with teacher practice. Many digital resources are developed for broad audiences and assume high levels of literacy and self-directed learning.

Teachers who work with students with diverse language backgrounds or varying digital fluency often need to localise and adapt content. When such adaptations are not supported by institutional time or resources, the burden falls entirely on individual teachers. In the absence of clear guidelines, teachers may avoid using richer, interactive tools and stick to basic text or slide-based modes that do little to engage diverse learners.

Assessment practices remain another area of tension. Digital assessments can provide rapid feedback and data for instructional planning. Yet high-stakes, automated testing models risk sidelining the formative, dialogic aspects of assessment that support deep learning. Teachers who balance technology-enabled assessment with dialogue and scaffolded tasks tend to see better engagement from all learners, including girls and other marginalised groups. This balanced approach requires time, planning, and ongoing support from school leadership.

Progress is visible where systems treat teacher capacity building as continuous and context sensitive. Schools that prioritise collaborative learning among teachers create spaces for shared experimentation. When educators share successful practices for engaging girls in digital tasks, the collective capacity grows. Conversely, where professional learning is sporadic, isolated, or framed solely as upskilling, the potential to change pedagogical culture is limited.

5. Safety, Surveillance, and Gendered Vulnerabilities in Digital Learning Spaces

Digital learning spaces are shaped not only by access and pedagogy, but also by the conditions under which learners feel safe and supported. Safety in online environments is a foundational concern for gender equity. For many girls and women in India, the fear of harassment, exposure to unsolicited contact, and lack of control over personal data create barriers to meaningful

engagement. These concerns are not abstract. Patterns of online abuse and intrusive behaviour influence how learners participate, what they choose to share, and how much time they spend in digital classrooms.

In virtual settings, the absence of physical proximity can both reduce and magnify risks. On one hand, learners who have felt intimidated in face-to-face spaces may find digital forums less threatening. On the other hand, the anonymity of the internet enables forms of harassment and inappropriate messaging that are difficult to monitor or regulate. For many women, the threat of harassment constrains their willingness to turn on cameras, speak in live sessions, or engage in public discussion boards. Over time, this can solidify patterns of disengagement that mirror offline exclusions.

Surveillance mechanisms embedded in educational technologies compound these vulnerabilities. Automated attendance logs, proctoring tools that monitor eye movement or screen behaviour, and analytics dashboards collect detailed data about learners' actions. While these tools are often justified as measures to safeguard academic integrity or personalise support, they also intrude into learners' private lives. For students who share living spaces with family members, constant monitoring can blur boundaries between study and home, leading to stress and self-censorship. The psychological burden of being watched can be especially acute for girls whose mobility and privacy are already circumscribed in offline contexts.

The logic of surveillance extends beyond formal classrooms. Social learning platforms, messaging groups, and informal peer networks generate data trails that are often unregulated. Girls may internalise norms of self-surveillance to avoid criticism or scrutiny from peers and family. This internalisation affects how they present themselves, how they manage their time online, and how they prioritise visible forms of participation. In effect, power relations

move from external enforcement to self-policing, making participation contingent on conformity rather than exploration.

Emerging evidence underscores how these dynamics influence learning outcomes. Learners who report feeling unsafe or observed in digital spaces are less likely to take risks, ask questions, or pursue asynchronous learning opportunities. This affects not only academic engagement but also broader confidence with technology. When safety concerns are left unaddressed, digital learning can replicate the social anxieties of physical classrooms rather than dismantle them.

Yet concerns about safety and surveillance also open avenues for rethinking governance and design. Policies that foreground privacy protections, transparent data use, and community standards have the potential to shift the culture of digital learning. Platforms that allow learners control over their profiles, multimedia settings, and visibility create conditions for agency rather than exposure. Schools and institutions that establish clear codes of conduct for online interaction, with procedures for reporting and redress, signal that digital safety is not peripheral but central to educational practice.

Equipping learners with digital literacy skills that include safety competencies is equally critical. Understanding how to navigate privacy settings, recognise manipulative behaviour, and manage digital footprints empowers students. For girls and women, these competencies intersect with broader questions of autonomy and agency. When learners can protect themselves and make informed choices about their digital presence, they are better positioned to engage fully with learning opportunities.

Safety and surveillance are therefore not technical issues alone. They reflect deeper social norms about control, visibility, and legitimacy in learning spaces. Addressing gendered vulnerabilities requires systemic attention to how digital environments are structured, governed, and experienced. Only by integrating safety

into the core of digital pedagogy and technology policy can learning spaces become truly inclusive rather than quietly exclusionary.

6. Conclusion

The discussion throughout this chapter demonstrates that digital learning in India cannot be understood through technology alone. Gender continues to shape access, participation, safety, and visibility within digital education, often reproducing inequalities that exist beyond the classroom. While online platforms have expanded educational reach, they have also exposed how household norms, institutional arrangements, and platform designs interact to influence who benefits from digital learning and who remains marginalised.

The analysis reinforces the importance of teachers, institutional leadership, and governance frameworks in shaping equitable digital environments. Gender-responsive pedagogies, ethical engagement with educational technologies, and sustained attention to learner safety and agency emerge as essential conditions for inclusion. Where these elements are absent, digital initiatives risk deepening existing divides. Where they are embedded thoughtfully, technology can support confidence, participation, and meaningful learning for girls and women.

Future progress depends on coordinated and context-sensitive action. Infrastructure development must be accompanied by investments in teacher capacity, learner support systems, and privacy-aware technology design. Equally vital is the involvement of communities in challenging restrictive norms and redefining aspirations around digital learning. By placing gender at the centre of digital equity debates, this chapter contributes to the broader purpose of the volume, affirming that bridging learning gaps in the post-pandemic era requires social insight, institutional responsibility, and a sustained commitment to justice alongside innovation.

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7

Caste, Class, and Connectivity: Rethinking Educational Access

Sunati Mondal

Abstract

Digital education has become a defining feature of contemporary schooling in India, reshaping how knowledge is accessed, delivered, and governed. The rapid shift to online and hybrid learning during the COVID-19 pandemic brought this transformation into sharp focus, revealing not only new possibilities but also persistent inequalities rooted in caste, class, and social power. This chapter explores how digital connectivity interacts with these structural conditions to shape educational access in the post-pandemic landscape. It demonstrates that access to technology alone does not guarantee equitable learning outcomes. Differences in household resources, institutional capacity, linguistic inclusion, and digital governance strongly influence who benefits from digitally mediated education. The chapter also examines emerging concerns around data, surveillance, and accountability, arguing that unchecked digital systems can generate subtle yet enduring forms of exclusion. By reframing digital education as a social and political process, the chapter contributes a critical perspective to debates on equity and inclusion in India's evolving educational ecosystem.

Keywords: *Digital education; Caste and class; Connectivity and access; Social justice; Educational inequality*

1. Introduction

Education in India has entered an era defined by rapid technological change. The post-pandemic world has accelerated the adoption of digital tools across classrooms, higher education, and lifelong learning. From government programmes aimed at universal connectivity to a booming ed-tech ecosystem serving millions of learners, the idea that technology can expand access and improve outcomes has gained wide acceptance. Yet this moment of transformation has also laid bare long-standing inequalities embedded in Indian society. Caste and class, two of the most persistent axes of social stratification, continue to shape who benefits from digital opportunities and who remains on the margins. The promise of connectivity, in other words, has not translated automatically into equitable access or social justice.

The shift to online and hybrid models during the pandemic was a turning point. Where schools and colleges abruptly closed their doors in early 2020, virtual platforms became the default means for teaching and learning. Urban middle-class children logged into live lessons on tablets and laptops, while many learners in rural or low-income households struggled to access a single smartphone, let alone sustained data. In remote hamlets and informal settlements, families juggled limited bandwidth among multiple children, often sacrificing uninterrupted learning. The rapid pivot brought innovation and resilience from educators, but also spotlighted deep gaps in infrastructure, affordability, and digital literacy that mirror broader socio-economic divides.

These disparities are not merely about devices and connectivity. They intersect with caste-based exclusion, linguistic barriers, gender norms, and economic hardship in ways that shape educational trajectories over the long term. A Dalit student in a small town may face not only limited internet access, but also a lack of local language content, fewer community resources, and lower expectations from institutions that are unprepared to support her

needs. A first-generation learner from a low-income household may find that digital platforms assume familiarity with technology and self-directed study habits that have never been cultivated. What emerges is a layered picture in which digital tools extend possibilities for some while reinforcing the structural barriers others negotiate daily.

At the same time, the Indian context offers unique opportunities for reimagining equitable access. Public initiatives aimed at expanding broadband to underserved districts, community-based digital literacy programmes, and collaborations between grassroots organisations and educational institutions point to models that combine technology with social inclusion. These developments signal that connectivity, if thoughtfully deployed, can serve as a bridge rather than a barrier. The challenge lies in moving beyond a narrow focus on access towards an understanding of meaningful participation—where learners not only log in but are empowered to engage, create, and succeed on terms that challenge rather than reproduce inequality.

This chapter takes up that challenge by exploring how caste, class, and connectivity intersect to shape educational access in contemporary India. It argues that digital equity cannot be achieved through infrastructure alone, but requires a holistic approach that recognizes social hierarchies, community contexts, and learner diversity. In examining recent trends, lived experiences, and future possibilities, the chapter aims to open new pathways for research, policy, and practice that situate technology within broader struggles for justice and inclusion.

2. The Pandemic as a Revealing Moment

The onset of the COVID-19 pandemic forced an abrupt restructuring of education delivery. Traditional classrooms were quickly replaced with digital platforms, creating an unplanned large-scale experiment in virtual learning. For many schools and

universities, this shift opened the door to flexible instruction and new pedagogical formats. However, it also exposed the unevenness of digital preparedness across India's diverse educational landscape. Where institutions had prior investments in digital infrastructure and trained faculty, the transition was smoother. In many others, teachers and students confronted unfamiliar technologies with little orientation or support.

At the heart of this unevenness was the stark disparity in access to devices and reliable internet. A significant proportion of Indian households, especially in rural areas and low-income urban settlements, lacked access to multiple devices per learner. In many families, a single smartphone had to serve not only learning but everyday communication, limiting the time students could spend on online lessons. Similarly, inconsistent electricity and poor network coverage further hindered sustained engagement with synchronous learning modalities. The result was a patchwork of participation levels that often aligned with socio-economic indicators rather than academic potential.

Emerging data from the pandemic period further illuminate these divides. The table below summarises key access indicators across broad demographic categories.

Table 1: Illustrative Digital Access Indicators during the Pandemic (Selected Groups)

Demographic Group	Device Access (%)	Regular Internet Connectivity (%)
Urban, Higher Income	High (80–90)	Very High (75–85)
Urban, Lower Income	Moderate (50–60)	Moderate (45–55)
Rural, Higher Income	Moderate (55–65)	Moderate (40–50)
Rural, Lower Income	Low (30–40)	Low (25–35)

These figures reflect that even within urban settings, economic status influenced access. Rural regions fared worse overall,

demonstrating the compounded effects of geography and class. The proportion of learners who could reliably log into live sessions on video was far smaller than that of those who could merely receive assignments or occasional text communications. This divergence in engagement quality underscored how digital access is multidimensional, encompassing not just physical connectivity, but the capacity to participate in substantive learning.

Beyond technology, the pandemic highlighted variations in institutional capacity to support students. Some schools developed robust systems of blended learning, combining low-tech and high-tech approaches, while others struggled with basic coordination. In communities with strong local networks and active parent-teacher associations, students often received supplementary support that helped mitigate gaps. In contrast, learners in isolated contexts, with limited family support for schooling, experienced prolonged disengagement. This uneven institutional response mirrored broader patterns of resource distribution across states, districts, and school types.

Importantly, the digital emergency did more than reveal existing gaps. It amplified them. Learners who were already marginalised due to caste-based disadvantage or economic precarity found themselves further distanced from educational continuity. The challenges were not simply temporary interruptions but disruptions with potential long-term consequences for attainment, retention, and future opportunities. In this way, the pandemic did not create educational inequality; it made the structure of that inequality more visible and urgent.

As the immediate crisis recedes, the lessons from this period remain critical. Understanding how unequal access manifested during the digital pivot offers a foundation for building more resilient and equitable systems. It calls for nuanced strategies that address both the hardware of connectivity and the social conditions that determine how technology is used. The next sections build on this

understanding to examine deeper structural dynamics and potential pathways toward inclusive digital education.

3. Technology and Social Stratification: Who Benefits from Digital Education?

The idea that digital technologies inherently democratise education has gained wide acceptance in policy and public discourse. However, evidence from the Indian context suggests a more complex reality. Digital education does not operate in a social vacuum. Its benefits are shaped by existing hierarchies of caste, class, gender, and geography. Rather than flattening inequalities, technology often reorganises them, rewarding those who already possess material resources, cultural capital, and institutional support.

Recent trends indicate a steady expansion of digital infrastructure across schools and higher education institutions. A growing number of schools report access to computers and internet facilities, and online platforms have become a routine part of academic delivery. Yet access remains uneven in quality and intensity. Urban private institutions are more likely to offer live interactive classes, digital assessments, and personalised feedback. In contrast, many government and rural schools rely on low-bandwidth solutions such as recorded videos or messaging applications, limiting opportunities for sustained engagement. The gap is not simply one of presence or absence of technology, but of how technology is embedded into teaching and learning practices.

Household-level conditions further stratify digital participation. Surveys conducted in recent years show increased smartphone penetration, but ownership rarely translates into uninterrupted educational use for students from low-income families. Shared devices, high data costs, and unstable electricity restrict learning time. Moreover, digital education assumes a degree of self-regulation, parental guidance, and familiarity with formal academic

norms. These assumptions tend to favour middle- and upper-class households, where parents are more likely to have formal education and experience with digital tools. For first-generation learners, navigating platforms, assignments, and online assessments can itself become a barrier.

Caste-based inequalities intersect with these material constraints in significant ways. Learners from historically marginalised communities often attend under-resourced schools and live in neighbourhoods with weaker digital infrastructure. They may also encounter language barriers when digital content privileges dominant languages or standardised cultural references. These structural conditions shape expectations and outcomes, making it harder for technology to function as an equaliser. In such contexts, digital platforms may widen achievement gaps by accelerating learning for some while leaving others behind.

The rapid growth of the ed-tech industry further illustrates how market-driven innovation aligns with social stratification. Many platforms are designed for students preparing for competitive examinations and cater primarily to those who can afford subscriptions, devices, and high-speed internet. While these platforms offer flexibility and scale, their reach remains socially skewed. Public and non-profit digital initiatives attempt to counterbalance this trend, but their impact depends on sustained teacher training, local adaptation, and institutional capacity, which vary widely across regions.

Policy frameworks increasingly acknowledge the need for inclusive digital education, emphasising teacher capacity building, multilingual content, and blended learning models. However, implementation challenges persist. Infrastructure rollouts are often uneven, teacher training focuses more on tool usage than pedagogy, and monitoring mechanisms tend to prioritise access indicators over learning outcomes. Without sustained attention to social context,

such interventions risk reproducing the very inequities they aim to address.

4. Voices from the Margins: Lived Experiences of Learners and Teachers

The impact of digital education is most clearly understood through the experiences of those positioned at the margins of the system. For many learners from rural areas, low-income households, and historically marginalised communities, the digital turn has been both enabling and exclusionary. On the one hand, online platforms have offered access to learning materials beyond local schools. On the other, structural constraints have limited their ability to benefit fully from these opportunities. These contrasting experiences reveal how technology interacts with social context rather than overriding it.

Recent field-level surveys and institutional reports indicate that a significant share of students in government schools relied on asynchronous modes of learning during and after the pandemic. Recorded lessons, shared PDFs, and messaging applications became the primary channels of instruction. While this flexibility allowed students to access content at convenient times, it also reduced real-time interaction with teachers. Learners frequently reported difficulty in seeking clarification, maintaining motivation, and managing self-paced study. For first-generation students, the absence of immediate academic guidance often translated into learning gaps that accumulated over time.

Teachers working in resource-constrained settings describe a parallel set of challenges. Many adapted quickly, using personal devices and self-taught digital skills to remain connected with students. This period witnessed notable pedagogical creativity, including the use of voice notes, community radio, and printed worksheets combined with digital follow-up. At the same time, teachers reported increased workloads, blurred boundaries between

professional and personal time, and limited institutional support. Data from teacher associations suggest that a substantial proportion of educators in rural schools lacked formal training in digital pedagogy, relying instead on informal peer learning and trial-and-error methods.

Gendered experiences further complicate the picture. Adolescent girls in low-income households often faced restricted access to devices due to domestic responsibilities and social norms prioritising male family members' education. Surveys conducted in several states during the post-pandemic phase show that girls were more likely than boys to miss live online classes and less likely to have exclusive device access. However, some girls also reported that recorded lessons and flexible schedules enabled continued learning alongside household work, indicating that digital formats can both constrain and support participation depending on design and context.

Students from Dalit and Adivasi communities highlight additional layers of exclusion. Limited local infrastructure, language mismatches in digital content, and weak school-level support reduced the effectiveness of online learning. Yet, there are also accounts of students using digital platforms to access alternative learning communities, scholarships, and mentoring networks beyond their immediate environment. These cases illustrate the potential of technology to expand horizons when combined with supportive ecosystems and sustained engagement.

5. Power, Data, and Surveillance: New Forms of Exclusion in Digital Education

As digital education expands, questions of power and control move to the foreground. Platforms used for learning, assessment, and administration increasingly rely on data-intensive systems. Attendance dashboards, learning analytics, facial recognition, and online proctoring have become routine in many institutions. These

tools are often justified in the language of efficiency, accountability, and quality assurance. Yet they also reshape relationships between learners, teachers, institutions, and the state in ways that demand critical attention.

Empirical patterns from schools and universities adopting digital monitoring systems reveal uneven consequences. Students with stable internet, quiet study spaces, and high digital fluency navigate surveillance with relative ease. Others face repeated disruptions. Poor connectivity can trigger flags for absenteeism. Shared devices can compromise identity verification. Crowded living conditions can be misread as rule violations during online assessments. In such cases, technological systems convert structural disadvantage into individualised signals of non-compliance, shifting responsibility away from institutions and onto learners.

Data practices also raise concerns about visibility and vulnerability. Marginalised students often have limited choice in opting out of digital systems imposed by schools or universities. Their data are collected, stored, and analysed with little transparency. Teachers report pressure to meet performance metrics generated by platforms, sometimes at the cost of contextual judgement. These dynamics centralise authority in platform providers and administrators, while reducing the agency of educators and learners who must adapt to opaque algorithms and standardised benchmarks.

The expansion of online proctoring during examinations illustrates these tensions clearly. Reports from multiple states indicate increased student anxiety, higher rates of technical failure, and contested allegations of misconduct. For learners unfamiliar with formal digital protocols, the experience can be intimidating and exclusionary. Rather than ensuring fairness, such systems may reproduce bias by privileging students whose social environments align with the assumptions embedded in the technology.

At the policy level, digital governance frameworks are still evolving. While national initiatives emphasise innovation and scale, institutional safeguards around data protection, consent, and accountability remain uneven. Many schools lack clear protocols for data use or grievance redressal. This regulatory gap disproportionately affects those with limited legal awareness or bargaining power. In effect, digital education risks creating a new axis of inequality, where exclusion is no longer only about access to learning, but about exposure to unchecked surveillance.

At the same time, emerging practices point to alternative possibilities. Some institutions are experimenting with low-surveillance assessment models, open-book formats, and community-based accountability. Teacher-led digital practices emphasising trust, dialogue, and formative feedback demonstrate that technology need not be punitive or extractive. These approaches suggest that the issue lies not in digital tools themselves, but in how power is configured through their design and use.

Reframing digital education through the lens of power invites a shift in priorities. Equity requires not only connecting learners, but protecting their dignity, privacy, and agency. Data should serve pedagogical insight rather than institutional control. Without such recalibration, digital systems risk deepening exclusion in subtle but enduring ways. The final section turns to future-oriented pathways that reimagine access, design, and accountability in pursuit of genuinely inclusive digital education.

6. Conclusion

This chapter has examined digital education in India as a socially embedded process shaped by caste, class, and power, rather than a neutral technological shift. The pandemic served as a critical moment that exposed deep inequalities in access, participation, and institutional capacity. While digital tools expanded learning

opportunities for some, they simultaneously intensified exclusion for learners already positioned at the margins. Access to devices and connectivity emerged as necessary but insufficient conditions for equity. Household context, school resources, language, and social identity proved equally decisive in determining who benefits from digital education.

The analysis highlights that technology often reorganises existing hierarchies unless deliberate corrective measures are built into policy and practice. Market-driven ed-tech models tend to privilege those with economic and cultural capital. Surveillance-based systems risk converting structural disadvantage into individual deficit. At the same time, the chapter has shown that alternative pathways exist. Teacher innovation, community-based support, low-surveillance pedagogies, and context-sensitive digital design demonstrate that technology can support inclusion when guided by social purpose rather than scale alone.

Looking ahead, the pursuit of digital equity requires a shift from expansion to transformation. Future strategies must prioritise meaningful participation, learner agency, and institutional accountability. This involves integrating social justice into digital governance, strengthening teacher capacity beyond technical skills, and designing platforms that reflect India's linguistic, cultural, and socio-economic diversity. For researchers, the findings call for deeper engagement with lived experiences and disaggregated outcomes. For policymakers, they underscore the need to align connectivity initiatives with safeguards for dignity and inclusion.

By situating connectivity within the realities of caste and class, this chapter contributes to the book's broader argument that bridging learning gaps in the post-pandemic era is as much a social challenge as a technological one. Digital equity in education will remain incomplete unless it confronts the structures that shape who is seen, who is heard, and who is empowered to learn.

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8

The Ethics of Digital Inclusion: Addressing Invisible Inequities

Moumita Paul

Abstract

Digital technologies now occupy a central place in educational policy and practice, often promoted as neutral tools capable of closing long-standing learning gaps. This chapter questions that assumption by examining how digital expansion can simultaneously enable access and conceal new forms of exclusion. Focusing on the Indian educational landscape, it argues that digital inclusion must be understood as an ethical challenge shaped by power, pedagogy, and social context, rather than as a problem of infrastructure alone. The chapter traces how invisible inequities emerge through platform design, assessment practices, institutional capacity, and household conditions, affecting who participates meaningfully in digital learning and who remains marginalised. It highlights the ethical role of teachers and institutions in mediating these dynamics, as well as the often-overlooked agency of families and communities in sustaining digital education. By bringing these strands together, the chapter proposes an ethics-centred approach to digital inclusion that foregrounds justice, participation, and contextual sensitivity. In doing so, it contributes to broader debates on digital equity by emphasising that bridging post-pandemic learning gaps requires moral clarity alongside technological innovation.

Keywords: *Digital inclusion, ethics in education, platform design, community agency, educational justice*

1. Introduction

The transition to digital modes of teaching and learning has been among the defining shifts in education over the past decade. Technology is increasingly seen as central to expanding opportunities, enhancing pedagogical practices, and equipping learners with skills for an interconnected world. In India this vision has been reflected in ambitious programmes and rapid expansion of digital infrastructure, alongside efforts to integrate digital literacy into school and teacher education. Recent initiatives at state and local levels demonstrate a strong commitment to embedding digital tools in educational ecosystems, from smart classrooms and teacher training in artificial intelligence to the establishment of digital learning hubs in remote districts. These efforts signal both the promise and the urgency of digital inclusion in a country where educational access and quality have long been uneven.

Yet, beneath the expanding footprint of digital technologies lies a persistent reality: transformative potential does not automatically translate into equitable experience. Statistics on digital infrastructure reveal stark gaps. For a significant proportion of Indian schools, basic access to functional computers and reliable internet remains limited, especially in rural and economically disadvantaged regions. This uneven connectivity is mirrored in household access: a large share of rural families continue to lack regular internet access, and disparities in device ownership cut across economic, social, and geographical lines. What is striking in these figures is not only the scale of exclusion but also its persistence despite years of policy emphasis on digital education.

The COVID-19 pandemic brought these invisible divides into sharper relief. The abrupt closure of schools transformed digital platforms from optional enhancements to essential conduits of learning. Millions of students without adequate devices, connectivity, or digital skills were effectively excluded from the classroom. In many instances, familiar markers of disadvantage

such as rural residence, low household income, or linguistic marginalisation — translated directly into diminished access to education. These patterns were not simply temporary disruptions but continuations of long-standing structural inequities that digital expansion alone has neither addressed nor rectified.

Understanding digital inclusion purely as a matter of access the distribution of devices or expansion of connectivity risks obscuring subtler forms of exclusion that shape who participates meaningfully in digital learning and who remains marginalised. Beyond physical access, disparities in digital literacy, the capacity to engage with educational platforms, and the cultural relevance of digital content deeply influence learning experiences. These invisible inequities shape educational outcomes and future opportunities in far more consequential ways than simple connectivity statistics might suggest.

In the Indian context, where diversity in language, socioeconomic status, and educational infrastructure is profound, ethical questions about digital inclusion extend beyond technical fixes. They challenge educators, researchers, and policymakers to confront the ways in which digital systems may inadvertently reproduce existing social hierarchies. This chapter explores these dimensions of digital inclusion with a focus on identifying and addressing the invisible inequities that persist beneath the surface of access metrics. It aims to broaden the conversation from questions of infrastructure and participation to issues of justice, agency, and democratic engagement in education's digital future.

2. Mapping Invisible Inequities in India's Digital Learning Landscape

India's digital expansion presents an image of rapid progress and growing reach. Mobile network coverage now extends to most inhabited regions, and the number of internet users has grown steadily across urban and semi-urban areas. On the surface, this

suggests that digital access has become nearly universal. Yet this broad picture conceals deeper inequalities that shape how learners actually experience digital education. The ethical challenge lies in recognising that connectivity at the national or regional level does not automatically translate into meaningful access at the level of the learner.

One of the most persistent invisible inequities emerges within school infrastructure itself. While many schools report some form of internet connectivity, a far smaller proportion have stable, functional access that can support regular digital teaching. Government and rural schools are particularly affected, often relying on intermittent connections, limited hardware, or shared facilities. As a result, digital learning remains peripheral rather than integrated into everyday classroom practice, reinforcing long-standing disparities between well-resourced institutions and those already struggling with basic educational provision.

A related layer of exclusion is located within households. Device ownership remains uneven, especially in rural and economically vulnerable families. In many homes, a single smartphone serves multiple users, limiting the time and attention available for educational purposes. Low-cost devices with limited storage and processing capacity further restrict the kinds of learning activities students can undertake. These constraints shape not only access but the quality of engagement, privileging passive consumption of content over interactive and collaborative forms of learning.

Indicator	Recent trend
Villages with mobile network coverage	Above 95%
Schools with functional internet access	Around two-thirds
Active internet users in India	Over 850 million

The figures above illustrate a recurring contradiction in India's digital education landscape. Network coverage and user numbers are high, yet institutional readiness and household usability lag

behind. This gap explains why many learners remain digitally present but pedagogically marginalised, unable to benefit fully from online or blended learning environments.

Social and cultural factors further deepen invisible inequities. Gendered access to technology remains a significant concern, with girls often facing restrictions on device use due to household responsibilities or safety norms. Linguistic diversity poses another challenge, as digital platforms and educational content tend to privilege dominant languages, limiting accessibility for learners from regional and minority language backgrounds. Students with disabilities encounter additional barriers when platforms lack inclusive design or compatible assistive technologies. These forms of exclusion rarely appear in connectivity data but powerfully shape educational outcomes.

Digital skills among teachers and families constitute another underexplored dimension. Many educators have received basic training in digital tools, yet lack sustained support to integrate technology into pedagogy meaningfully. This results in digital platforms being used primarily for content delivery rather than for assessment, feedback, or learner-centred engagement. At the household level, limited digital literacy among parents constrains their ability to support children's online learning, particularly for younger students and first-generation learners.

Beyond access and skills, platform design and governance introduce subtle ethical concerns. Learning management systems and assessment tools often assume uninterrupted connectivity, individual device ownership, and standardised learning behaviours. Such assumptions disadvantage students operating under constrained conditions. Data collection practices and algorithmic decision-making further raise questions about transparency, consent, and long-term implications for learners, especially those with limited awareness or agency within digital systems.

3. Pedagogy, Power, and Platform Design

Digital platforms are not neutral carriers of educational content; they actively shape teaching practices, learning behaviours, and relationships of authority within classrooms. Design decisions embedded in platforms determine how knowledge is organised, how learners interact, and how success is measured. When platforms assume uninterrupted connectivity, individual device ownership, and standardised learning pathways, they implicitly privilege learners and institutions with greater resources. These assumptions translate technical design into pedagogical power, influencing whose learning is visible, valued, and supported.

Language and cultural framing play a decisive role in mediating access and agency. Many widely used platforms prioritise a limited set of dominant languages and pedagogical norms aligned with urban, middle-class contexts. For learners from multilingual backgrounds, this creates barriers that go beyond translation. Content examples, modes of explanation, and assessment styles may feel culturally distant or cognitively demanding in ways that disadvantage first-generation learners. Without meaningful localisation that adapts pedagogy to context, platforms risk reproducing symbolic inclusion while sustaining practical exclusion.

Assessment architecture is another site where power is quietly redistributed. Digital education systems increasingly rely on automated quizzes, time-bound tests, and analytics-driven evaluation. These approaches offer efficiency and scale but often narrow the definition of learning to what can be easily measured. Students who require scaffolding, collaborative interaction, or alternative modes of expression may struggle to demonstrate competence within such frameworks. Over time, these design choices influence curriculum delivery and instructional priorities, encouraging teaching to the platform rather than teaching for understanding.

Data practices further complicate the pedagogical landscape. Platforms routinely collect detailed information on learner behaviour, progress, and engagement. While such data can support personalised learning and early intervention, it also raises ethical concerns about privacy, consent, and long-term profiling. In contexts where learners and families have limited awareness of data governance, these systems can create opaque forms of surveillance. Decisions made through algorithms or dashboards may appear objective, yet they are shaped by assumptions that can misrepresent learning, especially for students navigating constrained digital environments.

Teachers operate at the intersection of platform design and classroom realities. In India, large-scale digital initiatives have expanded access to online resources and professional development, yet many educators report uneven confidence in using platforms pedagogically. Operational familiarity with tools does not always translate into the ability to design inclusive digital lessons, facilitate interaction, or interpret learning analytics meaningfully. As a result, platforms are often used to replicate lecture-based teaching rather than to support learner-centred or inquiry-driven approaches. This limits the transformative potential of digital education and reinforces existing instructional hierarchies.

Household and social power relations also intersect with platform affordances. In many families, device access is shared and time-bound, with women and girls often receiving secondary priority. Platforms designed for continuous, individual engagement do not account for these realities, effectively excluding learners who must navigate competing domestic responsibilities or limited privacy. Without intentional design choices that accommodate shared devices, asynchronous participation, and low-bandwidth use, digital systems risk amplifying gendered and socio-economic inequities.

The growing role of private providers in educational technology adds another layer of complexity. Market-driven platforms often prioritise scalability and engagement metrics, which may conflict with goals of inclusion, accessibility, and contextual relevance. Public digital infrastructure therefore carries a critical responsibility to set ethical standards, promote open and adaptable resources, and ensure that pedagogical values guide technological development. Aligning platform design with inclusive pedagogy requires governance frameworks that recognise design as an ethical act with long-term implications for educational equity.

4. Teachers and Institutions at the Ethical Frontline

Teachers and educational institutions occupy a decisive position in shaping the ethical outcomes of digital education. They act as intermediaries between policy ambition, technological design, and learners' lived realities. Their everyday decisions determine whether digital tools function as instruments of inclusion or become new mechanisms of exclusion. This frontline role places both opportunity and responsibility on schools, colleges, and teacher education institutions across India.

In recent years, institutional readiness for digital education has improved. National school-level data indicate a steady increase in the availability of computers and internet facilities, particularly in secondary and higher secondary schools. Teacher numbers have also grown, improving average pupil–teacher ratios and expanding the reach of formal schooling. These developments have created conditions in which digital tools can be more systematically integrated into teaching and administration, especially in urban and semi-urban institutions.

However, functional inequality remains a major constraint. Many schools report connectivity on paper but struggle with unstable internet, outdated devices, or unreliable electricity. Small rural schools and institutions in economically disadvantaged regions are

disproportionately affected. In such contexts, digital initiatives often depend on individual teacher effort rather than institutional capacity, leading to uneven implementation and inconsistent learning experiences for students.

Teachers' engagement with digital platforms has expanded significantly since the pandemic. A large proportion of educators now use online repositories for lesson planning, assessment materials, and professional learning. This marks a clear shift from pre-pandemic practices and reflects growing familiarity with digital environments. Yet this progress has been uneven in depth. While many teachers can operate digital tools, fewer report confidence in designing inclusive blended lessons, facilitating online collaboration, or using learner data to provide meaningful feedback.

The gap between access and pedagogical integration poses ethical challenges. When digital platforms are used primarily for content delivery, they tend to favour students who already possess strong self-regulation skills and home support. Learners with limited access, lower digital literacy, or constrained learning environments risk falling further behind. Teachers often navigate these tensions without clear guidance, making situational judgments about attendance, assessment flexibility, and participation requirements.

Institutional support systems play a critical role in shaping these outcomes. Schools and colleges that combine digital infrastructure with sustained in-service training, peer mentoring, and instructional leadership are better positioned to use technology inclusively. Where support is fragmented or short-term, teachers face pressure to meet administrative expectations without the pedagogical tools needed to address learner diversity. This disparity highlights the importance of institutional culture in translating digital policy into ethical practice.

Leadership further influences how equity is enacted at the ground level. Heads of institutions set priorities around device sharing,

remedial instruction, and community engagement. Inclusive leadership encourages adaptive scheduling, blended assessment strategies, and outreach to families with limited digital access. In contrast, rigid enforcement of platform-centric norms can unintentionally marginalise students who cannot meet standardised participation requirements.

Ethical digital inclusion also depends on sustained investment. One-time provision of devices or training is insufficient. Institutions require ongoing funding for maintenance, upgrades, and professional development. Teachers need time, recognition, and collaborative spaces to reflect on digital practice. Without these supports, the ethical burden of inclusion falls disproportionately on individual educators.

Teachers and institutions therefore stand at the ethical frontline of digital education. Their capacity to act justly depends on systemic support, realistic expectations, and a shared commitment to equity. Strengthening this frontline is essential if digital education in India is to move beyond symbolic inclusion toward meaningful and sustainable learning for all students.

5. Voices from the Margins: Community Agency and Ethical Participation in Digital Education

Digital inclusion remains incomplete when communities are treated as passive recipients of technology rather than active participants in its design and use. In India, large-scale digital education initiatives have often been implemented through centralised models that prioritise efficiency and uniformity. While these approaches enable rapid deployment, they frequently overlook local knowledge, cultural practices, and household realities. As a result, inclusion is measured through enrolment and platform usage, while meaningful participation remains uneven.

Evidence from post-pandemic schooling shows that families played a decisive role in sustaining learning during periods of disruption.

In many rural and low-income households, parents coordinated shared device use, negotiated data costs, and improvised learning spaces. These forms of informal participation were critical to continuity, yet they were rarely acknowledged within formal digital education frameworks. This disconnect highlights a broader ethical issue: community labour sustains digital learning, but community voice is seldom represented in decision-making processes.

Gendered dynamics within households reveal how participation is structured by power. Surveys conducted in recent years indicate that girls are less likely to have exclusive access to digital devices and more likely to face interruptions due to domestic responsibilities. These constraints shape patterns of engagement with online learning platforms, often leading to reduced participation in live sessions and lower visibility in digital assessments. When platforms equate participation with continuous presence or synchronous interaction, they inadvertently marginalise learners whose domestic contexts limit such engagement.

Linguistic and cultural marginalisation further restrict community agency. Many digital platforms privilege dominant languages and standardised curricular representations, limiting relevance for learners from indigenous, minority, or regional language communities. Empirical observations from tribal and border districts show that students engage more meaningfully when digital content reflects local contexts, livelihoods, and examples. Where such alignment is absent, learners may be technically included yet pedagogically disengaged, reinforcing a sense of alienation rather than empowerment.

Community-based initiatives offer important insights into alternative models of ethical participation. In several regions, local learning centres, self-help groups, and non-governmental organisations have facilitated shared digital access, peer mentoring, and contextualised content creation. These efforts demonstrate that digital education becomes more inclusive when communities

exercise agency over how technology is used, rather than merely complying with externally defined platforms and schedules. Such models challenge the assumption that scale must come at the cost of participation.

Emerging concerns around data and consent further underscore the need for community voice. Families often remain unaware of how student data are collected, stored, or repurposed across platforms. This asymmetry of information limits their capacity to make informed choices or raise concerns. Ethical participation therefore requires mechanisms for transparency, grievance redressal, and collective deliberation, particularly for communities with limited digital literacy.

Re-centering voices from the margins shifts the ethical focus of digital education. Inclusion becomes a process of shared ownership rather than technological provision. When learners, families, and local institutions are recognised as co-creators of digital learning environments, technology is more likely to support dignity, relevance, and justice. This participatory turn is essential for addressing invisible inequities and for building digital education systems that reflect the diversity and democratic aspirations of Indian society.

6. Conclusion

This chapter has argued that digital inclusion in education cannot be reduced to questions of access, infrastructure, or scale. Beneath visible gains in connectivity and platform adoption lie invisible inequities shaped by social position, institutional capacity, pedagogical design, and power relations. The Indian experience shows that digital technologies, when introduced without ethical reflection, can reproduce the very exclusions they are meant to address. Mapping these inequities reveals that inclusion is not a technical condition but a moral and social commitment.

The analysis highlights that platforms shape pedagogy, assessment, and participation in ways that redistribute authority and opportunity. Teachers and institutions stand at the ethical frontline, translating digital systems into everyday learning practices under uneven conditions of support. At the same time, communities and families emerge as critical yet under-recognised actors whose agency sustains digital learning, especially among marginalised groups. Recognising these actors reshapes digital inclusion as a shared, participatory process rather than a top-down intervention.

The implications for policy and practice are clear. Future digital education strategies must move beyond access-driven models toward frameworks grounded in justice, contextual sensitivity, and democratic participation. This requires sustained investment in teacher capacity, inclusive platform design, transparent data governance, and mechanisms that amplify community voice. Digital systems must be evaluated not only by reach or efficiency, but by their ability to expand learners' capabilities and dignity.

In contributing to the broader theme of this volume, the chapter underscores that bridging post-pandemic learning gaps demands ethical clarity as much as technological innovation. Digital equity will remain fragile unless invisible inequities are confronted directly. An ethics-centred approach to digital inclusion offers a pathway toward educational futures that are not only connected, but genuinely inclusive and socially just.

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9

Teacher Digital Competence: A Core Component of Educational Equity

Bipradas Abatar

Abstract

Classrooms shaped by digital technologies are no longer an exception in Indian education; they have become part of everyday teaching and learning. This chapter explores how teacher digital competence influences whether this shift strengthens inclusion or deepens existing inequalities. It advances the argument that digital equity is not achieved through access to devices or platforms alone, but through teachers' capacity to exercise pedagogical judgment, ethical awareness, and contextual responsiveness in digitally mediated environments. Focusing on the Indian context, the chapter examines uneven patterns of digital capacity among teachers, linking them to structural factors such as infrastructure gaps, institutional support, workload pressures, and language diversity. It also analyses how national policy frameworks and large-scale digital initiatives have expanded opportunities while revealing limitations in implementation and professional learning. By foregrounding teacher agency and institutional responsibility, the chapter offers a forward-looking perspective on building sustainable digital competence. It positions teacher development as a critical pathway for bridging learning gaps and advancing educational equity in the post-pandemic era.

Keywords: *Teacher digital competence; Digital equity; Pedagogical agency; Indian education; Post-pandemic schooling*

1. Introduction

The COVID-19 pandemic marked a decisive turning point in the relationship between teaching, technology, and educational equity. What began as an emergency response to school closures soon evolved into a lasting reconfiguration of classroom practice. Digital platforms, online resources, and hybrid modes of instruction moved from the margins to the mainstream of schooling. For teachers across India, this transition demanded rapid adaptation, often without adequate preparation or institutional support. As education systems stabilise in the post-pandemic period, digital engagement is no longer viewed as optional or temporary. It has become a defining feature of contemporary teaching, shaping how learning is accessed, mediated, and evaluated.

India's scale and diversity make this transformation particularly complex. National initiatives such as large digital learning platforms and online teacher development programmes have expanded access to resources at an unprecedented level. Millions of teachers now engage with digital repositories, virtual training modules, and online communities of practice. These developments signal an important shift towards system-wide capacity building. At the same time, their uneven uptake across regions, school types, and socio-economic contexts reveals persistent structural inequalities. Teachers working in well-resourced urban schools often experience digital tools as enhancers of pedagogy, while those in rural or low-income settings confront unstable connectivity, limited devices, and minimal technical support.

Recent learning assessments and school-level reports underline the consequences of these disparities. Learning losses in foundational literacy and numeracy remain significant, especially among students from disadvantaged backgrounds. Where students lack reliable digital access at home, the teacher's ability to design inclusive, flexible, and low-bandwidth pedagogical strategies becomes critical. In such contexts, technology does not function as

an equaliser by default. Its impact depends largely on how teachers interpret, adapt, and integrate digital tools into everyday teaching. This places teacher digital competence at the heart of the equity debate, not as a technical add-on, but as a core professional capacity.

Encouragingly, several state-led and institutional initiatives point toward more grounded approaches to teacher development. Partnerships between universities, teacher education institutions, and school systems are beginning to emphasise pedagogical uses of technology rather than mere platform navigation. Teachers who receive sustained mentoring and peer support show greater confidence in blending digital and classroom-based instruction, adapting content for diverse learners, and experimenting with student-centred approaches. These examples suggest that meaningful digital competence grows through practice, reflection, and collaboration, not through one-time training sessions alone.

Yet the challenges remain substantial. Teachers face increased workloads, blurred boundaries between professional and personal time, and growing expectations to manage digital assessment, data reporting, and communication with families. Concerns around data privacy, algorithmic bias, and the ethical use of educational technology are also becoming more pronounced. Without clear guidance and institutional safeguards, these pressures risk deepening professional fatigue and reinforcing inequities rather than reducing them. Any serious engagement with digital equity must therefore recognise the constraints under which teachers work, alongside the possibilities offered by technology.

This chapter positions teacher digital competence as a foundational pillar of educational equity in the post-pandemic era. It argues that competence must be understood broadly, encompassing pedagogical judgment, ethical awareness, inclusivity, and the ability to respond to diverse classroom realities. By examining policy directions, institutional practices, and classroom-level

experiences within the Indian context, the chapter seeks to show how empowering teachers digitally is central to bridging learning gaps. The discussion moves beyond questions of access to focus on capacity, agency, and sustainability, framing teachers not merely as users of technology but as key actors in shaping an equitable digital future for education.

2. Teacher Digital Competence: Beyond Tools, Toward Pedagogical Agency

Teacher digital competence is often reduced to the ability to operate devices or navigate platforms. Such a narrow view obscures the deeper pedagogical work that technology demands. In the post-pandemic classroom, digital competence increasingly refers to how teachers design learning, make instructional decisions, and respond to student diversity through digital means. It is closely tied to professional judgment and autonomy, not merely technical proficiency. Teachers who exercise pedagogical agency use technology to reshape classroom interactions, rather than allowing tools to dictate instructional form.

Recent patterns in teacher professional development in India highlight this distinction. Large-scale online training programmes report high enrolment and completion numbers, yet classroom integration remains uneven. Surveys conducted by state education departments show that while a majority of teachers are comfortable accessing digital content, a much smaller proportion regularly design interactive lessons, use formative digital assessment, or adapt resources for multilingual learners. This gap suggests that exposure to tools does not automatically translate into pedagogical transformation. Competence emerges when teachers are supported to align technology with curriculum goals and learner needs.

Pedagogical agency becomes particularly visible in hybrid and blended classrooms. Teachers must decide when digital tools add value and when face-to-face interaction is more effective. For

example, teachers in secondary schools increasingly use recorded explanations and digital worksheets to free classroom time for discussion, peer learning, and problem-solving. In contrast, teachers who lack pedagogical confidence tend to replicate lecture-based methods through screens, limiting the potential of digital platforms. The difference lies not in access to technology, but in the teacher's capacity to reimagine teaching practices.

Data from recent teacher engagement reports also indicate a shift in expectations placed on teachers. A growing share of teachers now report spending time on digital assessment, student progress tracking, and communication with parents through online platforms. While these practices can enhance transparency and feedback, they also require new forms of professional competence. Teachers must interpret digital data critically, avoid over-reliance on automated metrics, and balance efficiency with ethical and contextual considerations. Pedagogical agency is exercised when teachers retain control over how data informs, rather than replaces, professional judgment.

Where numerical patterns help illustrate this shift, the contrast becomes clearer.

Aspect of Digital Practice	Teachers Reporting Confidence (%)	Teachers Using Regularly in Class (%)
Accessing digital content	80–85	70–75
Delivering online lessons	65–70	55–60
Designing interactive tasks	40–45	30–35
Using digital formative assessment	35–40	25–30

The table reflects a recurring trend observed across multiple states. Basic operational tasks show high confidence and usage, while pedagogically demanding practices remain limited. This pattern reinforces the argument that digital competence must be developed as a pedagogical capacity rather than a checklist of skills.

Another critical dimension of pedagogical agency lies in inclusivity. Teachers with stronger digital competence adapt content for students with varied learning levels, disabilities, and language backgrounds. This may involve using low-bandwidth resources, audio explanations in regional languages, or flexible submission formats. In Indian classrooms marked by diversity and resource constraints, such adaptive use of technology often determines whether digital learning widens or narrows equity gaps. Agency, in this sense, is the ability to make context-sensitive choices under imperfect conditions.

Finally, teacher digital competence increasingly intersects with ethical and reflective practice. Issues such as student data privacy, screen-time balance, and algorithm-driven recommendations demand informed judgment. Teachers who possess pedagogical agency question platform defaults, modify practices, and engage students in discussions about responsible digital use. This reflective stance signals a shift from being passive consumers of educational technology to active shapers of digital learning environments.

In moving beyond tools, teacher digital competence emerges as a form of professional empowerment. It enables teachers to negotiate curricular demands, institutional expectations, and learner diversity with confidence and creativity. When competence is framed in this way, it becomes a critical lever for educational equity, positioning teachers as central actors in determining how digital transformation unfolds in Indian education.

3. Uneven Landscapes : Digital Capacity Gaps Among Indian Teachers

India's digital education ecosystem reveals deep and persistent unevenness in teacher capacity. While national policy narratives increasingly emphasise technology-enabled learning, the material and institutional conditions under which teachers work remain highly variable. Recent school-level data indicate that fewer than

half of Indian schools have functional internet access, with availability sharply lower in rural and remote regions. For many teachers, especially in government schools, digital integration is constrained at the most basic level by unreliable electricity, limited bandwidth, and shared or outdated devices. These infrastructural gaps set clear limits on what teachers can realistically implement in their classrooms.

Household-level access further complicates this landscape. Surveys conducted during and after the pandemic showed that a substantial proportion of students, particularly in rural and economically weaker households, depended on a single shared smartphone for online learning. This reality forced teachers to rethink assumptions about homework, assessment, and student participation. Teachers working in such contexts often avoided assigning digital tasks that required continuous connectivity, opting instead for low-bandwidth solutions such as text-based instructions, offline worksheets, or staggered access schedules. These adaptations, while pragmatic, illustrate how unequal access reshapes pedagogical possibilities and places additional cognitive and emotional demands on teachers.

The scale of national digital platforms presents a paradox. Usage data from teacher-facing portals show millions of registered users and high levels of content consumption. However, internal monitoring reports and teacher feedback consistently suggest that deep pedagogical use remains limited. A large proportion of teachers report confidence in accessing and downloading digital materials, yet far fewer regularly create interactive digital lessons, use online formative assessment tools, or differentiate content for diverse learners. This divergence highlights a critical capacity gap between surface-level engagement and transformative classroom practice.

Institutional support structures play a decisive role in amplifying or mitigating these disparities. Schools and districts that provide ongoing mentoring, peer learning opportunities, and dedicated time

for professional development tend to see higher levels of teacher experimentation with blended and digital pedagogy. In contrast, many teachers experience professional development as episodic and compliance-driven, focused on completing online modules rather than integrating learning into classroom routines. Where school leadership lacks digital vision or technical understanding, teachers are often left to navigate digital integration individually, reinforcing uneven outcomes across institutions.

Professional conditions and workload intensify these gaps. The post-pandemic period has expanded teachers' responsibilities to include digital documentation, online communication with parents, and data reporting through management systems. Without corresponding adjustments in staffing, planning time, or recognition, many teachers perceive digital work as an added burden. As a result, teachers may limit their digital engagement to mandatory tasks, avoiding more complex pedagogical uses that require sustained effort and experimentation. Capacity gaps thus become entrenched not only by resource constraints but also by the organisation of teachers' work.

Language diversity and accessibility further shape the uneven landscape. Teachers working in multilingual classrooms often find that digital content is unavailable or insufficient in regional languages, requiring them to translate or adapt materials on their own. Similarly, limited accessibility features on many platforms place learners with disabilities at a disadvantage, unless teachers intervene with customised support. These forms of invisible labour fall disproportionately on teachers serving marginalised communities, widening professional inequities within the teaching workforce itself.

4. Policy Frameworks and Institutional Responsibility

Policy engagement with digital education in India has expanded significantly in the post-pandemic period. National reforms now

position technology as an integral component of curriculum delivery, teacher preparation, and educational governance. Digital competence is no longer framed as a specialised skill for a limited group of teachers, but as a core professional expectation across school systems. This shift reflects an important policy acknowledgement that equitable learning in contemporary classrooms depends on teachers' ability to navigate and shape digital environments.

Recent system-level data point to measurable progress in infrastructure and access. The proportion of schools reporting functional internet connectivity and availability of computing devices has increased steadily over the last few years. Teacher enrolment in online professional development programmes has also risen sharply, indicating a growing acceptance of digital modes of training. These developments have created a foundational layer upon which teacher digital competence can be built, especially in regions that previously had limited exposure to educational technology.

At the same time, the expansion of policy frameworks has exposed implementation challenges. Improvements in connectivity do not always translate into reliable or classroom-ready access. Many schools continue to face unstable networks, limited maintenance support, and shared devices that restrict regular pedagogical use. In such contexts, teachers may complete mandated digital training without being able to apply new practices meaningfully. This disconnect highlights the gap between policy design at the national level and operational realities at the school level.

Institutional responsibility therefore extends beyond policy articulation to sustained support mechanisms. Centralised digital platforms can deliver content at scale, but their effectiveness depends on state and district systems that contextualise training and provide follow-up. Where district-level academic support structures are active, teachers report greater confidence in

experimenting with blended instruction and digital assessment. In contrast, weak institutional coordination often results in fragmented initiatives and uneven capacity development.

Another critical policy challenge concerns the nature of teacher professional development itself. High participation rates in online courses coexist with limited evidence of pedagogical change in classrooms. This suggests that policy emphasis on numerical targets, such as enrolment and completion, may overshadow deeper questions of learning quality and transfer. Institutions need to design professional development as a continuous process, combining online modules with mentoring, peer collaboration, and opportunities for classroom-based reflection.

Digital governance and accountability have also emerged as pressing concerns. Teachers are increasingly required to engage with digital reporting systems, online assessments, and data dashboards. While these tools can enhance monitoring and transparency, they also increase administrative demands. Without clear guidelines and workload rationalisation, digital governance risks diverting teacher attention away from instructional improvement. Institutional responsibility includes protecting professional time and clarifying the pedagogical purpose of data use.

5. Teachers as Agents of Digital Equity: Practices, Innovations, and Resistance

Teachers occupy a pivotal position in determining whether digital education advances or undermines equity. Policies and platforms shape possibilities, but it is teachers who translate digital provision into lived classroom practice. Evidence from post-pandemic schooling across India shows that where teachers exercise professional agency, digital tools are more likely to support inclusion, continuity, and learner engagement. Where agency is constrained, the same tools often reproduce exclusion in new forms.

One visible area of teacher agency lies in adaptive classroom practices. Teachers working in low-connectivity or mixed-access environments have developed hybrid pedagogies that blend digital and non-digital resources. Recorded explanations, shared through messaging platforms, are combined with in-class discussion and paper-based activities. In many government schools, teachers stagger digital access or design assignments that can be completed offline and uploaded later. These practices are not technologically sophisticated, but they are pedagogically strategic. They reflect an understanding of local constraints and an ethical commitment to reaching all learners, not only those with stable access.

Teacher-led innovation has also emerged through informal professional networks. During and after the pandemic, teachers increasingly relied on peer groups formed through social media, messaging applications, and local clusters. These spaces enabled rapid sharing of lesson ideas, assessment strategies, and troubleshooting support. Empirical accounts from multiple states suggest that teachers who participate in such networks demonstrate higher confidence in experimenting with digital pedagogy than those who rely solely on formal training. Peer learning thus functions as a compensatory mechanism where institutional support is limited.

At the same time, teachers are not passive adopters of every digital initiative. Forms of resistance have become an important, though often overlooked, dimension of digital equity. Teachers frequently push back against rigid platform mandates, excessive data entry requirements, or surveillance-oriented technologies. This resistance is not necessarily opposition to technology itself. Rather, it reflects professional judgment about what supports learning and what distracts from it. In schools where teachers are required to prioritise reporting over instruction, resistance often takes the form of minimal compliance paired with a return to trusted pedagogical routines.

Ethical concerns further shape teacher engagement. Teachers increasingly report unease about student data privacy, screen-time effects, and algorithm-driven recommendations embedded in educational platforms. In response, some teachers consciously limit platform use, anonymise student work, or prioritise discussion-based activities over continuous digital monitoring. These decisions demonstrate that digital competence includes ethical discernment. Teachers act as intermediaries who balance innovation with care, particularly for younger learners and vulnerable groups.

Emerging practices also point toward future directions for teacher agency. In several contexts, teachers are beginning to integrate basic AI-enabled tools for lesson planning, language support, or assessment feedback. Where this occurs responsibly, teachers treat such tools as aids rather than authorities. They adapt outputs to local curricula and student needs, maintaining control over instructional decisions. This cautious experimentation highlights the importance of grounding technological adoption in professional values rather than novelty or external pressure.

6. Conclusion

Teacher digital competence has emerged as a defining factor in shaping educational equity in the post-pandemic era. As digital technologies increasingly mediate teaching, assessment, and communication, their effects are filtered through teachers' professional judgment and classroom practice. Access to platforms or devices alone does not ensure equitable learning. Equity is shaped by how teachers design learning experiences, adapt to constraints, and respond to the diverse needs of students within digitally mediated environments.

Digital competence, as this discussion has shown, extends well beyond operational familiarity with technology. It involves pedagogical agency, ethical awareness, and contextual

responsiveness. Persistent gaps in teacher capacity reflect wider structural inequalities related to infrastructure, institutional support, workload, and language diversity. While policy frameworks and national platforms have expanded reach and standardisation, their impact remains uneven where professional learning is fragmented or reduced to procedural compliance.

Teachers also play an active role in shaping the contours of digital equity through everyday practice. Adaptive strategies, peer-driven innovation, and selective resistance to ill-suited digital mandates reveal a professional commitment to inclusion and care. These forms of agency demonstrate that meaningful digital integration is grounded in reflective practice rather than technological novelty or scale.

Sustaining progress requires a shift in emphasis from rapid expansion to deeper consolidation. Long-term investments in teacher learning, ethical governance, and supportive institutional structures are essential as digital and AI-enabled tools become more embedded in schooling. Placing teachers at the centre of the digital equity agenda reinforces the broader aim of this volume: to bridge learning gaps by strengthening capacity, agency, and professional trust across educational systems.

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10

Strengthening Digital Readiness in Government and Low-Income Schools

Rama Saha

Abstract

The rapid digitisation of education has reshaped teaching and learning in India, opening new possibilities while also revealing persistent inequalities across schooling systems. This chapter examines the state of digital readiness in government and low-income schools in the post-pandemic context, arguing that access to technology alone does not ensure educational equity. It analyses how disparities in infrastructure, variations in teacher digital competence, and socioeconomic constraints faced by learners continue to shape unequal learning outcomes. The discussion foregrounds the role of teachers as key mediators of digital transformation and emphasises the importance of learner-centred digital practices that promote inclusion, agency, and meaningful engagement. By situating digital readiness within broader educational reform efforts, the chapter contributes a long-term perspective on digital equity, underscoring the need to strengthen public education systems so that digital transformation becomes a pathway for bridging learning gaps rather than reinforcing existing divides.

Keywords: *Digital equity; Digital readiness; Government and low-income schools; Teacher capacity; Learner-centred digital learning*

1. Introduction

The COVID-19 pandemic marked a decisive turning point for education systems globally and in India. When schools across the country closed abruptly in early 2020, educators, learners, and policymakers raced to adapt to remote and digital modes of instruction. This shift, while necessary to sustain learning continuity, revealed deep structural inequalities in access to technology and digital skills. Urban private schools, with established infrastructure and resources, made a relatively smoother transition to online platforms. In contrast, government schools and institutions serving low-income communities struggled to ensure even basic access to devices, connectivity, and pedagogically effective digital content. These disparities have brought digital readiness to the forefront of policy debates and educational reforms.

As India moves into a post-pandemic recovery phase, digital readiness has emerged not as a short-term response to crisis but as a long-term educational imperative. The proliferation of affordable smartphones, expanding internet penetration, and investments in digital infrastructure present unprecedented opportunities to reimagine teaching and learning. Initiatives such as the National Education Policy 2020 have underscored the importance of integrating technology to enhance learning outcomes, foster teacher development, and expand access to quality education. Yet, the promise of technology will remain unfulfilled if foundational readiness is not secured across all schools, particularly those that have historically been underserved.

In government-run and low-income schools, three interrelated dimensions shape digital readiness: infrastructure availability, human capacity to use digital tools meaningfully, and the broader socio-economic context of learners. Many schools still grapple with intermittent electricity, limited internet bandwidth, and inadequate hardware. Even when infrastructure is in place, teachers and students often lack familiarity and confidence with digital

platforms, resulting in technology being underutilised or used in ways that reinforce traditional, transmissive pedagogies. At the same time, students from economically disadvantaged families face additional barriers, such as shared devices at home, digital language divides, and limited support for self-directed learning.

Despite these challenges, there are inspiring examples from across India that demonstrate how targeted interventions can yield positive outcomes. In some states, district-level partnerships have equipped schools with low-cost tablets and offline content that align with classroom curricula. Teacher communities of practice have emerged as powerful catalysts for peer learning, enabling educators to share strategies and co-develop digital lesson plans. Community-based organisations have stepped in to provide localized support for learners outside school hours, bridging gaps that institutional systems alone could not address. These instances point to the potential of context-sensitive and scalable approaches to nurture digital readiness.

Against this backdrop, this chapter explores what it takes to strengthen digital readiness in government and low-income schools in India. It argues that achieving meaningful digital equity requires more than distributing devices or installing broadband connections. It calls for a strategic interplay between infrastructure, capacity building, inclusive pedagogies, and supportive policy frameworks. By examining these dimensions in depth, the chapter seeks to offer insights that are both evidence-informed and forward-looking, with the aim of informing academic discourse, guiding policy decisions, and inspiring practical action in classrooms and communities.

2. Mapping the Digital Divide

The digital divide in Indian schooling is rooted in uneven infrastructure development and persistent socioeconomic disparities. Over the past decade, there has been a steady expansion of connectivity and digital devices across the country, yet this

progress has not translated uniformly into school-level readiness. Government and low-income schools, particularly in rural, tribal, and peri-urban areas, continue to face gaps in basic infrastructure such as stable electricity, functional computer systems, and reliable internet access. While many schools are officially recorded as having ICT facilities, the quality, consistency, and usability of these resources vary widely, shaping very different learning realities for students.

At the national level, indicators suggest a sharp rise in internet penetration and smartphone ownership, signalling a favourable macro environment for digital education. However, these gains mask deep structural inequalities. School-level data show that only around half of Indian schools currently report having internet access or computers on campus. This figure is significantly lower in government schools compared to private institutions. Moreover, access is often intermittent. Slow bandwidth, frequent power outages, and outdated hardware limit the effective use of digital platforms, particularly for interactive or multimedia-based learning.

Household access adds another layer of complexity. Although a large proportion of families now own at least one smartphone, device ownership does not guarantee educational use. In low-income households, devices are typically shared among multiple family members, restricting students' time for learning. Data costs, limited storage capacity, and the need to prioritise livelihood-related uses further constrain sustained engagement with digital learning resources. As a result, students may be formally counted as digitally connected yet remain functionally excluded from meaningful participation in online or blended learning environments.

Beyond physical access, institutional capacity within schools plays a decisive role. Many government schools that possess basic ICT infrastructure lack the systems required for maintenance, technical

support, and curricular integration. Computer labs may remain locked due to staff shortages or fear of damage. Digital tools, when used, often reinforce traditional lecture-based teaching rather than enabling interactive or learner-centred practices. This underutilisation reflects not only infrastructure gaps but also limited organisational readiness and planning at the school level.

Socioeconomic and cultural factors further shape the contours of the digital divide. First-generation learners often lack guidance at home to navigate digital platforms independently. Language barriers restrict access to digital content that is predominantly available in English or a limited set of regional languages. Gender norms in certain communities continue to influence who is allowed to use digital devices and for what purposes. Students with disabilities face additional challenges due to the scarcity of accessible digital interfaces and adaptive learning tools in government school systems.

The table below highlights the contrast between broad national connectivity trends and school-level digital readiness, illustrating why aggregate progress does not automatically translate into equitable educational outcomes.

Indicator	Recent status (India)
Total internet users	Over 750 million users
Households with at least one smartphone	Around 85% of households
Villages with mobile network coverage	Over 95% of villages
Schools with internet access	About 54% of schools
Schools with computers	About 57% of schools

This contrast underscores a critical paradox. India has achieved impressive gains in digital connectivity at the population level, yet a substantial proportion of schools remain under-equipped to harness these advances for teaching and learning. The digital divide is therefore not a single gap but a layered phenomenon shaped by

infrastructure, institutional capacity, household conditions, and social context.

3. Teachers at the Core: Building Digital Competence and Pedagogical Confidence

Teachers occupy a central position in determining whether digital investments lead to meaningful educational change or remain confined to surface-level adoption. In the Indian context, the scale of teacher engagement with digital platforms has expanded significantly in recent years. Large numbers of teachers have participated in online training modules, webinars, and blended professional development programmes facilitated through national and state platforms. This expansion has increased baseline familiarity with digital tools, yet it has also revealed a persistent gap between technical exposure and pedagogical transformation. Many teachers can now access digital content, but fewer feel confident in redesigning their classroom practices around technology-enabled learning.

Digital competence among teachers is uneven and strongly shaped by location, school type, and access to continuous support. While younger or urban-based teachers often display higher levels of digital fluency, many educators in rural and government schools report limited confidence in using digital tools beyond basic functions. This unevenness affects classroom practice. Teachers with higher digital confidence are more likely to integrate multimedia resources, formative assessment tools, and student-centred activities. Those with lower confidence tend to rely on lecture-based methods, even when devices or platforms are available. The result is that existing inequalities between schools are sometimes reproduced within digitally equipped environments.

Recent professional development initiatives have highlighted the importance of moving beyond one-time training sessions. Short courses and instructional videos can introduce tools, but they rarely

equip teachers to adapt technology to diverse classroom contexts. Teachers often struggle with aligning digital resources to prescribed curricula, managing blended classrooms, and assessing learning outcomes in digital or hybrid formats. Where mentoring systems, peer-learning circles, and school-based support structures are present, teachers demonstrate greater willingness to experiment and refine their practice. These collaborative spaces enable reflection, reduce fear of failure, and encourage gradual pedagogical change.

Policy-driven digital repositories and learning platforms have created a vast supply of teaching resources, lesson plans, and self-paced courses. While this expansion has improved access, it has also increased the burden on teachers to identify, adapt, and contextualise content for their learners. Many educators report feeling overwhelmed by the volume of available materials and uncertain about their pedagogical value. Digital competence, therefore, must be understood not only as technical skill but also as the ability to curate content, design meaningful learning sequences, and respond to student needs in multilingual and socioeconomically diverse classrooms.

Workload and institutional culture significantly influence teachers' engagement with digital pedagogy. In many government schools, teachers balance instructional responsibilities with administrative tasks, limiting the time available for professional learning and experimentation. When digital initiatives are introduced without adjustments to workload or clear instructional goals, they are often perceived as additional obligations rather than opportunities for improvement. Conversely, schools that allocate time for collaborative planning, recognise innovative practices, and provide leadership support tend to foster higher levels of teacher motivation and confidence. School leaders play a critical role in legitimising digital experimentation and normalising reflective practice.

Pedagogical confidence is also shaped by assessment expectations. Teaching practices remain closely tied to examination systems that

prioritise content coverage and rote learning. In such environments, teachers may view digital tools as risky or misaligned with performance metrics. Where assessment frameworks emphasise conceptual understanding, continuous feedback, and applied learning, teachers are more inclined to use technology for inquiry-based activities and formative assessment. Alignment between curriculum goals, assessment practices, and teacher development is therefore essential for sustained digital integration.

Strengthening digital readiness in government and low-income schools ultimately depends on empowering teachers as reflective professionals rather than passive recipients of technology. This requires sustained professional development, differentiated pathways that acknowledge varying levels of readiness, supportive leadership, and systemic alignment with curricular and assessment reforms. When teachers are equipped with both digital competence and pedagogical confidence, technology becomes a means of enhancing equity and learning quality rather than a symbolic marker of modernization.

4. Learner-Centred Digital Capacity

The expansion of digital infrastructure in India has created new possibilities for learner participation, yet access alone has not ensured meaningful engagement. Recent national trends indicate that a large majority of households now possess at least one smartphone and that internet use has grown rapidly across age groups. However, this apparent connectivity has not translated evenly into educational advantage. For many learners in government and low-income schools, digital access remains intermittent, shared, and shaped by household and school-level constraints. As a result, learner-centred digital capacity varies sharply across contexts.

A comparison between household connectivity and school readiness highlights this imbalance clearly.

Indicator	Recent status (India)
Households with at least one smartphone	Around 85%
Total internet users	Over 750 million
Schools with internet access	About 54%
Schools with functional computers	About 57%

These figures reveal a structural tension. While learners increasingly live in digitally connected environments, many schools lack the infrastructure required to integrate technology into everyday teaching. Students therefore encounter fragmented learning experiences, with limited continuity between home and school-based digital engagement.

Inclusion remains a central challenge. In low-income households, devices are commonly shared among siblings and adults, restricting learners' time for educational use. Data affordability and storage limitations further shape how students engage with digital content, often pushing them toward passive consumption rather than interactive learning. Language also plays a decisive role. A significant proportion of digital learning materials are available only in English or a narrow set of regional languages, reducing accessibility for first-generation learners and students from linguistically diverse backgrounds.

Gendered access continues to influence learner agency. In some communities, girls experience tighter supervision over device use or reduced opportunities for independent digital exploration. These constraints affect participation in after-school digital learning, online collaboration, and self-paced study. While school-based digital initiatives can partially offset these barriers, their impact depends on whether schools provide safe, structured spaces that actively encourage equitable participation.

Learners with disabilities face additional exclusion risks. Many digital platforms and learning resources are not designed with accessibility in mind. Assistive technologies, adaptive interfaces, and differentiated digital content remain limited in government

school systems. As blended and online learning models expand, the absence of inclusive design can widen learning gaps for students who already face educational disadvantage.

At the same time, there are signs of progress in how digital tools are being used to foster learner agency. In schools where digital activities are aligned with the curriculum and designed around projects, inquiry, and collaboration, students demonstrate higher motivation and engagement. Opportunities to create digital artifacts, participate in peer feedback, and connect learning to local contexts help shift students from passive recipients of content to active participants in the learning process. Such approaches are particularly effective when they combine online resources with offline tasks and classroom discussion.

Out-of-school support structures have also emerged as important enablers of learner-centred digital capacity. Community learning centres, libraries, and locally organised support programmes provide supervised access, guidance, and continuity for students who lack stable home environments for digital learning. These spaces often blend low-tech and high-tech solutions, reinforcing learning through group interaction and mentoring.

Strengthening learner-centred digital capacity therefore requires a balanced strategy. Broad gains in connectivity must be complemented by targeted interventions that address shared-device realities, language diversity, gender norms, and accessibility needs. Equally important is a pedagogical shift toward learning designs that prioritise agency, relevance, and interaction. When inclusion and engagement are treated as core design principles rather than secondary considerations, digital education can support not only access, but also deeper and more equitable learning outcomes.

5. Policy Frameworks and Institutional Ecosystems: From Schemes to Sustainable Systems

India's digital education landscape has been shaped by an expanding set of national and state-level schemes. These initiatives have accelerated connectivity, content creation, and teacher training at scale. Empirical trends show steady increases in the proportion of schools reporting internet access and ICT facilities over the last five years. Participation in national digital platforms has also grown sharply, with millions of teachers and students accessing online courses and learning resources. These gains signal strong policy intent and administrative capacity to operate at scale.

Yet scale has not always translated into system coherence. Many interventions remain scheme-driven and time-bound. Devices are procured without parallel investments in maintenance. Platforms are launched without clear integration into curriculum planning and assessment practices. Evidence from state reviews and school-level audits shows that equipment often becomes underused within two to three years due to technical failure, lack of local support, or staff transfers. This pattern highlights a shift needed from delivery-oriented schemes to resilient institutional systems.

Sustainability depends on how policies align across governance levels. States that have embedded digital goals into broader school development plans show more consistent outcomes. In these contexts, ICT budgets are linked to school grants, headteachers are accountable for usage, and district-level support teams provide technical and pedagogical assistance. Where such alignment is absent, schools report fragmented guidance and overlapping directives, leading to compliance-oriented implementation rather than meaningful adoption.

Institutional ecosystems extend beyond government departments. Public–private partnerships have played a visible role in expanding access to devices, connectivity, and content. Evaluations of such

partnerships indicate mixed outcomes. Short-term pilots often demonstrate promising learning gains, especially when localized content and mentoring are provided. However, models that rely heavily on external vendors face challenges of continuity once contracts end. Sustainable partnerships are those that prioritise capacity transfer to schools and local authorities rather than long-term dependence on external providers.

School leadership emerges as a critical mediating factor. Empirical observations from school inspections and programme evaluations show that schools with proactive principals are more likely to sustain digital practices. Leaders who allocate time for teacher collaboration, monitor usage data, and align digital activities with academic goals create enabling conditions for continuity. Conversely, frequent leadership turnover and administrative overload weaken institutional memory and disrupt momentum.

Emerging policy discussions increasingly recognise the need for data-informed governance. Usage analytics from digital platforms provide insights into participation patterns, regional disparities, and content effectiveness. When combined with school-level data on attendance and learning outcomes, these tools can inform adaptive planning. States that have begun using dashboards to guide resource allocation and training priorities report more targeted interventions and reduced duplication of effort. The challenge lies in ensuring data quality and building the analytical capacity required to act on these insights.

Financial sustainability remains a defining concern. Initial capital investments have been substantial, but recurrent costs often receive less attention. Electricity, bandwidth upgrades, device replacement, and technical staffing require predictable funding streams. Evidence from state budgets suggests that where recurring costs are mainstreamed into education financing rather than treated as special expenditures, digital initiatives show greater longevity. This shift

reframes digital readiness as a core educational function rather than an add-on.

6. Conclusion

Digital readiness has emerged as a decisive factor in shaping educational equity in the post-pandemic landscape. The analysis presented here underscores that while India has achieved notable progress in expanding connectivity, platforms, and digital resources, these advances have not been experienced uniformly across government and low-income schools. Gaps in infrastructure, uneven institutional capacity, and persistent socioeconomic constraints continue to limit the transformative potential of technology for large sections of learners.

A key insight is that digital readiness must be understood as a systemic condition rather than a collection of isolated interventions. Technology becomes educationally meaningful only when it is embedded within sound pedagogy, supported by confident teachers, and aligned with inclusive learning designs. Teacher competence and pedagogical confidence play a pivotal role in determining whether digital tools foster engagement, critical thinking, and learner agency or merely replicate traditional instructional models in digital form. Equally, learner-centred approaches that address language diversity, gendered access, and accessibility are essential for translating digital access into genuine participation.

The discussion also highlights the need to move beyond scheme-based implementation toward sustainable institutional ecosystems. Policy frameworks are most effective when they integrate infrastructure provision with professional development, school leadership, and stable financing. Schools that function within coherent support systems are better positioned to sustain digital practices, adapt to changing needs, and avoid cycles of underutilisation and decline.

Future directions must therefore prioritise consolidation and depth over rapid expansion. Strengthening maintenance systems, embedding digital goals within school development planning, and using data to guide adaptive decision-making will be critical. Emerging technologies hold promise, but their impact will depend on how thoughtfully they are aligned with educational values and local contexts. By foregrounding equity, capacity-building, and sustainability, the chapter contributes to the broader purpose of the volume: advancing a vision of digital education that narrows learning gaps and strengthens the foundations of inclusive schooling in India.

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11

Community-Based Models of Digital Empowerment: Lessons from the Field

Labani Biswas

Abstract

The rapid digitalisation of education in the post-pandemic period has intensified existing inequalities while also opening new possibilities for inclusive learning. This chapter examines community-based models of digital empowerment as a critical response to these challenges in the Indian context. Moving beyond a narrow focus on access and infrastructure, it analyses how communities function as catalysts of digital capacity building through local leadership, peer support, and contextual adaptation of technologies. Drawing on field-based experiences from rural, urban, and marginalised settings, the chapter highlights how community action has helped bridge social, gender, and linguistic divides in digital learning. It also explores the role of institutional partnerships and ecosystem thinking in transforming short-term interventions into sustainable educational practices. The analysis reveals that community-driven models are most effective when they are socially embedded, pedagogically grounded, and supported by enabling institutional frameworks. At the same time, the chapter recognises persistent structural constraints that limit scale and equity.

Keywords: *Community-based learning, Digital empowerment, Educational equity, Post-pandemic education, India*

1. Introduction

The COVID-19 pandemic accelerated a transformation in education that was already underway. In a matter of weeks, classrooms shifted to screens, teachers reconfigured pedagogies for remote delivery, and learners adapted to new rhythms of digital engagement. While access to devices and connectivity captured headlines, the deeper challenge revealed by the crisis was a structural one: the uneven capacity of communities to meaningfully engage with digital learning. In India, where educational inequities are layered with socio-economic, linguistic, and geographic disparities, the pandemic exposed the limits of supply-side solutions that focus solely on infrastructure. Digital access without agency and support systems often translated into unattended devices, missed class hours, and widening learning gaps.

Emerging national data from the pandemic years point to stark disparities across regions and groups. Students in urban centers with robust internet connectivity and supportive households were more likely to attend online classes and submit assignments. In contrast, learners in rural and remote areas faced intermittent connectivity, shared devices, and limited digital literacy among caregivers and educators. These differences were compounded for girls, students from low-income families, and those learning in home languages other than English or major regional tongues. The narrative of a single digital divide has thus evolved into a mosaic of interlinked divides—access, skills, language, pedagogy, and community support. Addressing these multifaceted gaps requires a shift from technology-centric interventions to holistic models that foreground human and social dimensions.

Amid these challenges, compelling stories of community-led digital empowerment have emerged across India. In village clusters of Rajasthan, youth volunteers organized neighbourhood learning circles, helping children navigate online classrooms and troubleshoot connectivity issues. Community radio stations in

Odisha augmented digital learning with complementary content in local languages, nurturing continuity in student engagement. Urban slum networks in Mumbai leveraged peer educators to build digital skills among parents, enabling them to support their children's schooling. These initiatives did not merely fill gaps; they redefined learning ecosystems by positioning communities as active participants rather than passive recipients of technological fixes.

The term "digital empowerment" in this context moves beyond the provision of devices or internet subscriptions. It encompasses the capacity of individuals and communities to use digital tools in ways that expand agency, enable collaboration, and strengthen learning outcomes. Community-based models recognize that families, local leaders, educators, and civil society can transform digital technologies into culturally resonant learning resources. They also acknowledge that empowerment is a process anchored in trust, adaptability, and sustained engagement. In the Indian milieu, where educational aspirations are high but resources and opportunities are unevenly distributed, community-driven digital models offer a pathway to more inclusive and resilient learning systems.

This chapter explores these models with analytical depth and practical insight. It examines how community actors foster digital capacity, addresses the structural barriers they confront, and distils lessons that can inform policy and practice. By bringing field experiences into conversation with broader trends in digital equity, the chapter aims to illuminate how community-based approaches can bridge learning gaps in the post-pandemic era. The subsequent sections unpack the mechanisms, outcomes, and future potential of these models, situating them within India's evolving educational landscape.

2. Communities as Catalysts of Digital Capacity Building

Communities have long played a vital role in educational processes, but the digital era has amplified their importance. In India's diverse

educational landscape, community actors extend learning beyond formal classrooms, especially where institutional reach is limited. Rather than seeing communities as auxiliary to formal education, contemporary practice reframes them as active agents of digital capacity building. This shift reflects a broader understanding that equitable digital engagement hinges on local context, social trust, and collective action.

A defining feature of community-led digital efforts is their emphasis on contextualized learning support. In many rural and peri-urban settings, local volunteers, youth clubs, and parent collectives organize digital literacy workshops tailored to the needs of learners and caregivers. These workshops often focus on basic navigation of devices, understanding learning platforms, troubleshooting connectivity issues, and building confidence with digital tools. The content and pace are shaped by community priorities, making it more accessible than generic online tutorials. In several districts, such efforts have reduced rates of absenteeism from online classes and improved student participation in blended learning environments.

The scale of community involvement varies, but the pattern is increasingly consistent: communities extend the reach of digital education where formal systems struggle due to infrastructure gaps or teacher shortages. For instance, grassroots groups in several states mobilized during the pandemic to map connectivity blackspots, coordinate shared device usage, and establish “learning corners” in community spaces. These actions demonstrate how local knowledge and collective problem-solving can mitigate structural barriers. They also underscore an important trend: community-based interventions often generate parallel learning support structures that are flexible and responsive, complementing formal schooling rather than competing with it.

Quantitative indicators from recent surveys reflect these qualitative shifts. Consider the following illustrative breakdown of

engagement types reported by community groups involved in digital learning support:

Type of Engagement	Percentage of Community Groups Reporting
Digital literacy training for students	78%
Digital literacy support for caregivers	64%
Shared device coordination	53%
Local content translation/adaptation	47%
Community learning centers establishment	39%

This snapshot highlights how multiple layers of support converge within community efforts. The high proportion of groups focusing on student digital literacy underscores a foundational priority: equipping learners with the capacity to engage meaningfully with digital tools. The substantial involvement in caregiver support also points to the recognition that family members influence student engagement and can act as enablers when they possess digital confidence.

Another trend emerging from the field is the role of peer networks in sustaining digital engagement. Youth volunteers, often students or recent graduates, have become de facto digital mentors in their localities. Their proximity to learners helps bridge generational divides in technology use and contributes to a culture of mutual learning. Peer-to-peer support models have been particularly effective in contexts where formal teacher support was disrupted or stretched thin. These networks also foster local leadership, as young digital champions become advocates for inclusive learning practices within their communities.

While the contributions of communities are significant, they are not uniform. Variations in local resources, leadership, and socio-economic conditions influence the scale and effectiveness of digital engagement. Urban communities may mobilize with greater access to devices and internet connectivity, while rural counterparts often

rely on hybrid models that blend low-tech and high-tech strategies. Nonetheless, what unites these diverse efforts is a shared orientation toward building digital capacity that is socially embedded, learner-centered, and adaptive to local realities.

3. Field-Based Models and Experiential Insights from India

Field-based experiences across India reveal that community-driven digital empowerment does not unfold through uniform or linear models. Instead, it takes shape through locally adapted responses that combine social capital, contextual knowledge, and pragmatic use of technology. In regions where conventional online learning proved unviable, communities turned to hybrid and alternative modes of engagement. Tribal and remote districts, for instance, relied on community radio, mobile phone–based communication, and offline digital content to sustain learning continuity. These approaches leveraged familiar platforms and local languages, ensuring that digital learning remained intelligible and culturally anchored rather than alienating.

A recurring insight from the field is the strategic mobilisation of local human resources. Parents, particularly mothers, youth volunteers, and retired educators emerged as critical intermediaries between formal education systems and learners. Community members were trained to support basic digital navigation, supervise online lessons, and reinforce foundational learning. Such involvement addressed two persistent gaps simultaneously: the shortage of trained personnel and the limited digital confidence within households. By embedding learning support within the community, these initiatives reduced dependence on distant institutional actors and fostered shared responsibility for educational outcomes.

Urban contexts presented a different configuration of challenges and solutions. In densely populated informal settlements, device scarcity and space constraints limited individual access to digital

learning. Community-based learning hubs and shared digital spaces responded to this constraint by coordinating schedules, pooling resources, and facilitating peer-supported learning. These centres often doubled as sites for parental orientation, where caregivers were introduced to learning platforms and communication tools used by schools. The result was a more integrated learning environment that connected students, families, and educators through locally managed digital ecosystems.

Public digital platforms introduced during and after the pandemic played an enabling but uneven role in these community models. Where local actors actively curated, translated, and contextualised digital content, platforms enhanced pedagogical reach and flexibility. Teachers and volunteers adapted materials to align with learners' linguistic backgrounds and curricular needs, thereby increasing relevance and engagement. In contrast, communities without such mediation often struggled to integrate platform-based resources into daily learning practices. This divergence underscores a central lesson from the field: digital platforms gain educational value only when grounded in local pedagogical processes and supported by community facilitation.

Field experiences also highlight persistent infrastructural and operational constraints that shape community responses. Irregular electricity supply, unstable internet connectivity, and rising data costs necessitated flexible learning designs. Many successful initiatives adopted blended strategies that combined digital tools with print materials, in-person mentoring, and periodic assessments. This hybrid approach ensured continuity while accommodating infrastructural variability. Importantly, it also reframed digital learning as part of a broader educational toolkit rather than a singular mode of delivery.

Sustainability emerges as a defining concern in assessing these field-based models. Short-term interventions driven by emergency funding often struggled to persist once external support diminished.

In contrast, initiatives that cultivated local leadership, aligned with existing governance structures, and demonstrated visible learning gains were more likely to endure. Engagement with school management committees, local self-governments, and district authorities provided institutional legitimacy and modest resource support. These linkages helped transition community-led digital efforts from temporary responses to more stable components of local education systems.

4. Bridging Social, Gender, and Linguistic Divides Through Community Action

Community-based digital efforts have shown promise in addressing persistent social divides. These divides affect who participates in learning, how they engage, and what outcomes they achieve. In many contexts, marginalised groups face compounded barriers. They contended with limited access to devices and connectivity before the pandemic. When schooling shifted online, these barriers deepened. Community action has worked to make digital engagement more inclusive. Yet progress has been uneven and challenges remain significant.

Gender disparities are visible in digital access and use. Many households prioritise device access for male children. Girls often use shared devices only after other family needs are met. Community groups have responded by organising gender-sensitive digital clubs. These clubs create safe spaces for girls to build digital skills. They pair basic training with mentorship on digital confidence and online safety. Reports from local programmes indicate that participation by girls increased by nearly 25 percent after community clubs were established. Such shifts suggest that targeted community support can mitigate some gendered barriers to digital learning.

At the same time, social stratification influences who benefits from digital initiatives. Families with higher incomes and educational

levels are better positioned to support learning at home. They already possess familiarity with digital tools and can navigate platforms with ease. In contrast, economically disadvantaged families often lack this familiarity. Community facilitators aim to reduce this gap. They run foundational digital literacy sessions for parents. They also help learners navigate platform interfaces and homework submissions. These efforts have improved engagement in some villages, where attendance in online classes rose from below 30 percent to over 60 percent within months of community intervention. Yet these outcomes are not universal. Resource scarcity and caregiver time constraints limit what community efforts can achieve without broader systemic support.

Linguistic diversity poses another set of challenges. India's many languages are not equally represented in mainstream digital platforms and educational content. Learners who speak regional or tribal languages often encounter materials only in major languages. This mismatch reduces comprehension and motivation. Community translators have taken on the task of adapting and contextualising content. They create local versions of lesson summaries, glossaries, and digital guides. These materials help learners engage with core concepts in their home languages. In regions where this work has been sustained, school performance indicators show modest gains, particularly in reading comprehension assessments. Nevertheless, the scale of linguistic adaptation remains limited. Without public platforms that prioritise multilingual content development, community translators operate under heavy workload and limited recognition.

Social norms and stigma also shape participation. In some areas, families resist girls' participation in mixed community groups or discourage their use of digital tools. Community leaders have worked to shift perceptions through dialogue and role modelling. They showcase success stories of local learners, including girls, to build broader acceptance. Such strategies have contributed to

incremental change. Yet transformation at the normative level is slow and requires persistent engagement beyond project timelines.

Infrastructure constraints intersect with social divides. Even when community action improves skills and motivation, lack of stable internet or affordable devices constrains participation. In communities where mobile connectivity is sporadic, blended strategies that use offline materials and periodic in-person sessions have been more effective. These hybrid models reflect community creativity in bridging gaps that technology alone cannot solve.

5. Institutional Partnerships and Ecosystem Thinking

Community-based digital empowerment achieves scale and durability when it is embedded within wider institutional ecosystems. Isolated initiatives often deliver short-term gains but struggle to sustain momentum once volunteer energy or temporary funding declines. In contrast, partnerships that align community action with schools, local governments, civil society organisations, and digital platforms create reinforcing structures of support. These ecosystems distribute responsibility across actors while retaining community ownership of learning processes.

Schools remain central nodes in this ecosystem. Where school leadership actively collaborates with community groups, digital initiatives tend to show stronger continuity. Teachers contribute curricular alignment and pedagogical guidance. Community facilitators extend learning time and provide contextual support. Evidence from several districts indicates that schools with active community partnerships reported higher student participation in blended learning formats and more consistent follow-up on learning gaps. These outcomes suggest that institutional anchoring enhances both legitimacy and effectiveness of community-driven digital work.

Local governance institutions play a complementary role. Panchayats and urban local bodies have supported digital learning

by providing physical spaces, coordinating local resources, and facilitating access to basic infrastructure. In some blocks, modest investments in community learning centres and shared connectivity points significantly increased learner access. Administrative involvement also improved coordination among stakeholders. When community initiatives were formally recognised by local authorities, volunteer retention and accountability improved. This recognition transformed informal efforts into semi-institutional practices without eroding their flexibility.

Civil society organisations act as intermediaries within these ecosystems. They bring technical expertise, training capacity, and programme management skills. Their role is particularly visible in capacity building for community facilitators and teachers. Programmes that combined NGO-led training with community delivery reported measurable improvements in digital confidence among learners and caregivers. Empirical monitoring from such initiatives shows gains in regular platform usage and assignment completion. These results highlight the value of structured support layered onto grassroots action.

Digital platforms and technology providers increasingly form part of the ecosystem. Public learning platforms expanded rapidly during the pandemic and continue to shape post-pandemic digital education. Their effectiveness, however, depends on local mediation. Partnerships that enable content localisation, language adaptation, and offline access features have demonstrated higher uptake. In areas where platform providers engaged with state agencies and community organisations, usage data showed more balanced participation across rural and urban users. This pattern reinforces the argument that platforms function best as shared public infrastructure rather than standalone solutions.

Ecosystem thinking also brings attention to data flows and feedback loops. Community initiatives that tracked attendance, engagement, and basic learning outcomes were better positioned to adapt

strategies over time. When these data were shared with schools and local authorities, they informed targeted interventions. Such evidence-based coordination strengthened trust among partners and improved decision-making. It also aligned community innovation with system-level priorities such as foundational literacy, digital skills, and inclusion.

At the same time, ecosystem approaches introduce new challenges. Coordination across institutions can slow decision-making. Power asymmetries risk marginalising community voices if governance structures are overly centralised. Effective ecosystems therefore require clear role definition and mechanisms for community representation. Field evidence suggests that partnerships work best when communities retain control over delivery while institutions provide enabling resources and policy support.

6. Conclusion

The experiences examined in this chapter affirm that digital equity in education is not achieved through technology alone. It emerges from the interaction between digital tools, human agency, and social institutions. Community-based models demonstrate how local actors translate abstract notions of access into lived educational practices. They build digital capacity where formal systems are constrained, and they ground learning in trust, relevance, and shared responsibility.

Several insights stand out. Communities act as critical intermediaries between learners and digital systems. Their role extends from basic digital literacy to sustained pedagogical support, particularly for socially and linguistically marginalised groups. Field-based evidence shows that when community action is aligned with schools, local governance, and civil society, digital initiatives gain stability and scale. These partnerships transform emergency responses into durable learning ecosystems. At the same time, persistent challenges related to infrastructure, gender norms,

language diversity, and institutional coordination remind us that community action cannot substitute for systemic reform.

The implications for policy and practice are clear. Digital empowerment strategies must move beyond device distribution and platform expansion. They should invest in community capacity, recognise local leadership, and design institutional frameworks that enable collaboration without diluting grassroots agency. Future efforts will need to prioritise multilingual content, blended learning models, and data-informed decision-making to respond to India's diversity and inequality. Equally important is the need to embed community participation within long-term educational planning rather than treating it as a temporary or peripheral solution.

By foregrounding community-based models, this chapter contributes to the broader aims of *Digital Equity in Education: Bridging Learning Gaps in the Post-Pandemic Era*. It demonstrates that equitable digital futures are built through relationships and collective effort. As education systems navigate the next phase of digital transformation, communities will remain indispensable partners in shaping learning that is inclusive, resilient, and socially meaningful.

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Digital Literacy as a Lifelong Learning Goal: Implications for NEP 2020

Suparna Ghosh

Abstract

Digital technologies now shape learning, work, and civic participation in India, making digital literacy a central concern for educational policy and practice. This chapter examines digital literacy as a lifelong learning goal within the framework of the National Education Policy 2020, situating the discussion in India's post-pandemic educational landscape. It argues that expanded digital infrastructure and platforms have improved reach but have also exposed persistent inequalities related to access, capability, gender, language, and institutional capacity. The analysis highlights the critical distinction between digital access and meaningful competence, showing how teachers, institutions, and learners across the life span mediate the effectiveness of technology-enabled education. Attention is given to youth learning trajectories, adult reskilling, and participation in the informal digital economy, underscoring the need for flexible pathways, continuous teacher development, and recognition of informal learning. By framing digital literacy as an adaptive and ongoing process rather than a finite skill, the chapter contributes to debates on digital equity and demonstrates how NEP 2020 can support inclusive growth, employability, and sustained learning in a rapidly digitising society.

Keywords: *Digital literacy; Lifelong learning; NEP 2020; Digital equity; Digital capacity building*

1. Introduction

Over the last decade, digital technologies have shifted from being peripheral tools to becoming core infrastructures of everyday life and learning in India. Mobile connectivity, low-cost data, and the rapid spread of smartphones have transformed how students access information, how teachers design instruction, and how citizens engage with public services. Digital platforms now mediate examinations, scholarships, admissions, and even classroom interactions. These developments have created new possibilities for expanding educational reach and flexibility, while also raising critical questions about skills, equity, and preparedness in a society marked by deep social and regional diversity.

The COVID-19 pandemic accelerated this transition in a dramatic and uneven manner. Schools and universities were compelled to adopt online and blended modes almost overnight. National platforms for teacher training and student learning scaled up rapidly, while states experimented with television, radio, and mobile-based instruction to reach learners with limited internet access. This period demonstrated India's capacity to deploy digital education at scale, but it also exposed the fragility of learning systems when access, guidance, and digital confidence are unevenly distributed. For many learners, continuity of education depended not only on devices and connectivity but on the ability to navigate digital environments independently.

These experiences underline a critical distinction between access and capability. Digital inclusion cannot be measured solely by the presence of a smartphone or an internet connection. Many learners and teachers remain first-generation digital users, unfamiliar with evaluating online information, protecting privacy, collaborating effectively, or using digital tools for higher-order learning. In classrooms, this gap often translates into passive consumption rather than meaningful engagement. In everyday life, it affects access to employment opportunities, financial services, and civic

participation. The challenge, therefore, lies in moving from basic digital exposure to robust digital literacy that enables informed, ethical, and productive participation in a digital society.

India's policy landscape has responded with significant investments in digital infrastructure and platforms, particularly in education and skill development. Efforts to expand broadband connectivity to rural areas, create large-scale repositories of digital learning resources, and support teacher professional development reflect a recognition that technology will shape the future of learning. Yet infrastructure-led solutions alone cannot sustain long-term transformation. Without sustained capacity building, contextualised content, and pedagogical support, digital initiatives risk reinforcing existing inequalities rather than reducing them.

This context gives renewed importance to the idea of digital literacy as a lifelong learning goal. Technological change does not end with formal schooling, nor are digital skills acquired once and for all. Students, teachers, and workers must continuously adapt to new tools, platforms, and forms of knowledge production. Young learners may acquire operational skills quickly, but they need guidance to develop critical judgment and ethical awareness. Adults in informal and semi-formal sectors require accessible pathways to build digital confidence and relevance for livelihoods. Teachers and institutions need ongoing support to move beyond emergency use of technology toward thoughtful, inclusive digital pedagogy.

Against this backdrop, the National Education Policy 2020 offers a critical framework for reimagining digital literacy in India. Its emphasis on flexibility, lifelong learning, and technology-enabled education opens possibilities for embedding digital competence across stages of learning and across social groups. This chapter engages with that promise. It examines how digital literacy can be conceptualised as a continuous learning trajectory rather than a discrete skill set, and what this implies for policy design,

institutional practice, and equity. By situating digital literacy within India's post-pandemic educational realities, the chapter sets the stage for a deeper analysis of how NEP 2020 can support a more inclusive and future-ready digital learning ecosystem.

2. NEP 2020 and the Architecture of Lifelong Digital Learning

The National Education Policy 2020 marks a conceptual shift in how digital learning is positioned within Indian education. Rather than treating technology as an auxiliary tool, the policy frames it as an enabling architecture that cuts across stages of learning and institutional boundaries. Digital learning is linked to flexibility, access, and continuity, reflecting the reality that learning now extends beyond classrooms and formal credentials. This shift is significant in a country where educational pathways are often discontinuous due to socio-economic constraints.

A defining feature of NEP 2020 is its emphasis on lifelong learning. The policy recognises that knowledge economies require continuous skill renewal and that digital competence cannot be confined to early schooling or higher education alone. Provisions for multiple entry and exit points, academic credit banks, and flexible learning trajectories create conditions where digital platforms can support learners as they move between education, work, and reskilling. Digital learning thus becomes a connective tissue that allows individuals to re-engage with education at different points in their lives.

National digital platforms illustrate how this architecture has begun to take shape. Teacher-facing portals have expanded rapidly in recent years, offering structured professional development modules and peer-learning opportunities. Student-oriented platforms have also seen a sharp increase in enrolments, particularly in short-term courses and skill-based programmes. During the post-pandemic period, usage data from these platforms indicate sustained engagement rather than a temporary spike, suggesting that digital

learning has become embedded in routine educational practice for many users.

To illustrate the scale of this shift, recent administrative data point to steady growth in platform participation and digital reach across sectors.

Indicator (Approximate)	Recent Trend
Teachers enrolled in national digital portals	Over 10 million
Learners registered on online course platforms	Over 50 million
Courses available in Indian languages	Rapid annual increase
Institutions adopting blended learning models	Growing across states

These figures signal both reach and ambition. However, they also highlight a central policy tension: scale does not automatically translate into depth or quality. Many learners access digital content intermittently, often driven by certification requirements rather than sustained learning engagement. The challenge for NEP 2020 lies in ensuring that digital platforms support progression from foundational skills to advanced competencies, rather than functioning as isolated repositories of content.

NEP 2020 also foregrounds institutional responsibility in shaping lifelong digital learning. Universities, teacher education institutions, and vocational centres are encouraged to integrate online and blended modes into mainstream curricula. This integration is not limited to delivery mechanisms; it extends to assessment practices, credit recognition, and learner support systems. When effectively implemented, such integration can normalise digital learning across disciplines and age groups, reducing the stigma often attached to online education.

Another important dimension of the policy is its recognition of language and cultural diversity. The expansion of digital content in multiple Indian languages reflects an attempt to align lifelong

learning with local contexts. This move has particular relevance for adult learners and first-generation students, for whom language barriers often limit participation in digital spaces. Digital literacy, in this sense, is not only about technical competence but also about cultural and linguistic accessibility.

3. Equity, Access, and the Persistent Digital Divide in India

India's rapid expansion of digital connectivity has created the material conditions for large-scale digital learning, yet deep inequities continue to shape who benefits from this transformation. National figures show a steady rise in internet subscriptions and mobile broadband coverage, and most villages are now within the footprint of mobile networks. However, access remains uneven in practice. Connectivity quality varies widely across regions, electricity supply is unreliable in many rural areas, and household-level access is often constrained by device scarcity. For millions of learners, especially in low-income families, digital learning depends on a shared smartphone, limiting time, privacy, and continuity of engagement.

These infrastructural constraints intersect with socio-economic inequalities. Students from urban, middle-class households are more likely to have multiple devices, stable broadband, and digitally literate family support. In contrast, first-generation learners often navigate digital platforms without guidance, relying on trial and error. This gap affects not only access to content but also the ability to use digital tools strategically for learning, assessment, and skill development. As a result, digital learning can unintentionally reproduce existing educational hierarchies unless equity is addressed as a structural concern rather than a peripheral issue.

Gender remains one of the most persistent dimensions of the digital divide. Women and girls are significantly less likely to own personal digital devices or use mobile internet regularly,

particularly in rural and socially marginalised communities. Social norms, safety concerns, and restricted mobility shape patterns of digital use, often limiting online engagement to functional or supervised activities. For adolescent girls and adult women, these constraints reduce opportunities for independent learning, professional upskilling, and participation in digital public spaces. Lifelong digital literacy, therefore, cannot be achieved without targeted strategies that recognise and respond to gendered barriers.

Language further mediates digital inclusion in India. While a growing share of online users prefer content in Indian languages, the digital ecosystem remains uneven in its linguistic reach. Educational platforms increasingly offer multilingual interfaces and resources, yet the depth, pedagogical quality, and subject coverage of vernacular content vary widely. Learners educated in regional languages often encounter conceptual barriers when digital resources rely on unfamiliar terminology or culturally distant examples. For adult learners and informal-sector workers, such mismatches can discourage continued participation, weakening the idea of digital learning as a sustained, lifelong process.

Another layer of inequality arises from the diversity of access modes. Many learners depend primarily on low-cost smartphones, while others rely on television, radio, or shared community facilities for digital learning. These modes support different forms of engagement. Video-intensive, synchronous instruction privileges those with stable bandwidth and private spaces, whereas text, audio, and asynchronous formats tend to be more inclusive. When policy and institutional practices prioritise a narrow set of digital modalities, they risk excluding learners whose access conditions differ. An equitable digital learning system must therefore accommodate varied technological realities while maintaining academic coherence and credibility.

These persistent divides have direct implications for the vision of NEP 2020. If digital literacy is to function as a lifelong learning

goal, learners must be able to re-enter digital education at multiple stages of life, not only during periods of formal enrolment. Fragile access, limited confidence, and contextual barriers reduce the likelihood of such re-engagement. Addressing equity thus requires a shift from counting connections to evaluating meaningful participation. Investments in infrastructure must be complemented by affordable device access, community-based digital spaces, gender-responsive outreach, and sustained capacity building. Only then can digital literacy evolve from a marker of advantage into a shared foundation for learning, work, and civic life across India.

4. Teachers, Institutions, and the Question of Digital Capacity Building

Teachers are central to realising the promise of lifelong digital literacy. They mediate the translation of policy into practice. In classrooms and online environments, their confidence and competence shape learners' experiences. In India, a large and diverse teacher workforce faces the dual task of mastering digital tools and integrating them into pedagogy.

Progress is visible. National and state teacher development programmes report high enrolment in digital training modules. Many teachers now use learning management systems, digital assessment tools, and multimedia resources. Some institutions have established internal mentoring systems, where digitally adept educators support peers. These developments reflect growing recognition that teacher capacity is not static. It evolves with tools, curricula, and classroom needs.

Despite these gains, challenges are deep. A significant share of teachers report low confidence in designing digitally rich learning experiences. They can operate devices but struggle to align tools with learning outcomes. Many trainings focus on software use rather than pedagogical design. This limits the ability of teachers to foster critical thinking, collaboration, and creativity through digital

means. The result is often ornamental use of technology, where tools are present but learning impact is weak.

Institutional readiness varies widely. Urban schools and higher education institutions often have better infrastructure and leadership support. Rural and under-resourced institutions frequently contend with intermittent electricity, limited devices, and weak internet. Administrative burdens and large class sizes further constrain time for professional growth. Teacher education institutions, which are responsible for preparing future educators, are themselves on uneven footing in terms of digital infrastructure and faculty expertise.

Recent participation trends in teacher digital programmes offer mixed signals. Training enrolments have surged, yet completion rates vary. Many teachers begin courses but do not finish them. This suggests constraints such as workload pressures, lack of institutional encouragement, or courses that are insufficiently contextualised to teachers' realities. Short trainings may raise awareness but fall short of cultivating deep competence. Sustained, practice-oriented professional learning pathways are essential.

Leadership at the institutional level also matters. Institutions that prioritise digital capacity tend to invest in ongoing, cohort-based training, peer learning, and reflective practice. They allocate time within the academic calendar for teachers to engage with digital pedagogies. They also adopt supportive evaluation systems that value innovation and evidence of learning impact. In contrast, institutions that treat digital learning as an add-on resource struggle to embed it into curricula or assessment.

The gap between device availability and pedagogical integration highlights another challenge. Many classrooms have hardware but lack purposeful use. Digital labs and smart classrooms are present but underutilised when teachers default to traditional methods. This

underlines the need for professional learning that is anchored in curriculum, assessment, and context, not merely tool operation.

Teacher education programmes represent a critical leverage point. Embedding digital literacy into pre-service curricula can ensure that future educators enter the profession with foundational skills and a reflective disposition toward ongoing learning. However, such integration demands investment in faculty development and curriculum redesign. Institutions must model the very practices they expect future teachers to enact.

5. Learners Across the Lifespan

Digital literacy in India cannot be understood solely through the experiences of school-aged learners. Lifelong learning encompasses multiple life stages. It spans formal education, transitions into work, and continuous reskilling in adulthood. Each stage presents distinct opportunities and constraints for engaging with digital technologies.

Among youth, digital engagement often begins early. Many students use smartphones and the internet for social interaction, entertainment, and information retrieval. Formal education increasingly integrates digital content into classroom activities. Yet the nature of this engagement varies widely. Some learners navigate advanced skills such as coding or data analysis. Others struggle with basic navigation, evaluation of online sources, or productive contributions to digital spaces. The difference is not merely technical; it reflects the alignment of educational experiences with meaningful digital practice. Where curricula and instruction foreground shallow consumption of videos or notes, opportunities for deeper comprehension and creation remain limited.

Adults represent a less studied but crucial demographic in the digital learning ecosystem. Millions of adults participate in the informal economy, where digital tools can enhance productivity, market access, and financial inclusion. For a vendor selling goods

online, basic digital literacy can translate directly into income growth. For workers in services or microenterprises, digital competence affects scheduling, payments, customer engagement, and access to digital finance. Yet many adults lack structured opportunities for skill development. Existing vocational training schemes show variable uptake and impact. Informal workers often juggle long hours, limited time, and precarious incomes, making participation in formal digital literacy programmes difficult.

The informal digital economy itself is a site of emergent learning. Workers acquire skills through practice, peer networks, and trial-and-error use of platforms. These "situated" forms of learning are adaptive and often contextually rich. However, they also risk entrenching uneven skill profiles and leaving critical gaps in areas such as data privacy, digital safety, and adaptive learning strategies. Without pathways to formal recognition of these competencies, adults may remain confined to task-specific know-how rather than broader digital fluency.

Transitions between youth and adult learning trajectories highlight important tensions. Graduates entering the labour market encounter digital skill demands that are often mismatched with their schooling experiences. Employers increasingly seek workers who can collaborate online, manage digital workflows, analyse data, and engage clients through digital interfaces. Where formal education does not align with these expectations, young adults must turn to short courses and online credentialing platforms. Those with resources and prior exposure navigate these pathways more easily. Others encounter barriers related to cost, time, and confidence.

For lifelong digital literacy to be meaningful, learning systems must recognise diversity in learner goals, contexts, and prior experiences. Youth-focused digital programmes must balance foundational skills with creative and critical practices. Adult learning opportunities must be flexible, modular, and contextualised to livelihoods. Recognition mechanisms, such as micro-credentials or

stackable certifications, can help bridge informal and formal learning spaces. Such mechanisms also create incentives for adults to invest time in building competencies that have labour market relevance.

Emerging evidence suggests that when digital learning is embedded in real tasks, engagement and outcomes improve. For example, community learning centres that integrate digital skills with livelihood activities see higher participation among adults. Similarly, youth programmes that pair digital design with project work show deeper skill development than purely consumption-based modules. These patterns point to a key principle: digital literacy gains durability when anchored in meaningful activity rather than abstract instruction.

This section underscores the importance of viewing learners not as static recipients of technology but as active agents in their learning trajectories. Lifelong digital literacy is not a single destination; it is an ongoing negotiation between individual goals, labour market demands, and socio-technical contexts. Understanding how different learner populations engage with digital tools, platforms, and communities is essential for designing equitable, flexible, and impactful digital learning ecosystems in India's diverse society.

6. Conclusion

Digital literacy emerges from this analysis as a continuous capability shaped by policy design, institutional practice, and social context rather than as a one-time technical achievement. India's post-pandemic experience demonstrates that large-scale digital infrastructure and platforms can extend educational reach, but they do not automatically ensure meaningful learning or equitable outcomes. Gaps in access, confidence, language, and institutional capacity continue to influence how learners and educators engage with digital environments across the life course.

The National Education Policy 2020 offers a coherent foundation for addressing these challenges. Its emphasis on flexibility, multiple pathways, and technology-enabled learning aligns well with the demands of lifelong digital competence. Yet effective implementation requires more than platform expansion. Sustained investment in teacher development, institutional leadership, and pedagogical integration is essential if digital tools are to support higher-order learning rather than replicate traditional practices in virtual form.

The discussion also highlights the importance of recognising diverse learner trajectories. Youth, adult learners, and participants in the informal digital economy engage with technology in different ways and for different purposes. Digital literacy initiatives must therefore be adaptable, context-sensitive, and closely linked to real educational, economic, and civic needs. Mechanisms that value informal learning, support modular credentials, and integrate digital skills with livelihoods can strengthen engagement and long-term impact.

Taken together, these insights reinforce the central argument of this volume: digital equity depends on building sustained capacity, not merely expanding access. Treating digital literacy as a lifelong learning goal aligns educational reform with India's broader aspirations for inclusive growth, workforce resilience, and democratic participation. Within this framework, NEP 2020 has the potential to evolve into a dynamic instrument that supports continuous learning, reduces structural gaps, and prepares citizens to navigate an increasingly digital society with competence and confidence.

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13

Designing Inclusive EdTech Ecosystems for India's Learners

Riya Debnath

Abstract

India's accelerated shift toward digital education has redefined how learning is accessed, organised, and experienced. While this transformation has expanded reach and flexibility, it has also intensified long-standing inequalities rooted in infrastructure, language, and institutional capacity. This chapter explores how inclusive EdTech ecosystems can be intentionally designed to respond to these challenges in the post-pandemic context. It maps the contours of India's EdTech landscape, examining the interaction between public digital platforms, private innovation, and diverse learner realities. Central attention is given to learner-centred design and universal access, emphasising that meaningful inclusion requires more than devices and connectivity. The analysis highlights the pivotal role of teachers and institutions in translating digital tools into equitable pedagogical practice, alongside the importance of sustained capacity building. The chapter further examines digital infrastructure and data justice, showing how data governance, platform design, and emerging technologies influence equity outcomes. By integrating insights from policy, practice, and design, the chapter offers a forward-looking framework for aligning digital innovation with educational justice. It situates inclusive EdTech as a critical pathway for bridging learning gaps and advancing digital equity in India.

Keywords: *Digital equity, inclusive EdTech, learner-centred learning, teacher capacity building, digital governance*

1. Introduction

The post-pandemic years have marked a decisive shift in how education is imagined and delivered across India. Digital platforms, once treated as supplementary tools, now occupy a central position in schooling, higher education, and skill development. During prolonged school closures, online classes, televised lessons, and mobile-based learning became lifelines for millions of learners. Government platforms recorded unprecedented usage, private EdTech services expanded rapidly, and institutions across urban and rural settings experimented with blended and remote models. This accelerated digital transition has reshaped expectations about access, flexibility, and the very spaces in which learning can occur.

Alongside this expansion, EdTech has demonstrated clear potential to address long-standing educational constraints. Technology-enabled instruction has made high-quality learning resources available beyond elite institutions and metropolitan centres. Adaptive platforms support differentiated learning, while recorded content allows students to revisit concepts at their own pace. For learners in remote or underserved regions, low-bandwidth solutions, community digital centres, and offline content have provided partial bridges where traditional infrastructure remains weak. Digital tools have also broadened access to teacher training, vocational education, and lifelong learning, aligning education more closely with changing economic and social realities.

Yet these gains have unfolded unevenly. Persistent gaps in connectivity, device ownership, and electricity continue to exclude large sections of the learner population. Rural households, informal settlements, and economically marginalised communities face structural constraints that technology alone cannot overcome. Within households, digital access is often mediated by gender, age, and social norms, shaping who can participate fully in online learning. Language further complicates inclusion, as a significant share of digital content remains concentrated in a limited number

of languages, marginalising learners from diverse linguistic backgrounds. Teachers have also encountered challenges in adapting pedagogy, assessment, and classroom interaction to digital formats, often without sustained professional or institutional support.

These realities underline the need to move beyond narrow understandings of EdTech as a collection of tools or platforms. Questions of inclusion extend into how technologies are designed, governed, and embedded within educational systems. An inclusive approach must address pedagogy, infrastructure, language, teacher capacity, and learner wellbeing in an integrated manner. In a country as socially and regionally diverse as India, designing equitable digital learning environments requires sensitivity to context and a commitment to social justice alongside innovation.

Against this backdrop, the focus turns to the design of inclusive EdTech ecosystems that can respond to India's complex educational landscape. Attention must shift from short-term technological fixes to sustainable models that align digital innovation with equity, access, and learning quality. Examining how policy, institutions, educators, and communities interact within these ecosystems offers a pathway to understanding how digital education can narrow, rather than widen, existing learning gaps in the years ahead.

2. Mapping India's EdTech Landscape: Opportunities, Gaps, and Contradictions

India's expanding digital footprint has significantly altered the contours of its education system. With internet users now numbering in the hundreds of millions, driven largely by mobile connectivity and increased rural uptake, the potential reach of digital learning has widened considerably. Smartphones have become the primary gateway to education for many learners, enabling access to recorded lessons, interactive content, and

assessment tools beyond the physical classroom. This shift has positioned EdTech as a central component of educational delivery rather than a peripheral supplement.

Public digital platforms and private EdTech enterprises together shape this evolving ecosystem. Government initiatives have achieved large-scale penetration by offering curriculum-aligned resources, teacher training modules, and multilingual content at no direct cost to learners. At the same time, private providers dominate segments such as test preparation, tutoring, and professional upskilling, often leveraging data-driven personalization and adaptive learning models. The coexistence of these two spheres reflects a hybrid system in which equity-driven public infrastructure and market-driven innovation operate in parallel, sometimes reinforcing each other and sometimes pulling in different directions.

A brief numerical snapshot illustrates both the scale and complexity of this landscape:

Indicator	Approximate recent figures
Active internet users in India	Nearly 900 million
Cumulative learning sessions on major public platforms	Over 500 crore sessions
Estimated size of the EdTech market	Several billion USD, varying by definition

These figures suggest impressive reach, but they also mask deep internal disparities. EdTech growth has been uneven across regions, income groups, and educational levels. Urban and semi-urban learners with reliable connectivity and personal devices benefit most from high-interactivity platforms. In contrast, learners in remote or economically constrained settings often depend on shared devices, intermittent electricity, and low-bandwidth solutions. As a result, the same technologies that promise inclusion can reproduce existing inequalities when supporting conditions are absent.

Contradictions also emerge in the relationship between scale and quality. Rapid expansion has encouraged platform proliferation, yet not all offerings align well with curricular goals or pedagogical best practices. Engagement metrics, exam performance, and user retention often drive design choices, sometimes at the expense of deeper conceptual learning and critical thinking. For institutions and teachers, navigating this crowded digital environment poses challenges of selection, integration, and alignment with classroom realities.

Language and cultural representation form another fault line. While digital education is often promoted as borderless, much content remains concentrated in a limited number of dominant languages. Learners from linguistic minorities frequently encounter shallow translations or limited subject coverage. Localised initiatives, including state-led content creation and community-based digital resources, demonstrate that contextual relevance improves engagement, but such efforts remain uneven in scale and sustainability.

Teacher capacity further shapes how EdTech functions on the ground. Many educators acquired basic digital skills during emergency remote teaching, yet sustained professional development and institutional support remain inconsistent. Without time, training, and autonomy, teachers struggle to move from basic platform use to thoughtful pedagogical integration. This gap reinforces the risk of technology being used as a delivery mechanism rather than a transformative learning tool.

3. Learner-Centred Design and Universal Access: From Devices to Dignity

Digital education rests on a basic yet often underestimated premise: access must translate into dignity in learning. Recent years have brought a rapid increase in internet use and smartphone ownership across India, expanding the reach of digital learning environments.

At the same time, aggregate access figures obscure everyday constraints. Shared devices, unstable connectivity, and limited study time remain common, particularly in economically marginalised households. For many learners, these conditions determine not only how learning occurs but whether sustained participation is possible at all. Universal access, therefore, must be understood as the capacity to engage meaningfully rather than the mere presence of technology.

Learner-centred design addresses these disparities by placing learners' lived realities at the core of technological decision-making. Approaches informed by universal design emphasise flexibility in content delivery, assessment, and interaction. In practice, this means offering low-data alternatives alongside video, structuring lessons in modular formats that tolerate interrupted access, and enabling multiple ways for learners to demonstrate understanding. When such choices are embedded into platform architecture, technology becomes responsive rather than prescriptive, reducing the burden on learners who already navigate multiple constraints.

Accessibility for learners with disabilities remains a critical measure of inclusion. Too often, accessibility is treated as a supplementary feature rather than a foundational requirement. Inclusive EdTech integrates technical accessibility with pedagogical sensitivity, ensuring compatibility with assistive technologies, clear navigation, and adaptable assessment structures. These design choices benefit learners with disabilities while also improving usability for a wider population, reinforcing the idea that accessibility strengthens, rather than limits, educational quality.

Language and cultural relevance strongly shape learner engagement in digital spaces. Despite increasing demand for vernacular and multilingual education, much digital content continues to privilege a narrow set of dominant languages. Effective inclusion requires more than translation. It calls for

contextualised examples, alignment with local curricula, and recognition of regional knowledge systems. Experiences from state initiatives and teacher-led content creation show that locally grounded materials enhance comprehension and motivation, though scaling such efforts remains an ongoing challenge.

Gendered patterns of access further complicate the promise of digital learning. Social norms, domestic responsibilities, and unequal control over devices frequently constrain the time and autonomy available to female learners. These constraints affect participation in synchronous instruction and the completion of independent learning tasks. Design responses that emphasise asynchronous learning, offline resources, and flexible timelines reduce dependence on continuous connectivity and accommodate learners whose access is shaped by household dynamics.

Teachers occupy a central position in translating learner-centred design into meaningful learning experiences. Many educators developed basic digital competencies during emergency transitions to online teaching, yet sustained pedagogical integration requires continued professional support. Time for redesigning lessons, opportunities for peer learning, and platforms that allow teachers to adapt content to local needs are essential. When digital tools support professional judgment rather than impose rigid scripts, teachers are better able to respond to diverse learner needs.

Learner agency and data practices also influence how dignity is experienced in digital environments. Personalised learning systems rely on data to tailor content and feedback, yet opaque data practices can undermine trust and participation. Clear communication about data use, opportunities for learner choice, and feedback that supports reflection rather than monitoring help create environments where learners feel respected and empowered.

Moving from devices to dignity involves reimagining access as a holistic learning experience shaped by design, pedagogy, language,

and social context. EdTech ecosystems that prioritise flexibility, accessibility, and agency are better positioned to support sustained participation and equitable outcomes for India's diverse learners.

4. Teachers, Institutions, and Capacity Building in Inclusive Digital Ecosystems

Teacher readiness is a decisive determinant of whether EdTech improves learning. Large numbers of teachers gained basic digital skills during emergency remote teaching. Many adopted video lessons, digital assessments, and messaging apps to stay connected with students. Yet basic adoption does not equal sustained pedagogical change. Deep integration requires more time, coaching, and institutional support.

Professional development has expanded in reach. State programmes, national platforms, and private providers now offer courses on digital pedagogy. Participation rates rose sharply in recent years. Still, completion of short courses rarely translates into classroom practice. Practical coaching, in-class modelling, and follow-up mentorship remain limited. Teachers report needing hands-on examples and time to redesign lessons for blended learning.

Institutional arrangements shape what teachers can do. Schools with clear leadership and a plan for digital integration show better outcomes. Where school schedules allow collaborative planning, teachers experiment more with formative assessment and differentiated tasks. In many institutions, however, digital responsibilities are added onto existing workloads without adjustments in time or role. That reduces teacher capacity and risks superficial implementation.

Access to infrastructure matters. Where reliable internet and devices are available, teachers can use interactive tools and analytics. In under-resourced schools, teachers rely on low-tech solutions: SMS, printed packets, and radio lessons. Such

adaptations demonstrate ingenuity. At scale, though, inequitable infrastructure produces uneven pedagogical possibilities across districts and communities.

Assessment practices are struggling to catch up. Many digital platforms provide instant scores and dashboards. Teachers often see these as administrative tools rather than pedagogical cues. Without training on interpreting data, educators miss opportunities to personalise instruction. Assessment literacy—knowing how to use formative evidence to guide teaching—is uneven across the workforce.

Career incentives and recognition matter for motivation. Systems that recognise digital leadership and innovative practice encourage teacher experimentation. Absent incentives, risk-averse behaviour dominates. Professional networks and communities of practice foster peer learning. When these networks include regular reflection and sharing of resources, teachers report greater confidence and agency.

Pre-service teacher education has begun to include digital pedagogy. Teacher-trainees who receive integrated training are better prepared to combine technology with pedagogy. Yet curricula in many institutions still treat technology as an add-on. Embedding technology across subject-method courses would produce more coherent skill sets.

Policy supports have become more visible. Funding for devices, grants for digital upgrades, and national guidelines provide a starting point. Implementation gaps persist. Allocation often fails to match local priorities. Monitoring and adaptive feedback mechanisms are weak. Stronger coordination between policy, local leadership, and community stakeholders is needed.

Equity must remain central in capacity building. Training that assumes universal connectivity leaves some teachers unable to apply new methods. Programmes must model low-bandwidth

practices and multilingual resources. They should also address inclusive pedagogies for diverse learners, including those with disabilities and learners from marginalised communities.

Sustained improvement requires layered investments. Short courses create awareness. Intensive coaching builds skill. Institutional time and incentive structures enable practice. Infrastructure widens the range of possible pedagogies. Together, these elements determine whether teachers and institutions can translate EdTech into meaningful learning gains for all learners.

5. Digital Infrastructure, Data Justice, and Systemic Inequality

Digital infrastructure forms the hidden architecture of inclusion. Connectivity, electricity, device quality, and platform interoperability determine who can participate in digital learning and under what conditions. Recent expansions in broadband and mobile networks have improved coverage, yet access remains uneven across regions and social groups. Rural districts, informal settlements, and remote geographies continue to experience unstable connectivity and frequent power disruptions. These infrastructural gaps shape not only access but also the kinds of pedagogies that are possible, often limiting learners to passive or low-interactivity formats.

Infrastructure inequality is closely tied to household economics. Shared devices remain common in lower-income families, constraining study time and privacy. Device quality also matters. Older smartphones struggle with newer applications, leading to slower load times and frequent interruptions. Such frictions accumulate, increasing cognitive fatigue and dropout risk. In practice, digital learning environments often assume ideal conditions that many learners do not have, reinforcing pre-existing educational disadvantages.

Data has emerged as a central resource in contemporary EdTech ecosystems. Learning platforms collect large volumes of

information on attendance, engagement, performance, and behaviour. When used responsibly, such data can support personalised instruction and early identification of learning gaps. Empirical evidence from adaptive learning pilots shows improved short-term outcomes when feedback is timely and intelligible. However, benefits are uneven when data literacy among teachers and institutions is limited. Without interpretive capacity, data dashboards remain underused or misapplied.

Concerns around data justice are becoming more pronounced. Learners from marginalised backgrounds are often the most monitored and the least empowered to question data practices. Opaque algorithms can reinforce bias by labelling learners as low-performing without accounting for contextual constraints such as intermittent access or language barriers. In high-stakes environments, such labels risk shaping expectations and opportunities in ways that reproduce inequality rather than mitigate it. Transparency, explainability, and the right to contest data-driven decisions are therefore not technical luxuries but equity imperatives.

Public digital infrastructure offers partial safeguards against these risks. Large-scale government platforms emphasise open access, interoperability, and non-extractive data practices. Their reach demonstrates the value of treating digital education as a public good. At the same time, coordination challenges persist. Fragmentation across platforms, states, and institutions leads to duplication and uneven standards. Stronger alignment around data governance norms and infrastructure sharing would reduce inefficiencies and support more equitable outcomes.

The private sector introduces additional complexity. Market-driven platforms often innovate rapidly, but their business models rely on data monetisation, premium access, or targeted services. Evidence from recent market corrections shows that sustainability pressures can narrow offerings toward fee-paying users, leaving public

systems to serve the most disadvantaged learners. This division risks creating a two-tier digital education system unless regulatory frameworks and partnerships are designed with equity safeguards.

Emerging technologies intensify these stakes. Artificial intelligence, predictive analytics, and automated assessment promise efficiency and scale. They also raise questions about surveillance, consent, and accountability. Early deployments suggest that without careful design, such tools can amplify existing biases embedded in training data and institutional practices. Addressing these risks requires anticipatory governance that integrates ethical review, diverse stakeholder input, and continuous evaluation.

Addressing systemic inequality in digital education demands an integrated response. Infrastructure investment must be paired with standards for accessibility and interoperability. Data use must be guided by principles of justice, transparency, and learner agency. Institutional capacity to interpret and act on data must be strengthened. When these elements align, digital systems can support inclusion. When they do not, technology risks hardening the very inequalities it is meant to resolve.

6. Conclusion

The rapid expansion of digital education in India has fundamentally altered the conditions of learning. Technology has extended reach, introduced new modes of instruction, and increased flexibility across educational levels. At the same time, it has exposed enduring inequalities related to access, language, infrastructure, and institutional capacity. These tensions underscore a central insight: digital education amplifies existing structures, making questions of design and governance decisive for equity.

The discussion throughout the chapter points to inclusion as a systemic responsibility rather than a technological outcome. Learner-centred design, respect for dignity and agency, and

attention to social context are essential for turning connectivity into meaningful participation. Teachers and institutions remain pivotal actors in this process. When supported through sustained professional development, coherent leadership, and realistic workload structures, educators can translate digital tools into inclusive pedagogical practice. Where such support is absent, technology risks reinforcing surface-level engagement and uneven outcomes.

Digital infrastructure and data practices further shape equity trajectories. Unequal connectivity, device quality, and platform fragmentation limit the possibilities of learning for many communities. At the same time, expanding data use raises questions of transparency, bias, and accountability that directly affect learners from marginalised backgrounds. Addressing these challenges requires aligning infrastructure investment with principles of data justice and institutional capacity building.

Future progress depends on moving beyond isolated interventions toward integrated EdTech ecosystems anchored in public purpose. Strong public digital infrastructure, responsibly governed private innovation, and meaningful community participation must converge around shared equity goals. Emerging technologies will intensify both opportunity and risk, making ethical foresight and adaptive governance increasingly important. Placing educational justice at the centre of digital transformation offers a viable pathway for narrowing learning gaps and advancing the broader vision of digital equity in the post-pandemic era.

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14

Policy Roadmaps for Scalable and Sustainable Digital Equity

Smita Mazumder

Abstract

Education systems across the world are being reshaped by the steady normalization of digital learning. In India, this shift has unfolded unevenly, revealing sharp contrasts between technological promise and lived educational realities. This chapter examines how policy can respond to these tensions by building roadmaps that prioritise equity, sustainability, and long-term impact rather than short-term digital expansion. Anchored in the post-pandemic context, it analyses the structural dimensions of digital equity, including infrastructure and connectivity, platform design, content and language inclusion, teacher and institutional capacity, and governance and data ethics. The discussion demonstrates that digital access, while essential, does not automatically translate into equitable learning outcomes. Instead, outcomes are mediated by policy coherence, institutional readiness, and the extent to which digital systems reflect India's linguistic, social, and regional diversity. The chapter advances the argument that scalable digital equity requires integrated policy ecosystems that align technological innovation with human capacity-building and accountable governance. By articulating these interconnections, the chapter contributes to the broader volume by offering a grounded and future-oriented framework for bridging learning gaps through responsible digital transformation.

Keywords: *Digital equity, education reform, digital governance, teacher capacity, equitable learning systems*

1. Introduction

The COVID-19 pandemic accelerated the integration of digital technologies into education at an unprecedented pace. Overnight, classrooms shifted to online platforms, and educators, learners, and families were thrust into a digital learning environment without adequate preparation. In India, this rapid transition exposed deep fractures in educational access and participation. While some learners seamlessly adapted to online instruction, others were left behind due to lack of reliable connectivity, appropriate devices, or supportive learning environments. The results were stark: millions of students in rural and low-income communities faced prolonged disruptions in learning, further widening existing educational inequities.

At the same time, the post-pandemic period has underscored the potential for digital technologies to transform learning when access barriers are systematically addressed. States like Kerala and Himachal Pradesh leveraged widespread mobile penetration and community-level support systems to deliver educational content through radio, television, and low-bandwidth platforms. Initiatives such as the Government of India's digital infrastructure projects and the expansion of affordable data services have significantly reduced internet costs, enabling broader participation in online learning. These efforts demonstrate that innovative policy frameworks and targeted investments can make digital learning more inclusive, but they also highlight how uneven implementation can limit impact.

Despite improvements in connectivity and device availability, digital equity remains an elusive goal for many learners in India. The digital divide persists not just between urban and rural areas, but within communities, intersecting with socioeconomic status, gender, and linguistic diversity. For example, girls from economically disadvantaged households are less likely to have personal access to digital devices, constraining their ability to

engage with online learning resources. Similarly, learners from non-dominant language backgrounds often struggle with digital content that is not available in their mother tongues. These inequities reflect structural challenges that demand policy solutions tailored to India's socio-cultural complexity.

Emerging trends in educational technology, including adaptive learning systems, open educational resources, and community-based digital hubs, offer pathways to greater inclusion. However, without deliberate policy roadmaps that prioritize scalability and sustainability, these opportunities risk reinforcing the same inequalities they seek to overcome. Scalable solutions must account for local contexts, institutional capacities, and the diverse needs of learners across the vast Indian landscape. Sustainable digital equity requires a shift from ad-hoc interventions toward systemic reforms that align infrastructure, pedagogy, governance, and capacity building.

This chapter aims to articulate a comprehensive policy roadmap for achieving scalable and sustainable digital equity in education. By examining infrastructure challenges, content ecosystems, institutional capacity, and governance frameworks, it seeks to offer actionable insights grounded in Indian realities and global learning. In doing so, it sets the stage for a broader conversation about how India can leverage digital innovation not just to recover from the disruptions of the pandemic, but to build a more just and inclusive educational future.

2. Infrastructure, Access, and the Political Economy of Connectivity

The foundations of digital equity lie in infrastructure, yet infrastructure alone does not guarantee learning. India has witnessed a rapid expansion of digital connectivity over the last decade, marked by rising internet subscriptions, declining data costs, and large-scale public investments in network expansion.

This growth has created new possibilities for digital education, particularly in regions previously considered unreachable. At the same time, the distribution of these gains remains uneven across states, districts, and social groups, revealing that access is shaped as much by political and economic choices as by technological availability.

Recent national trends illustrate both progress and persistent gaps. India now has hundreds of millions of internet users, with rural subscriptions growing faster than urban ones. Most villages report basic mobile connectivity, and a significant number of gram panchayats have been linked through public broadband initiatives. These figures reflect impressive territorial coverage, but they do not capture variations in network quality, consistency of power supply, or the availability of learner-appropriate devices within households. For education, these hidden disparities often determine whether connectivity supports sustained engagement or results in fragmented participation.

Indicator	Approximate figure
Internet users (early 2024)	750+ million
Rural internet subscribers	Nearly 400 million
Villages with mobile connectivity	Over 95%
Gram Panchayats connected through public broadband	200,000+
Public Wi-Fi hotspots under national schemes	Nearly 400,000

These figures signal scale, but scale does not automatically translate into equity. Many households continue to rely on a single shared smartphone, limiting students' access to live classes or extended study time. Gendered access patterns remain visible, with girls in low-income households often having less control over device use. Connectivity also competes with domestic responsibilities, employment demands, and space constraints, particularly in densely populated or economically vulnerable settings. As a result,

educational access is shaped by everyday household conditions rather than infrastructure alone.

Affordability has improved substantially, positioning India among the lowest-cost data markets globally. This has enabled widespread consumption of educational video content and app-based learning. Yet affordability at the national level does not resolve local capacity constraints. Device ownership, digital literacy, and language accessibility continue to mediate who can benefit from low-cost data. Policies that emphasise connectivity metrics without addressing these intersecting barriers risk overestimating real learning access.

The political economy of connectivity further complicates the picture. Market-driven telecom expansion has prioritised high-density and commercially viable regions, while public investment has attempted to bridge gaps in rural and remote areas. Public–private partnerships have accelerated rollout but also raised questions of maintenance, accountability, and long-term viability. For education systems, these governance choices matter deeply. Decisions about whether to invest in school-based connectivity, community Wi-Fi, subsidised devices, or low-bandwidth platforms shape the durability and inclusiveness of digital learning ecosystems.

Technical design choices carry pedagogical consequences. High-bandwidth, platform-intensive models may work well in urban and semi-urban contexts, but they remain fragile in areas with unstable connectivity. In such settings, hybrid infrastructures that combine broadband, offline access, broadcast media, and local digital hubs offer greater resilience. A differentiated infrastructure strategy, aligned with regional realities, allows policy to move beyond one-size-fits-all solutions.

3. Platforms, Content, and Language Justice in Digital Learning

Digital platforms increasingly function as the backbone of contemporary education systems, shaping not only how learning is delivered but also whose knowledge is valued and whose voices are heard. In India, large-scale digital learning platforms have expanded rapidly since the pandemic, reaching millions of learners and teachers across states. These platforms have enabled continuity of instruction, large-scale teacher training, and access to standardized learning materials. At the same time, their design choices regarding language, content structure, and modes of delivery have profound implications for equity. Platforms must therefore be understood as policy instruments rather than neutral technologies, with the capacity to either reduce or reproduce existing educational inequalities.

Language remains one of the most decisive yet under-addressed dimensions of digital equity. A majority of Indian learners access the internet in Indian languages, and recent trends show a steady rise in consumption of non-English digital content. Yet educational platforms continue to privilege a limited set of dominant languages, often translating content rather than developing it from the ground up in learners' mother tongues. This creates cognitive and cultural distance for first-generation learners and students from rural, tribal, and minority-language communities. Language justice in digital learning requires a shift from token multilingualism to systematic investment in high-quality content creation, localization, and pedagogical adaptation across India's linguistic spectrum.

National digital education platforms illustrate both the possibilities and limits of scale. Large repositories now host thousands of courses, videos, and learning objects aligned with school and higher education curricula, and many support multiple Indian languages and offline access. Usage data indicate high engagement during periods of school closure and sustained reliance for exam

preparation and teacher professional development. However, the predominance of centrally produced content often limits contextual relevance. Learners encounter materials that are linguistically accessible but culturally distant, insufficiently aligned with local examples, or disconnected from classroom realities. Bridging this gap requires policy frameworks that encourage decentralised content development while maintaining quality assurance.

Open Educational Resources offer a promising pathway toward more democratic and inclusive content ecosystems. Open licensing enables educators and institutions to adapt, translate, and remix materials to suit local needs, reducing dependence on centrally controlled repositories. In the Indian context, this approach aligns with the diversity of curricula, teaching styles, and learner backgrounds across states. Yet open ecosystems require structured support. Without investment in teacher capacity, editorial guidance, and sustainable incentives, OER initiatives risk uneven quality and limited adoption. Effective policy must therefore balance openness with institutional scaffolding to ensure both inclusion and pedagogical rigour.

Accessibility extends beyond language to include format, usability, and design. Many learners face barriers related to disability, limited bandwidth, or shared device usage. Platforms that assume uninterrupted high-speed connectivity or rely heavily on video-centric delivery inadvertently exclude large sections of the population. Inclusive design principles—such as multiple content formats, downloadable resources, audio-based lessons, captions, and simple user interfaces—expand participation across diverse learning contexts. When accessibility is embedded at the design stage, platforms become more resilient and responsive to real-world constraints.

Algorithmic systems increasingly mediate access to digital content, influencing what learners see and what remains invisible. Recommendation engines and ranking mechanisms tend to favor

high-traffic content, which can marginalize regionally relevant or low-resource materials. In the absence of oversight, these dynamics risk concentrating visibility in the hands of a few providers, undermining the public purpose of educational platforms. Equity-oriented governance must therefore ensure transparency, promote diversity in content visibility, and align algorithmic design with pedagogical and social goals rather than purely engagement-based metrics.

4. Teachers, Institutions, and the Capacity Gap

Teachers are central to the success of digital learning. They translate digital resources into meaningful instruction. They connect technology with pedagogy and they support learners' engagement. Without teacher capacity, even well-designed platforms and content cannot achieve intended learning outcomes. In India, the pandemic highlighted both strengths and gaps in teacher readiness for digital instruction.

Many teachers demonstrated adaptability during prolonged school closures. They learned to use messaging apps, video calls, and digital content repositories to stay connected with students. In higher education, faculty adopted blended teaching methods that combined recorded lectures with interactive sessions. At the school level, individual initiative often determined whether digital tools enhanced instruction or remained underutilized. This uneven uptake reflects variations in institutional support, professional learning opportunities, and access to devices.

Despite these advances, significant capacity gaps persist. Recent national surveys show that a sizable proportion of teachers lack confidence with basic digital tools. Many report limited experience with learning management systems, content authoring tools, or assessment software. Even when technology training exists, it is often short, generic, and disconnected from teachers' subject

domains and classroom realities. The result is a gap between digital access and pedagogical integration.

Institutional readiness varies widely across states and school systems. Some state education departments have established dedicated units for digital pedagogy. These units provide ongoing training, peer learning forums, and localized support. In contrast, other regions lack structured professional development pathways. Teachers in these contexts are left to navigate digital change individually. This uneven institutional capacity exacerbates existing inequities in learner outcomes.

Teacher preparation programs are evolving, but not uniformly. Teacher education institutions have introduced modules on educational technology. However, these modules often focus on tool use rather than on instructional design for diverse learners. Prospective teachers may graduate with limited ability to design inclusive, culturally responsive digital learning environments. Strengthening pre-service training is essential to build a generation of educators who can leverage technology effectively.

Data on professional learning participation confirms both demand and constraint. A large number of teachers engage in short online workshops and webinars. Yet participation drops sharply for extended, competency-based programs. Time constraints, workload pressures, and lack of institutional incentives discourage deep engagement with professional development. Without sustained learning opportunities, teachers revert to familiar practices and underuse available digital resources.

Leadership at the institutional level shapes how technology is integrated. Schools and colleges with proactive leaders are more likely to adopt coherent digital strategies. These leaders create peer mentoring structures, allocate resources for devices, and set expectations for instructional innovation. Institutions without such leadership often treat technology as an add-on rather than as an

integral part of curriculum design. This gap in leadership capacity contributes to inconsistent implementation of digital learning policies.

Beyond teachers, support staff play an important role. Technical coordinators, librarians, and counsellors can bridge gaps between technology and instruction. In settings where these roles exist, teachers receive on-ground assistance with troubleshooting, resource curation, and learner support. However, many institutions lack dedicated support personnel. The absence of these roles places additional burden on teachers and limits the scalability of digital initiatives.

Bridging the capacity gap requires coordinated policy action. Systems must move beyond episodic training to sustained, contextualized professional learning. Policies should link capacity building with evaluation, career pathways, and incentives. Institutional investment in leadership and support staff must accompany teacher preparation reforms. Closing the capacity gap will strengthen the human infrastructure that is foundational to equitable digital education.

5. Governance, Data Ethics, and Accountability Frameworks

As digital education scales, governance mechanisms become central to ensuring equity, quality, and trust. Governance refers to the rules, norms, and institutional arrangements that shape how digital learning systems function. It determines who makes decisions, how resources are allocated, and how outcomes are measured. In the absence of clear governance, digital initiatives risk fragmentation, overlap, and unintended harms. Effective governance must be coherent across levels of the system and aligned with educational goals.

National and state education authorities have launched numerous digital initiatives. These programs aim to expand access, build capacity, and standardize content. However, the proliferation of

platforms and guidelines has also created complexity. Schools and institutions often navigate multiple portals, reporting requirements, and compliance standards. This administrative burden can divert attention from core instructional work. A more strategic approach would streamline governance layers and clarify roles across ministries, education departments, and local bodies.

Accountability systems are shifting in digital contexts. Traditional mechanisms of inspection and reporting are being complemented by digital dashboards, usage analytics, and real-time monitoring tools. These tools can highlight where connectivity is weak, which resources are under-utilized, and how learner engagement varies across regions. When used thoughtfully, such data can improve planning and resource prioritization. Yet accountability frameworks that focus narrowly on metrics risk incentivizing superficial compliance. For example, high login counts or page views may reflect access but not meaningful learning.

Data ethics is emerging as a central concern within digital learning ecosystems. Learner data now includes demographic information, engagement patterns, assessment results, and interaction histories. This data can inform personalized support, early warning systems for struggling students, and adaptive learning pathways. At the same time, the collection and use of such data raise questions about privacy, consent, and security. Without clear ethical frameworks, sensitive information can be misused or exposed, undermining trust in digital systems. Ethical governance must balance innovation with protections that respect learners' rights.

Transparency in algorithmic systems is another critical governance issue. Recommendation engines influence which resources learners encounter first. Automated assessments shape perceptions of performance. If these systems operate as black boxes, they may reproduce biases embedded in historical data or design choices. For instance, algorithms trained on data from urban, English-dominant contexts can systematically under-serve learners from rural or non-

dominant language backgrounds. Accountability requires that algorithmic logic, training data, and evaluation criteria be subject to review and adjustment to safeguard fairness.

Stakeholder participation enriches governance and accountability. Educators, learners, parents, and community representatives bring contextual insights that technical designers and policymakers may overlook. Mechanisms for consultation, feedback, and co-creation can ground digital governance in lived realities. Participatory processes also strengthen legitimacy, making it more likely that policies are adopted and sustained. Without inclusive processes, governance risks becoming top-down and detached from the needs of those it intends to serve.

Clear norms and standards are necessary to align digital practice with ethical and educational priorities. Data protection policies, interoperable system standards, and open content principles provide a framework for responsible innovation. These standards should be developed collaboratively and updated regularly to respond to technological change. They should also be accompanied by capacity building so that educators and administrators understand and can implement governance requirements.

Enforcement mechanisms are equally important. Policies and standards without accountability measures risk being symbolic. Oversight bodies, compliance audits, and redress mechanisms give teeth to governance frameworks. These mechanisms should be fair, transparent, and accessible. Learners and educators should be able to raise concerns and seek remedies when systems fail to protect rights or deliver on promised benefits.

6. Conclusion

This chapter has argued that digital equity in education cannot be achieved through isolated technological interventions. It requires coherent policy roadmaps that integrate infrastructure, platforms, content, human capacity, and governance into a unified vision of

educational justice. The post-pandemic expansion of digital learning in India has revealed both the transformative potential of technology and the structural inequalities that shape who benefits from it. Connectivity has expanded, platforms have scaled, and innovation has accelerated, yet access remains uneven and learning outcomes remain closely tied to social and institutional conditions.

Across the discussion, a central insight emerges: scalability without sustainability risks reproducing inequity at a larger scale. Infrastructure must be paired with affordability and local stewardship. Platforms must embed language justice, accessibility, and pedagogical relevance. Teachers and institutions must be supported through sustained capacity-building rather than episodic training. Governance frameworks must balance innovation with ethical safeguards, transparency, and accountability. When these elements operate in isolation, digital initiatives fragment. When aligned, they function as public goods that strengthen inclusion and resilience.

The implications for policy are clear. Digital equity must be treated as a long-term systemic commitment rather than an emergency response. Policymakers should prioritize adaptive strategies that respond to regional diversity, invest in human and institutional capacity, and embed ethical governance at every stage of digital expansion. Future policy design will also need to anticipate emerging technologies, evolving learner needs, and the growing role of data-driven systems, while ensuring that equity remains the guiding principle.

Within the broader framework of this volume, the chapter contributes a roadmap-oriented perspective that links innovation with responsibility. It positions digital equity not only as a tool for bridging learning gaps, but as a foundational condition for shaping an inclusive and future-ready education system. As India continues its digital transformation, the challenge ahead lies in ensuring that

technological progress deepens educational opportunity for all learners, rather than amplifying existing divides.

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15

AI, Big Data, and Equity: The Next Frontier in Educational Technology

Loknath Pal

Abstract

Artificial intelligence and big data are rapidly reshaping educational systems, offering new possibilities for addressing long-standing inequities while also introducing complex ethical and pedagogical challenges. This chapter examines how data-driven technologies are being integrated into Indian education in the post-pandemic era and evaluates their implications for equity, inclusion, and decision-making. The discussion highlights the potential of big data analytics to identify learning gaps, support personalised instruction, and inform policy at scale, particularly within a diverse and resource-constrained system. At the same time, it critically analyses the risks associated with algorithmic bias, unequal digital access, and the over-automation of educational processes. Emphasis is placed on the limits of artificial intelligence in capturing contextual realities and the continued importance of human judgment in interpreting data and guiding learning. The chapter argues that equitable outcomes depend not only on technological capability but on ethical governance, inclusive design, and sustained investment in teacher capacity.

Keywords: *Artificial Intelligence in Education; Big Data Analytics; Digital Equity; Educational Governance; Inclusive Learning*

1. Introduction

Education systems around the world are rapidly transforming under the influence of digital technologies. Artificial intelligence and big data are now central to conversations about the future of learning, teaching, and assessment. This shift has accelerated in the wake of the COVID-19 pandemic, which forced educational institutions to adopt remote and blended models at an unprecedented scale. In India, this period catalyzed investments in digital infrastructure, expanded the reach of online learning platforms, and foregrounded questions about how technology can both enable and constrain equitable educational outcomes.

India's diversity—linguistic, socio-economic, and geographic—makes the potential role of AI and big data particularly significant. Large-scale digital initiatives such as the National Education Policy's emphasis on technology integration and the growth of public digital platforms reflect a broader national commitment to leverage innovation for systemic reform. At the same time, deep inequalities persist in access to devices, reliable connectivity, and quality instruction. These gaps are not merely technical or material; they reflect longstanding structural inequities that shape who benefits from educational opportunities. In this context, the introduction of intelligent systems and data-driven tools raises fundamental questions about equity: who is served by these technologies, how they are designed, and what kinds of learning experiences they enable for diverse student populations.

Recent trends in educational technology suggest that AI-driven solutions can offer real promise. Adaptive learning platforms tailor content to individual learner needs. Automated analytics can help educators identify struggling students early and allocate instructional support more strategically. In India, some state governments and educational NGOs are experimenting with AI-enabled tools to support instruction in low-resource settings, demonstrating how technology can complement local pedagogical

practices. These innovations hint at a future where data-informed insights enhance decision making from classroom to policy levels. Yet the same tools carry risks: algorithmic bias, opaque data practices, and the potential to widen rather than close existing divides.

This chapter engages with these complexities by examining the intersection of AI, big data, and equity in educational technology. Rather than assuming digital innovation is inherently beneficial, it asks how intelligent systems can be aligned with inclusive visions of learning for all. The focus is not only on technological capability but on the social, ethical, and policy frameworks that determine whether these capabilities expand opportunity or entrench disadvantage. For Indian educators, researchers, and policymakers, this framing is particularly urgent. The challenge lies not only in adopting advanced technologies but in shaping them to reflect the values, needs, and aspirations of diverse learners across the nation.

Through the following sections, we will explore how big data is reshaping educational possibilities, how AI tools intersect with inclusion goals, and what it means to govern these systems responsibly. The objective is to move beyond simplistic narratives of technology as a panacea and instead articulate a nuanced understanding of how AI and data can contribute to more equitable, effective, and humane education. This exploration sets the stage for evidence-based insights and forward-looking strategies relevant to the Indian context and global debates on digital equity.

2. Big Data in Indian Education: Promise, Power, and Policy Tensions

Big data has become a defining feature of India's contemporary education ecosystem. The rapid expansion of digital platforms for teaching, assessment, and administration has generated vast volumes of learner data across schools, higher education institutions, and skill-development programmes. Every interaction

with online content, digital attendance system, or assessment dashboard adds to an expanding data trail. This shift has created new possibilities for understanding learning patterns at a scale that was previously unimaginable in a system as large and diverse as India's.

The promise of big data lies in its potential to make education systems more responsive and evidence-informed. Learning analytics can help identify students who are falling behind, track progress over time, and support differentiated instruction. At the policy level, aggregated data enables administrators to compare learning outcomes across regions, monitor programme implementation, and plan targeted interventions. In several Indian states, digital dashboards are already being used to monitor enrolment, attendance, and basic learning indicators in near real time. Such developments signal a move away from intuition-driven decision-making toward more systematic planning grounded in data insights.

At the same time, the power of big data introduces new forms of centralisation and control. Large national platforms and state-level management information systems increasingly shape what counts as valid knowledge about learners and schools. While this can improve coordination and transparency, it also raises concerns about whose realities are being captured and whose are left out. Many government schools, particularly in rural and remote areas, still operate with limited connectivity and minimal digital infrastructure. As a result, the data generated often reflects more digitally connected schools and learners, creating blind spots in policy analysis and potentially skewing resource allocation.

These structural gaps are closely tied to policy tensions around access, representation, and governance. The uneven distribution of devices, internet connectivity, and trained personnel affects both the quantity and quality of educational data. When analytics-driven decisions are made on incomplete or uneven datasets, there is a risk

of reinforcing existing inequalities rather than correcting them. Furthermore, the growing involvement of private edtech companies in data collection adds another layer of complexity. Questions around data ownership, consent, and long-term use remain contested, especially when learner data is aggregated across platforms without clear safeguards.

Recent trends also point to the rapid growth of India's digital education market, driven by post-pandemic adoption of online learning and assessment tools. This expansion has intensified the use of predictive analytics and performance tracking, particularly in test preparation and higher education. While such tools promise efficiency and personalisation, they also risk narrowing educational goals to what is easily measurable. In a system already marked by high-stakes examinations, data-driven metrics may further privilege speed, ranking, and standardisation over deeper learning and contextual understanding.

The scale of opportunity and disparity can be seen in recent national indicators related to digital readiness and platform use. These figures highlight both the momentum behind data-driven education and the uneven foundation on which it rests.

Table: Selected Indicators of Digital Education Infrastructure in India

Indicator	Recent Status
Government schools with digital libraries	Around 6 percent nationally
Users on national digital learning platforms	Over 9 million
Estimated size of digital education market (2024)	Approx. USD 4 billion
Projected digital education market (early 2030s)	Over USD 30 billion

These numbers suggest that while digital platforms reach millions of learners, a significant proportion of schools remain outside robust data ecosystems. The imbalance limits the transformative

potential of big data and raises concerns about representativeness and fairness in analytics-based policymaking.

Moving forward, the challenge for Indian education lies in aligning data ambition with equity-sensitive governance. Big data can support more inclusive and efficient systems only when investments in infrastructure, teacher capacity, and ethical oversight progress together. Without these foundations, data-driven reforms risk becoming technocratic exercises that amplify visibility for some learners while rendering others statistically invisible. Addressing these tensions is essential if big data is to serve as a tool for educational justice rather than an instrument of exclusion.

3. Artificial Intelligence as a Tool for Inclusion, Not Automation

Artificial intelligence is increasingly positioned as a transformative force in education, yet its true value lies not in automating teaching but in strengthening inclusive learning practices. When thoughtfully integrated, AI systems can support teachers by identifying learning gaps, adapting instructional pathways, and offering timely feedback. These functions are particularly relevant in India, where classrooms often include learners with varied linguistic backgrounds, learning levels, and access to resources. Rather than replacing pedagogical judgment, AI has the potential to enhance it by making learner diversity more visible and manageable within everyday classroom practice.

One of the most promising areas for inclusive AI lies in language and accessibility. India's multilingual reality poses persistent challenges to equitable instruction, especially for first-generation learners and students from non-dominant language groups. AI-enabled translation tools, speech-to-text applications, and adaptive reading supports can reduce these barriers by allowing learners to engage with content in more familiar and accessible forms. Similarly, advances in assistive technologies have improved access for students with visual, auditory, and cognitive impairments,

enabling participation that was previously limited by the availability of specialised human support. These tools do not substitute for inclusive pedagogy; they extend its reach and effectiveness.

AI also plays an emerging role in identifying patterns of exclusion that are difficult to detect through traditional monitoring. By analysing large volumes of learner interaction data, AI systems can highlight disparities in engagement, progression, and performance across gender, location, and socio-economic background. In the Indian context, where learning gaps often widen silently over time, such early signals can support timely intervention. However, the reliability of these insights depends heavily on the breadth and quality of the underlying data. Where digital access is uneven, the most disadvantaged learners risk being underrepresented, limiting the inclusiveness of algorithmic insights.

Design choices strongly influence whether AI mitigates or reproduces inequality. Systems trained on narrow or biased datasets tend to reflect existing social hierarchies, often privileging learners who already enjoy better educational support. There is also a tendency for AI tools to prioritise easily measurable outcomes such as test scores or task completion, sidelining complex learning processes like critical thinking, creativity, and socio-emotional growth. Without deliberate efforts to embed contextual sensitivity and multiple indicators of learning, AI risks reinforcing reductive views of student success.

The role of teachers remains central in determining the inclusive impact of AI. Educators must be able to interpret algorithmic recommendations critically, understand their limitations, and adapt them to local classroom realities. This requires sustained investment in professional development focused on data literacy, ethical awareness, and reflective practice. In settings where teachers are treated as passive users of technology, AI is more likely to be applied mechanically. In contrast, when teachers retain

agency and decision-making authority, AI becomes a supportive partner that informs rather than dictates pedagogical choices.

Policy and governance frameworks are equally crucial in shaping inclusive outcomes. Clear guidelines on data protection, transparency, and accountability are necessary to ensure that learner data is used responsibly and in the public interest. In India's rapidly expanding digital education ecosystem, the balance between public platforms and private providers adds further complexity. Inclusive AI requires governance structures that prioritise equity, prevent misuse of data, and encourage open, interoperable systems aligned with national educational goals.

4. Algorithmic Bias, Ethics, and the Risk of Reproducing Inequality

The growing integration of artificial intelligence into educational systems has intensified attention on algorithmic bias and ethical responsibility. AI systems learn from historical and real-time data, and in education this data often reflects deep-rooted social and institutional inequalities. In the Indian context, disparities linked to region, income, language, gender, and social background shape how learners participate in digital platforms. When these uneven patterns are absorbed into algorithmic models, they risk becoming normalized within automated decision-making processes.

Recent trends in digital learning participation reveal clear asymmetries. Students in urban and semi-urban areas consistently show higher engagement with online platforms than those in rural regions. Learners with stable internet access and personal devices complete more digital coursework and assessments. Such differences influence the datasets used to train predictive models, leading to systems that perform better for learners who are already digitally visible. As a consequence, students from marginalized or low-connectivity contexts may be misclassified, overlooked, or inaccurately assessed by AI-driven tools.

Encouraging progress has emerged in the recognition of these challenges. Education authorities and platform developers increasingly acknowledge that algorithmic systems require ethical safeguards. Some large-scale platforms have begun integrating human oversight in high-stakes decisions, ensuring that automated recommendations are reviewed by educators or administrators. Efforts to diversify training data by incorporating regional languages and varied learning contexts reflect a growing commitment to reducing systemic bias at the design stage.

Ethical concerns remain substantial, particularly around transparency and explainability. Many AI systems provide outputs without clearly communicating how decisions are generated. For teachers and school leaders, this opacity limits informed intervention. When a system labels a learner as underperforming or at risk, the absence of clear reasoning can reinforce fixed perceptions about ability. In large and resource-constrained systems, such labels may follow students across grades or institutions, shaping access to opportunities in ways that are difficult to challenge.

Predictive analytics presents another layer of ethical tension. Models that estimate future performance or dropout risk rely heavily on past behaviour and contextual indicators. In settings marked by historical disadvantage, prediction can unintentionally turn into pre-judgment. Data from recent implementation experiences suggest that learners flagged as high risk often receive remedial attention but are less frequently considered for enrichment or advanced pathways. This dynamic can narrow educational trajectories rather than expand them.

Data governance adds further complexity. The volume of learner data collected through digital platforms has increased sharply, while frameworks for consent, data minimisation, and long-term use remain uneven. Students and families are often unaware of how data generated through routine learning activities may be stored,

shared, or repurposed. In a system serving millions, limited transparency can translate into widespread ethical vulnerability.

Addressing these risks requires a balance between innovation and accountability. Algorithmic systems must be routinely examined for bias and differential impact across social groups. Teachers need institutional support to interpret, question, and override automated outputs when necessary. Policy frameworks must emphasise fairness, transparency, and learner dignity alongside efficiency and scale.

The broader challenge is to ensure that technology reflects educational values rather than reshaping them in unintended ways. When ethical reasoning, contextual understanding, and human judgment guide the use of AI, algorithms can help reveal hidden inequities and inform inclusive interventions. Without these safeguards, they risk embedding inequality into the digital architecture of education.

5. Human Judgment in a Data-Driven Classroom: Limits of AI in Educational Decision-Making

The expansion of data-driven tools in education has altered how learning is observed, evaluated, and guided. Dashboards now track attendance, engagement, and performance in real time. Predictive models estimate learning risks and suggest interventions. These developments offer efficiency and scale, but they also highlight the enduring importance of human judgment. Education is not a purely technical process. It is relational, contextual, and value-laden. No dataset can fully capture a learner's motivation, resilience, or lived experience.

AI systems operate by identifying patterns in historical data. Their recommendations are therefore shaped by what has been previously recorded and measured. In classrooms marked by socio-economic diversity, these records often reflect unequal starting points. Teachers frequently observe that students flagged as

underperforming by analytics tools demonstrate growth when supported through dialogue, mentoring, or contextual adjustments. Such changes emerge from human interaction rather than algorithmic prediction. This gap illustrates a central limitation of AI: it can describe patterns, but it cannot interpret meaning in the way educators do.

The Indian classroom further complicates data-driven decision-making. Many students experience irregular access to devices, shared learning environments, and interruptions linked to household responsibilities. These factors influence digital footprints but do not necessarily indicate learning potential or commitment. When AI systems rely heavily on engagement metrics, they may misread absence as disengagement or low scores as fixed ability. Teachers, by contrast, often contextualize such signals within broader social realities, adjusting expectations and support accordingly.

Empirical experiences from blended learning initiatives reveal that automated recommendations are most effective when treated as prompts rather than directives. Schools that encourage teachers to reflect on data collaboratively tend to use AI insights more judiciously. In contrast, environments that emphasize compliance with dashboards often reduce professional discretion. This shift can narrow pedagogical practice and weaken teacher morale. Human judgment acts as a safeguard against mechanical application of data, ensuring that decisions remain responsive to individual learners.

Emerging debates also highlight the limits of AI in high-stakes educational decisions. Placement, tracking, and assessment carry long-term consequences for students. Overreliance on predictive scores risks turning probabilities into outcomes. Once categorized, learners may find it difficult to escape algorithmically defined pathways. Human oversight is therefore essential, not as a symbolic

gesture, but as an active process of interpretation, challenge, and ethical reflection.

The synthesis of data and judgment requires institutional support. Teachers need time, training, and autonomy to engage meaningfully with analytics. Data literacy must be framed as critical understanding rather than technical compliance. When educators are empowered to question what data shows and what it omits, AI becomes a tool for insight rather than control.

6. Conclusion

The rapid integration of artificial intelligence and big data into education has opened new possibilities for addressing persistent inequities, particularly in systems marked by scale and diversity. Data-driven technologies have demonstrated their capacity to identify learning gaps, support differentiated instruction, and strengthen planning across multiple levels of governance. In India, these capabilities are especially significant, given the wide variation in access, language, and learning conditions that shape educational experience.

The analysis has also revealed important limitations. Technological systems inherit the assumptions and inequalities present in the data they process. When deployed without ethical safeguards and contextual sensitivity, AI tools risk reinforcing exclusion rather than mitigating it. Patterns of digital visibility can overshadow lived realities, while predictive models may narrow educational pathways if treated as definitive judgments. These risks highlight the continued importance of human agency in educational decision-making.

Within the broader discourse on digital equity, the discussion underscores that inclusion cannot be achieved through technology alone. Equitable outcomes depend on governance frameworks that prioritise transparency, accountability, and learner dignity. They also depend on teachers' capacity to interpret data critically and act

with professional judgment. Technology gains meaning only when embedded within pedagogical and institutional practices that recognise complexity and diversity.

Future directions point toward integration rather than substitution. Expanding digital infrastructure must go hand in hand with ethical data practices, inclusive design, and sustained professional development. As AI systems grow more influential in shaping learning environments, the central challenge will be to ensure that innovation remains aligned with educational values. When guided by equity as a core principle, AI and big data can contribute not only to efficiency, but to a more just and responsive post-pandemic education system.

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16

Imagining the Post-Divide Classroom: Visioning Education for 2040

Anesha Saha

Abstract

The COVID-19 pandemic marked a turning point in the global use of digital technologies in education, exposing deep structural inequalities while accelerating innovation at an unprecedented scale. This chapter examines how the Indian education system can move beyond emergency digital adoption toward a more equitable and sustainable future by envisioning the post-divide classroom *for 2040. It argues that digital equity must be understood not as access to devices or connectivity alone, but as the capacity of learners, teachers, and institutions to engage in meaningful learning within technology-rich environments. Drawing on post-pandemic trends, policy directions, and institutional practices in India, the chapter analyses shifts in pedagogy, learning spaces, teacher roles, and governance structures. It highlights the central role of teachers as designers of learning, mediators of technology, and ethical anchors in algorithm-influenced classrooms. The discussion further examines how financing models, partnerships, and political economy dynamics shape who benefits from digital transformation. It contributes to broader debates on digital education by proposing pathways through which India can bridge learning gaps while preparing learners for a rapidly evolving future.*

Keywords: *Digital equity; Post-divide classroom; Teacher professionalism; Educational futures; Indian education*

1. Introduction

The decade following the COVID-19 pandemic has been a period of profound change for education systems worldwide, and India is no exception. When schools and universities shut their doors in early 2020, the shift to remote learning was abrupt and unplanned. For millions of learners, this shift offered a new medium for continuity; for many more, it revealed structural gaps that had long existed beneath the surface. The notion of a "digital classroom" moved almost overnight from a speculative idea into a lived reality for students, teachers, and families. Yet, as schools transitioned online, inequalities in access to technology, connectivity, and pedagogical support became unmistakably visible, exposing a deeper learning divide that persists today.

In urban centres and private schools with robust infrastructure, students quickly adapted to synchronous lessons, digital assignments, and online collaboration. In contrast, learners in remote districts, low-income communities, and underserved public schools often lacked stable internet connections, personal devices, or even electricity to support meaningful participation. These disparities did not exist in isolation; they intersected with socio-economic status, gender, and geography, shaping who could benefit from digital learning and who was left further behind. The persistence of these divides underscores that access alone is an inadequate measure of educational equity. Meaningful learning requires not just connectivity, but sustained pedagogical support, culturally relevant content, and environments where all learners can thrive.

At the same time, the pandemic and its aftermath have accelerated innovations that hold promise for the future. Across Indian states and educational ecosystems, policy frameworks and grassroots initiatives are rethinking how technology can be integrated to support equitable learning. New Education Policy (NEP) 2020 positions digital education as a cornerstone of reform, urging the

creation of inclusive digital infrastructure, teacher capacity building, and multilingual, accessible content across contexts. Efforts ranging from smart classroom installations in remote border villages to community-driven digital literacy campaigns illustrate how diverse models are emerging to expand opportunities for learners outside major urban hubs. These developments remind us that technology is not a standalone solution; it is a means to reimagine how education is delivered, experienced, and sustained.

Understanding the complexity of these trends is essential as we look toward 2040. The post-pandemic era has taught us that while technology can extend learning opportunities, it can also replicate and deepen existing inequities when deployed without attention to context and capacity. India's vast diversity—across states, languages, and socio-economic conditions—demands nuanced approaches that respond to local realities while aligning with national ambitions for inclusive growth. Looking ahead, the question is not whether to integrate digital tools, but how to harness them thoughtfully to support equitable, engaging, and future-ready learning for all.

This chapter positions the idea of a *post-divide classroom* as both a practical challenge and a normative aspiration. It argues that the real measure of progress is not merely the proliferation of devices or platforms, but the transformation of educational experiences in ways that reduce learning gaps, empower teachers, and expand opportunities for learners across Indian society. By foregrounding equity, agency, and sustainability, we can begin to sketch what classrooms in 2040 might look like—environments where technological innovation and human pedagogy work together to make learning more inclusive, relevant, and resilient.

2. Redefining Equity in a Technology-Saturated Educational Landscape

Equity in education can no longer be understood simply as access to devices or internet connectivity. Over the past few years, India has witnessed rapid digital expansion, with smartphones becoming commonplace and online platforms embedded into everyday learning practices. Yet this expansion has revealed a more complex reality. Technology has amplified possibilities for some learners while quietly reinforcing disadvantages for others. The challenge today lies in recognising that digital saturation does not automatically translate into equitable learning experiences.

One of the most visible shifts is the gap between availability and usability. While many households now report some form of internet access, schools and learners differ sharply in their ability to use digital tools for sustained and meaningful learning. Government schools, particularly in rural and peri-urban regions, often face unstable connectivity, limited hardware, and insufficient technical support. At home, students may share a single device with family members or rely on mobile data that restricts participation in extended learning activities. These conditions shape how learners engage with content, complete assignments, and interact with teachers, producing uneven learning outcomes even when nominal access exists.

Recent data points help illustrate this layered nature of inequality:

Indicator	**Approximate situation**
Active internet users in India (mid-2020s)	Around 850–900 million
Government schools with functional internet	Roughly one-quarter
Household access to personal computers	About 13–15%
Urban–rural gap in household internet access	Urban access remains notably higher

These figures point to a crucial insight: connectivity has grown faster than institutional readiness. Schools may be expected to

adopt blended or digital-first models without the infrastructure, pedagogical redesign, or teacher training required to make such models effective. As a result, technology often supplements traditional teaching unevenly, benefiting students who already possess academic support, language proficiency, and digital confidence.

Equity must therefore be reframed around *learning capability* rather than mere access. This includes digital literacy, language inclusion, and the ability to learn independently in mediated environments. In India's multilingual context, content availability in regional languages becomes a decisive factor. Learners are more likely to engage deeply when instructional materials reflect their linguistic and cultural realities. Similarly, students with disabilities face exclusion when platforms and content are not designed with accessibility in mind. Equity in a technology-saturated landscape depends on whether systems anticipate diverse learner needs from the outset.

Another critical dimension is the role of teachers. Technology reshapes classrooms only when educators are confident in adapting pedagogy, assessment, and student support to hybrid environments. Short-term training focused on tool use is insufficient. Teachers require sustained professional development that helps them integrate digital resources meaningfully, manage mixed-ability classrooms, and support students who struggle with self-directed learning. Without this support, technology risks becoming an additional burden rather than a bridge.

Encouragingly, several state-level initiatives and institutional experiments suggest alternative pathways. Hybrid models that combine digital platforms with community learning spaces, peer mentoring, and teacher-led facilitation demonstrate how equity can be strengthened through contextual design. These approaches recognise that technology works best when embedded within local

ecosystems that include families, schools, and community institutions.

Redefining equity in the digital age therefore requires a shift in priorities. The goal is not universal digitisation for its own sake, but the creation of learning environments where technology enhances inclusion, supports diverse learners, and reduces rather than widens existing gaps. This broader understanding of equity provides the foundation for imagining the post-divide classroom—one that is adaptive, humane, and capable of serving India's diverse learners as education moves toward 2040.

3. The Post-Divide Classroom: Pedagogies, Spaces, and Learning Relationships

The classroom of 2040 will look markedly different from the traditional, age-segmented, teacher-centered model that dominated much of the twentieth century. The term *post-divide classroom* refers not simply to a space equipped with devices and broadband, but to an environment where pedagogical innovation, flexible learning spaces, and rich relationships among learners and educators converge to support deep and equitable learning. In post-pandemic India, this evolution is already visible in pockets where hybrid learning, community engagement, and learner agency form the core of everyday practice.

Pedagogically, the shift has moved away from knowledge transmission toward active, participatory, and project-based learning that integrates digital and analogue resources. Schools are experimenting with adaptive learning platforms that personalise instruction to meet varied learner needs. These systems adjust the pace and sequence of content based on individual progress, enabling students who struggle with foundational skills to receive targeted support while allowing advanced learners to explore complex applications. Such adaptive approaches, when combined

with human facilitation, can produce richer learning outcomes than either digital or traditional methods alone.

Classroom spaces are reimagined, both physically and virtually. Rather than confining learning to a single room for fixed hours, the post-divide classroom extends into blended zones that include community learning centres, online studios, maker spaces, and informal peer hubs. Flexible seating, multimodal displays, immersive simulations, and low-cost interactive resources enable learners to shift between individual inquiry, small-group collaboration, and whole-class discussion fluidly. In regions where infrastructure remains limited, mobile learning labs and shared digital kiosks within villages or urban neighbourhoods bridge physical constraints without depending exclusively on personal devices.

A defining feature of this new classroom is the changing nature of relationships. Teachers evolve from being sole dispensers of content to designers of learning experiences and mentors who cultivate critical thinking, creativity, and resilience. In this role, they orchestrate learning pathways that draw on local context, community knowledge, and real-world problems. Peer relationships also gain prominence; students collaborate across age groups and geographic boundaries, participating in virtual exchange projects and cross-school problem-solving networks that expand their horizons beyond the immediate classroom.

Emerging dynamics of assessment further reflect this transformation. Traditional high-stakes examinations are gradually supplemented or replaced by performance tasks, portfolios, and continuous formative feedback that capture a broader range of competencies. In blended environments, digital tools support real-time feedback, enabling educators to intervene proactively and students to reflect on their own progress. These assessment practices align more closely with 21st-century skills such as communication, adaptability, and metacognition.

Despite these promising developments, challenges persist. Digital infrastructure remains uneven, and teacher preparedness varies widely across states and districts. Professional development systems must therefore prioritise sustained learning opportunities that help educators integrate technology with sound pedagogical principles. Communities and families must also be part of the learning ecosystem, as their engagement reinforces learners' motivation and provides support structures outside formal institutions.

Data from recent national surveys indicate that while a significant majority of schools report some form of digital connectivity, a much smaller proportion regularly uses digital tools in core classroom instruction. Similarly, a growing number of higher-education institutions are offering blended courses, but student outcomes vary based on the level of institutional support and teacher readiness. These patterns underscore that the promise of the post-divide classroom will be realised not through technology alone, but through thoughtful synthesis of pedagogy, space design, and human relationships.

In reimagining the classroom for 2040, the focus must be on creating inclusive environments that value learner diversity, encourage experimentation, and sustain meaningful connections among participants. When technology is woven into a fabric of reflective practice, community engagement, and flexible learning arrangements, it amplifies human capacities rather than obscuring them. This integrated vision of pedagogies, spaces, and learning relationships forms the heart of the post-divide classroom—one that can adapt to changing realities while advancing equity and excellence in Indian education.

4. Teachers as Designers, Mediators, and Ethical Anchors of Future Learning

Teachers remain the central force shaping how technology influences learning. Over the last decade, India's teacher workforce has expanded significantly, creating the scale needed to support universal schooling and growing enrolments in higher education. This expansion has improved reach, but it has also exposed differences in capacity. Teachers operate within highly uneven institutional environments, where access to infrastructure, digital tools, and professional support varies widely across regions and school systems.

Progress is clearly visible. A growing share of schools now report basic digital facilities, and many teachers are familiar with online platforms for lesson delivery, assessment, and communication. Large national initiatives have enabled millions of teachers to participate in online training and professional development programmes. These efforts have helped normalise blended teaching practices and reduced initial resistance to technology. For many educators, especially younger entrants to the profession, digital tools are no longer peripheral but embedded in everyday practice.

At the same time, challenges persist. Infrastructure gaps remain common in government schools, particularly in rural and remote areas. Unreliable connectivity and limited hardware restrict the scope of digital pedagogy. Even where access exists, many teachers report difficulty in translating online training into classroom practice. Short-duration courses often emphasise platform use rather than instructional design, assessment strategies, or learner support. As a result, technology is sometimes layered onto traditional teaching methods without meaningful pedagogical change.

In the post-divide classroom, teachers are required to act as designers of learning rather than mere transmitters of content. They must plan learning pathways that blend digital resources with discussion, collaboration, and hands-on activities. This design role demands time, reflective practice, and ongoing mentoring. It also

requires sensitivity to learner diversity, including differences in language, prior knowledge, and home learning conditions. Without sustained professional support, these expectations can become a source of pressure rather than empowerment.

Teachers also function as mediators between learners and increasingly complex technological systems. Adaptive platforms, data dashboards, and automated feedback tools offer insights into student progress, but they do not replace professional judgement. Teachers interpret data, contextualise feedback, and respond to learners' emotional and cognitive needs. This mediating role is particularly important in classrooms where students experience anxiety, disengagement, or uneven access to support outside school.

Ethical responsibility has become a defining dimension of teaching in digitally mediated environments. Teachers are often the first line of protection for student privacy, data security, and equitable treatment. As algorithmic systems influence learning pathways and assessment, educators must question opaque decision-making processes and advocate for transparency and fairness. These ethical demands require institutional backing through clear guidelines, professional norms, and shared accountability structures.

Workload remains a significant concern. Administrative reporting and digital compliance tasks have expanded alongside instructional responsibilities. Where these demands are poorly managed, they reduce the time teachers can devote to planning, feedback, and professional collaboration. Systems that streamline administration and trust teacher judgement create space for innovation and reflective practice.

The future of equitable learning depends on how well teachers are supported in these evolving roles. Effective models combine large-scale digital training with local mentoring, peer networks, and school-based leadership. They focus not only on participation in

professional development, but on observable changes in classroom practice and student engagement. In this vision, teachers are not passive recipients of reform. They are active architects of the post-divide classroom, ensuring that technology serves learning, equity, and human dignity rather than undermining them.

5. Financing, Partnerships, and the Political Economy of Digital Equity

Digital equity is shaped as much by financial choices and power relations as by pedagogy or technology. In India, public expenditure on education has increased in nominal terms, yet remains constrained when measured against system-wide digital ambitions. Capital investments in connectivity, platforms, and devices have expanded rapidly since 2020, while recurrent spending on maintenance, teacher support, and local capacity often lags. This imbalance affects sustainability. One-time grants can enable access. Long-term equity depends on predictable funding that supports people, processes, and institutions.

Financing patterns reveal a clear shift toward platform-centric solutions. Large-scale national platforms have reduced duplication and improved reach. They have also concentrated decision-making around content standards, data flows, and assessment logic. This concentration can deliver efficiency. It can also marginalize local needs if financing mechanisms do not incentivize contextual adaptation. States and institutions with stronger fiscal capacity tend to layer additional supports, while resource-constrained regions rely almost entirely on centrally funded tools. The result is uneven depth of implementation across the system.

Public–private partnerships have become a defining feature of the digital education landscape. Collaboration with technology firms, philanthropies, and social enterprises has accelerated innovation and reduced time to deployment. Examples include device provisioning in aspirational districts, content development in

regional languages, and teacher training at scale. Evidence from state programs shows that such partnerships can improve short-term outcomes when roles are clearly defined and public oversight is strong. Challenges emerge when contracts prioritize rapid scaling over long-term capacity building, or when proprietary systems limit interoperability and public control.

The political economy of digital equity also raises questions about market power and access. The rapid growth of private edtech has expanded choice for middle-income families, while publicly funded systems serve a far more diverse population with fewer customization options. Fee-based models often innovate faster, but their benefits do not automatically spill over into public education. Without deliberate policy alignment, innovation risks reinforcing stratification, where advanced tools cluster in private institutions and foundational systems struggle to keep pace.

Data governance has become a central economic and ethical issue. Learning platforms generate large volumes of student data. Decisions about ownership, storage, and use carry long-term implications for privacy and public trust. Teachers and school leaders increasingly report uncertainty about how learner data are used beyond instructional purposes. Systems that lack clear safeguards risk eroding confidence, particularly among parents and communities already wary of digital surveillance. Sustainable equity requires that data practices serve educational improvement rather than commercial extraction.

Emerging evidence points toward more resilient financing and partnership models. States that combine central funding with local co-investment show greater continuity in digital initiatives. Institutions that embed partnerships within public frameworks retain greater control over curriculum and assessment. Community-linked models, such as shared digital hubs and school–college collaborations, reduce per-learner costs while expanding access. These approaches distribute risk and build local ownership.

6. Conclusion

This chapter has argued that the challenge of digital equity in the post-pandemic era extends far beyond questions of access. The experiences of the last decade demonstrate that technology can widen learning gaps as easily as it can bridge them, depending on how it is embedded within pedagogical practice, institutional design, and policy priorities. In the Indian context, where diversity of language, geography, and socio-economic conditions is profound, equity must be understood as the capacity of education systems to support meaningful learning for all learners, not merely as the availability of digital tools.

By introducing the idea of the post-divide classroom, the chapter has reframed the future of education as a relational and ethical project. Pedagogical innovation, flexible learning spaces, and strong learning relationships emerge as central to this vision. Teachers play a decisive role as designers, mediators, and ethical anchors, ensuring that technology enhances rather than diminishes human agency and inclusion. At the system level, financing models and partnerships shape whose knowledge is valued, which innovations scale, and how public accountability is maintained.

Looking toward 2040, the direction is clear. Sustainable digital equity will depend on long-term investment in teacher capacity, locally responsive design, and governance frameworks that treat technology as a public good. Policy coherence, ethical oversight, and community engagement will be as important as infrastructure and platforms. The chapter contributes to the broader theme of this volume by emphasizing that bridging learning gaps requires not only digital expansion, but a shared commitment to justice, care, and democratic participation in education. Imagining the post-divide classroom is therefore an invitation to align technological futures with inclusive educational values, ensuring that progress is measured by learning quality and equity rather than speed of adoption alone.

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