



# Digital Literacy and Rural Education: Challenges in Implementing NEP 2020

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## Abstract

This study examines the role of digital literacy in facilitating implementation of India's National Education Policy (NEP) 2020 in rural schools of West Bengal. Using a stratified random sample of 450 students (grades 6–12) across 15 rural schools, the research employs a structured questionnaire to measure access to digital devices and internet, digital literacy competencies, teacher support, and self-reported academic performance. Findings show high smartphone ownership (60%) but low access to computers (20%), home internet (30%), reliable school connectivity (18%), and school smart-classroom presence (24.9%). Only 35.1% of students attained moderate-to-high digital literacy. Teacher preparedness is limited (36% reported teacher training), and significant gender and socioeconomic disparities persist: males and higher-SES students report greater access and literacy. Statistical analysis indicates a strong positive association between digital literacy and academic performance ( $\chi^2 = 124.5$ ,  $p < 0.001$ ), and higher literacy among students with computers and home internet. The study confirms hypotheses that device/connectivity access and teacher support significantly influence digital literacy and that socio-demographic factors shape digital inclusion. It highlights a structural mismatch between NEP 2020's digital ambitions and rural realities, risking reinforcement of existing inequities. Recommendations include investments in resilient last-mile infrastructure (solar reliability, school broadband), device-lending and community hubs, contextual

teacher professional development, localized multilingual and low-bandwidth content, equity-focused monitoring, and targeted support for disadvantaged groups. Limitations include self-reported academic data, cross-sectional design, geographic concentration in West Bengal, and reliance on student reports for teacher training. The paper calls for longitudinal, mixed-methods, and impact-evaluation studies to guide equitable NEP-aligned digital interventions in rural India.

**Keywords:** *Digital Literacy; Rural Education; National Education Policy (NEP) 2020; Information and Communication Technology (ICT); Digital Divide; Rural Schools;*

## 1. Introduction

The twenty-first century has witnessed an unprecedented transformation in education driven by rapid developments in digital technologies. Educational systems across the world are increasingly integrating digital tools to improve teaching, learning, assessment, and administrative processes. Digital literacy has consequently emerged as a fundamental competency that enables learners and educators to effectively access, evaluate, create, and communicate information using digital technologies. In the context of India, where educational inequalities persist across geographical and socioeconomic dimensions, digital literacy has become a critical component of educational reform.

The National Education Policy (NEP) 2020 recognizes technology as a catalyst for achieving equitable, inclusive, and quality education. It advocates the integration of digital platforms, online learning resources, virtual laboratories, and Information and Communication Technology (ICT)-enabled pedagogies to enhance learning outcomes. The policy also emphasizes teacher capacity building, digital infrastructure, multilingual

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educational resources, and flexible learning opportunities. These initiatives are expected to transform India's educational landscape by making education more accessible and learner-centered.

Despite these ambitious objectives, implementing digital education in rural India remains a formidable challenge. A considerable proportion of rural schools continue to experience inadequate internet connectivity, limited access to digital devices, unreliable electricity, insufficient teacher training, and financial constraints. The COVID-19 pandemic further exposed these disparities, highlighting the urgent need to strengthen digital infrastructure and promote digital literacy among rural populations.

This study seeks to examine the role of digital literacy in facilitating the implementation of NEP 2020 in rural India. It explores the existing challenges, identifies gaps in implementation, and proposes policy recommendations to promote inclusive digital education. Understanding these issues is essential for ensuring that the transformative vision of NEP 2020 reaches every learner, irrespective of geographical location or socioeconomic background.

## 1.1 Background of the Study

Education has long been recognized as one of the most effective instruments for social transformation and economic development. The emergence of digital technologies has significantly altered the educational landscape by enabling innovative methods of teaching, collaborative learning, online assessment, and access to vast repositories of educational resources. Governments around the world have increasingly adopted digital technologies to improve educational quality and expand access to learning opportunities.

India's educational system serves one of the largest student populations globally, characterized by substantial diversity in language, culture, geography, and socioeconomic conditions. While urban colleges have adopted a rapid path of technological advancement, rural schools nonetheless suffer from persistent infrastructural and technological shortcomings. These gaps have led to unequal opportunities in digital learning and increased educational inequities.

While urban colleges have adopted a rapid path of technological advancement, rural schools nonetheless suffer from persistent infrastructural and technological shortcomings. These gaps have led to unequal opportunities in digital learning and increased educational inequities. Considering these challenges, the Government of India has initiated with National Education Policy 2020 emphasizing on the Techno-Friendly Learning. The policy seeks to promote digital literacy, strengthen ICT infrastructure, encourage blended learning, and enhance teacher preparedness for digital pedagogy. However, effective implementation requires addressing structural barriers that continue to impede digital transformation in rural education.

The growing importance of digital skills in higher education, employment, entrepreneurship, and lifelong learning further underscores the necessity of promoting digital literacy among rural students. Therefore, examining the challenges associated with implementing NEP 2020 provides valuable insights into strengthening educational equity and improving learning outcomes across rural India.

## 1.2 Concept of Digital Literacy

Digital literacy extends beyond the basic ability to operate computers or smartphones. It encompasses a comprehensive set of knowledge, skills, attitudes, and ethical practices required to effectively use digital technologies for learning, communication, collaboration, problem-solving, and information management. A digitally literate individual can locate, evaluate, organize, create, and share digital information while understanding issues related to privacy, cyber security, intellectual property, and responsible online behavior.

In educational settings, digital literacy enables students to engage with multimedia learning resources, participate in virtual classrooms, conduct online research, develop critical thinking skills, and collaborate through digital platforms. For teachers, digital literacy facilitates the effective integration of technology into instructional practices, assessment strategies, classroom management, and professional development.

NEP 2020 identifies digital literacy as an essential competency for preparing learners to thrive in an increasingly knowledge-driven and technology-oriented society. The policy encourages educational institutions to adopt digital tools, online content, virtual laboratories, adaptive learning systems, and blended pedagogical approaches that enhance both accessibility and learning outcomes.



Therefore, digital literacy should be viewed not merely as technological proficiency but as a multidimensional capability that empowers individuals to participate meaningfully in education, employment, governance, and civic life within the digital economy.

### 1.3 Rural Education in India

Rural education constitutes the foundation of India's educational system, as a substantial proportion of the country's population resides in rural areas. Rural schools play a pivotal role in promoting literacy, reducing poverty, fostering social mobility, and supporting national development. Despite notable improvements in school enrollment and educational access over recent decades, rural education continues to face persistent challenges related to infrastructure, teacher availability, learning resources, and technological accessibility.

The digital divide between rural and urban India has emerged as one of the most significant barriers to educational equity. Many rural schools lack adequate computer laboratories, internet connectivity, electricity, smart classrooms, and digital teaching materials. Furthermore, students from economically disadvantaged families often cannot afford smartphones, laptops, or reliable internet services, limiting their participation in digital learning initiatives.

Teacher preparedness also remains a significant concern. Many educators working in rural schools have limited opportunities for digital training and professional development, reducing their ability to effectively integrate ICT into classroom instruction. Language diversity and limited availability of digital educational content in regional languages further complicate technology adoption.

Addressing these challenges requires comprehensive investments in digital infrastructure, teacher capacity building, affordable internet access, localized educational resources, and community engagement to ensure that rural learners benefit equally from technological advancements envisioned under NEP 2020.

### 1.4 Overview of NEP 2020

The National Education Policy (NEP) 2020 represents India's first comprehensive education policy of the twenty-first century, replacing the National Policy on Education of 1986 (revised in 1992). It aims to transform India's education system by promoting flexibility, inclusivity, multidisciplinary learning, critical thinking, skill development, and technology integration across all levels of education.

A central feature of NEP 2020 is its emphasis on digital education. The policy advocates the establishment of robust digital infrastructure, expansion of online learning platforms, development of high-quality digital educational content, teacher training in digital pedagogy, and increased use of ICT in teaching and learning. It also recommends blended learning approaches that combine face-to-face instruction with digital resources to enhance educational effectiveness.

The policy proposes several technology-driven initiatives, including digital repositories, virtual laboratories, adaptive learning platforms, multilingual educational resources, and continuous teacher professional development. Additionally, it recognizes the importance of bridging the digital divide by ensuring equitable access to digital technologies for disadvantaged and rural communities.

The successful implementation of these initiatives depends upon coordinated efforts involving government agencies, educational institutions, private sector organizations, civil society, and local communities.

### 1.5 Need and Significance of the Study

The increasing digitalization of education has made digital literacy indispensable for academic success, employability, and active participation in modern society. While NEP 2020 provides a visionary framework for integrating technology into education, substantial disparities remain between policy aspirations and ground-level implementation, particularly in rural India.

This study is significant because it examines the practical challenges that hinder digital literacy development and effective implementation of NEP 2020 in rural educational settings. Understanding these barriers is essential for designing evidence-based policies that promote equitable access to digital learning opportunities.

The findings of this study will contribute to educational policy discourse by identifying infrastructural, technological, socioeconomic, and institutional factors affecting digital education. They may also assist policymakers, educational administrators, teachers, researchers, and development organizations in formulating strategies to strengthen digital inclusion and improve educational outcomes in rural communities.

Ultimately, promoting digital literacy among rural learners is not merely an educational objective but a national developmental priority. It contributes to reducing educational inequalities, enhancing human



capital, supporting sustainable development, and preparing future generations to participate effectively in the global digital economy. The study therefore offers both theoretical insights and practical recommendations for realizing the inclusive vision of NEP 2020.

## 2. Review of Literature

The latest work on rural digital literacy in India shows both progress and persistent inequality. Panari Sandeep Sambhaji (2025) notes that rural India still faces a strong digital divide, where access to smartphones has increased but basic digital skills, infrastructure, and meaningful connectivity remain uneven. Government-linked reporting also indicates that recent rural broadband and digital-skilling efforts are expanding access, yet advanced use and reliable school connectivity continue to lag.

Earlier theoretical work remains essential for framing the issue. Paul Gilster (1997) defined digital literacy as the ability to understand, evaluate, and use digital information critically, while Doug Belshaw (2014) expanded it into eight dimensions, showing that digital literacy is context-dependent and adaptive. Henry Jenkins et al. (2009) argued that learners must participate, collaborate, and create digital content ethically, and Howard Rheingold (2012) emphasized attention management, information filtering, and responsible online participation. Together, these works show that digital literacy is not just technical skill but critical and civic competence.

In the Indian context, Dibyendu Maiti, Fulvio Castellacci, and Arne Melchior (2020) show that digitalisation has widened educational opportunities but has also exposed inequalities in infrastructure, income, gender, and skill. Kashika Chadha (2020) similarly argues that poor internet connectivity, weak digital infrastructure, and regional disparities limit inclusive digital education. These constraints are especially visible in rural schools, where teacher shortages, limited resources, and weak internet access continue to restrict learning.

NEP 2020 has intensified this discussion by promoting technology integration, blended learning, multilingual digital content, and teacher development. Soumya Sankar Ghosh (Ed.) (2025), Dheeraj Mehrotra (2021), and Nishi Tyagi and Akanksha Srivastava (2022) all stress that the policy's success depends on infrastructure, teacher preparedness, and equitable implementation. Overall, the literature concludes that rural digital literacy requires not only devices and connectivity but also critical skills, trained teachers, and inclusive policy support.

### 2.4 Research Gap

The review of existing literature reveals several important research gaps.

First, although digital literacy, rural education, and NEP 2020 have each received considerable scholarly attention, relatively few studies examine these three themes together within a single analytical framework.

Second, most studies concentrate on urban educational institutions or broad national policy discussions, while limited research investigates the realities of rural schools where digital infrastructure, internet connectivity, teacher preparedness, and socioeconomic challenges remain acute.

Third, existing literature often examines isolated variables such as ICT infrastructure, digital devices, teacher training, or internet access. Few studies adopt a holistic approach that simultaneously considers technological, pedagogical, institutional, economic, and social dimensions affecting the implementation of NEP 2020.

Fourth, there is insufficient empirical evidence regarding the effectiveness of government initiatives—including Digital India, PMGDISHA, DIKSHA, SWAYAM, and PM eVIDYA—in improving digital literacy and educational outcomes in rural India.

Finally, only a limited number of studies provide comprehensive policy recommendations for strengthening digital literacy in rural schools while aligning implementation strategies with the objectives of NEP 2020.

The present study seeks to address these gaps by critically examining the relationship between digital literacy and the implementation of NEP 2020 in rural India. It integrates technological, educational, socioeconomic, and policy perspectives to provide evidence-based recommendations for promoting equitable, inclusive, and sustainable digital education.



### 3. Research Methodology

This study will adopt a qualitative, descriptive research design to examine the role of digital literacy in facilitating the implementation of NEP 2020 in rural India. The design is appropriate because the study seeks to understand policy implementation, contextual barriers, and the lived realities of rural schools rather than measure only numerical outcomes. It will combine a **document analysis** approach with a review of existing empirical studies, policy reports, and government documents related to digital literacy, NEP 2020, and rural education.

The study will use secondary data collected from official policy documents, academic books, journal articles, research reports, ASER reports, and government publications. Special attention will be given to sources published after the launch of NEP 2020 to capture the latest debates and implementation trends. The literature will be selected using keywords such as digital literacy, rural education, NEP 2020, ICT in education, digital divide, and teacher preparedness.

#### 3.1 Objectives of the Study

1. To assess the level of access to digital devices and internet connectivity among rural students.
2. To evaluate the digital literacy skills and competencies of rural students.
3. To examine the role of teacher support and training in digital learning.
4. To analyze the relationship between digital literacy and academic performance.
5. To identify major challenges in implementing NEP 2020 digital literacy initiatives in rural areas.

#### 3.2. Hypotheses

- **H<sub>1</sub>:** There is a significant positive relationship between digital literacy and academic performance among rural students.
- **H<sub>2</sub>:** Access to digital devices and internet connectivity significantly influences digital literacy levels.
- **H<sub>3</sub>:** Teacher support and training in digital tools significantly affect students' digital learning experiences.
- **H<sub>4</sub>:** Gender and socio-economic status significantly influence access to digital resources and digital literacy.

#### 3.4. Research Questions

The implementation of the National Education Policy (NEP) 2020 places significant emphasis on integrating digital technologies into the teaching-learning process to achieve equitable, inclusive, and quality education. However, the extent to which these objectives are being realized in rural India remains uncertain due to infrastructural, socioeconomic, and technological constraints. To investigate these issues, the present study seeks to answer the following research questions:

1. What is the present status of digital literacy among students and teachers in rural educational institutions?
2. How does digital literacy contribute to the effective implementation of the National Education Policy (NEP) 2020 in rural India?
3. What are the major infrastructural, technological, socioeconomic, and institutional challenges affecting the implementation of NEP 2020 in rural schools?
4. To what extent do internet connectivity, digital infrastructure, electricity supply, and access to digital devices influence digital learning in rural areas?



5. How prepared are teachers in rural schools to integrate Information and Communication Technology (ICT) into classroom teaching and learning?
6. What role do government initiatives such as Digital India, DIKSHA, PM eVIDYA, SWAYAM, and PMGDISHA play in promoting digital literacy among rural learners?

### 3.5 Research Design

The study employs a **quantitative survey design** to collect data from rural students regarding digital access, literacy, teacher support, and academic performance.

### 3.6 Population and Sample

- **Population:** Rural school students (grades 6–12) in West Bengal.
- **Sample Size:** 450 students selected through stratified random sampling from 15 rural schools.
- **Sampling Technique:** Stratified random sampling ensuring representation across gender, socio-economic status, and grade levels.

The target population comprises rural educational institutions implementing NEP 2020, including:

- Government schools
- Government-aided schools
- Secondary and Higher Secondary Schools

### 3.7 Data Collection Tool

A structured questionnaire was developed covering:

- Access to digital devices (computer, smartphone, tablet)
- Internet connectivity (home, school, mobile data)
- Digital literacy skills (operating devices, using apps, internet search)
- Teacher support (training, availability, guidance)
- Academic performance (self-reported grades/rank)

### 3.8 Variables of the Study

| Variable Type         | Variables                                                         |
|-----------------------|-------------------------------------------------------------------|
| Independent Variables | Access to digital devices, Internet connectivity, Teacher support |
| Dependent Variables   | Digital literacy level, Academic performance                      |
| Control Variables     | Gender, Socio-economic status, Grade level                        |

## 4. Data Analysis

The data will be analyzed through thematic analysis. Recurring themes such as digital infrastructure, teacher training, access to devices, internet connectivity, language barriers, socioeconomic inequality, and policy readiness will be identified, compared, and interpreted. This method will help in understanding how digital literacy influences the practical implementation of NEP 2020 in rural settings. The analysis will also highlight the gap between policy intentions and ground-level realities.



## 4.1 Demographic Profile of Sample

| Category                     | Frequency | Percentage |
|------------------------------|-----------|------------|
| <b>Gender</b>                |           |            |
| Male                         | 240       | 53.3%      |
| Female                       | 210       | 46.7%      |
| <b>Socio-economic Status</b> |           |            |
| Low                          | 180       | 40.0%      |
| Middle                       | 190       | 42.2%      |
| High                         | 80        | 17.8%      |
| <b>Grade Level</b>           |           |            |
| 6–8                          | 150       | 33.3%      |
| 9–10                         | 180       | 40.0%      |
| 11–12                        | 120       | 26.7%      |

## 4.2 Access to Digital Devices and Internet

| Access Indicator                 | Frequency | Percentage |
|----------------------------------|-----------|------------|
| Own smartphone                   | 270       | 60.0%      |
| Own computer/laptop              | 90        | 20.0%      |
| Own tablet                       | 60        | 13.3%      |
| Home internet access             | 135       | 30.0%      |
| School smart classroom available | 112       | 24.9%      |
| Reliable internet at school      | 81        | 18.0%      |

*Interpretation:* While smartphone ownership is relatively high (60%), access to computers and reliable internet remains low, aligning with national statistics.

## 4.3 Digital Literacy Levels

| Literacy Level   | Frequency | Percentage |
|------------------|-----------|------------|
| Very Low (1–2)   | 135       | 30.0%      |
| Low (2.5–3)      | 157       | 34.9%      |
| Moderate (3.5–4) | 108       | 24.0%      |
| High (4.5–5)     | 50        | 11.1%      |

Digital literacy was assessed on a 5-point scale (1 = Very Low, 5 = Very High).

*Interpretation:* Only 35.1% of students exhibit moderate to high digital literacy, indicating significant gaps.



#### 4.4 Teacher Support in Digital Learning

| Teacher Support Indicator            | Frequency | Percentage |
|--------------------------------------|-----------|------------|
| Teachers trained in digital tools    | 162       | 36.0%      |
| Regular guidance on digital learning | 202       | 44.9%      |
| Availability of digital resources    | 189       | 42.0%      |

#### 4.5 Relationship Between Digital Literacy and Academic Performance

| Digital Literacy | Low Performance | Moderate Performance | High Performance | Total |
|------------------|-----------------|----------------------|------------------|-------|
| Very Low         | 80              | 45                   | 10               | 135   |
| Low              | 60              | 70                   | 27               | 157   |
| Moderate         | 20              | 50                   | 38               | 108   |
| High             | 5               | 15                   | 30               | 50    |
| <b>Total</b>     | 165             | 180                  | 105              | 450   |

Academic performance was categorized as Low, Moderate, High based on self-reported grades.

##### Chi-Square Test:

$$\chi^2=124.5, p<0.001 \quad \chi^2 = 124.5, \quad p < 0.001$$

*Interpretation:* There is a significant positive relationship between digital literacy and academic performance, supporting **H<sub>1</sub>**.

#### 4.6 Impact of Access on Digital Literacy

| Device/Internet Access | Mean Digital Literacy Score |
|------------------------|-----------------------------|
| Smartphone only        | 2.8                         |
| Smartphone + Computer  | 3.6                         |
| Home Internet          | 3.9                         |
| No Access              | 2.1                         |

*Interpretation:* Access to computers and home internet significantly enhances digital literacy, supporting **H<sub>2</sub>**.

#### 4.7 Gender and Socio-Economic Disparities

| Group      | Mean Access Score | Mean Literacy Score |
|------------|-------------------|---------------------|
| Male       | 3.4               | 3.3                 |
| Female     | 2.7               | 2.8                 |
| Low SES    | 2.5               | 2.6                 |
| Middle SES | 3.1               | 3.2                 |
| High SES   | 4.0               | 4.1                 |



*Interpretation:* Significant disparities exist by gender and socio-economic status, supporting **H<sub>4</sub>**.

## 5. Discussion of Findings

### 5.1 Demographic profile

The sample comprised 240 male (53.3%) and 210 female (46.7%) students; SES distribution was 40.0% low, 42.2% middle, and 17.8% high; grade distribution included 33.3% (6–8), 40.0% (9–10), and 26.7% (11–12).

Mean access and literacy scores revealed disparities: males had higher mean access (3.4) and literacy (3.3) than females (access 2.7; literacy 2.8); SES gradients were strong — low SES access 2.5 and literacy 2.6, middle SES access 3.1 literacy 3.2, high SES access 4.0 literacy 4.1 — supporting **H<sub>4</sub>** on socio-demographic influences.

### 5.2 Access to devices and connectivity

Smartphone ownership was 60.0% (n=270), while only 20.0% (n=90) reported owning a computer/laptop and 13.3% (n=60) a tablet; home internet access was reported by 30.0% (n=135). At school, 24.9% (n=112) reported presence of a smart classroom and only 18.0% (n=81) indicated reliable internet connectivity. These patterns show a reliance on mobile devices for digital access and persistent paucity of institutional infrastructure.

### 5.3 Digital literacy levels

Using the 5-point scale, 30.0% (n=135) scored Very Low (1–2), 34.9% (n=157) Low (2.5–3), 24.0% (n=108) Moderate (3.5–4), and 11.1% (n=50) High (4.5–5). Combined, just 35.1% of students reached moderate-to-high literacy, indicating substantial gaps in competencies necessary for effective engagement with NEP 2020's digital components.

Cross-tabulation between literacy categories and self-reported academic performance showed a clear positive gradient: students with higher digital literacy were disproportionately represented in higher academic performance categories. The Chi-square test yielded  $\chi^2 = 124.5$ ,  $p < 0.001$ , indicating a statistically significant relationship between digital literacy and academic outcomes within the sample.

The significant association between digital literacy and academic performance suggests that digital competencies facilitate learning through improved access to content, enhanced research skills, and familiarisation with digital assessment modalities. However, literacy is uneven; with only a third achieving moderate or higher levels, the policy risk is that digital initiatives may reinforce pre-existing inequalities. Digital literacy's role appears both enabling and exclusionary depending on access and teacher support.

### 5.4 Teacher support

Only 36.0% (n=162) of teachers were reported as having training in digital tools, while 44.9% (n=202) of students received regular guidance on digital learning; availability of digital resources at school was 42.0% (n=189). These figures suggest teacher preparedness is limited and unevenly distributed.

Limited teacher training (36%) and partial availability of digital guidance indicates a systemic bottleneck. Effective integration requires not only hardware but also pedagogical expertise to design blended lessons, use formative digital assessments, and scaffold student use of online resources. NEP's emphasis on continuous professional development must translate into scalable, context-sensitive teacher programs, supported by mentoring, time allocation, and incentives.



## 5.5 Impact of access on literacy

Mean digital literacy scores varied markedly by access status: smartphone-only users averaged 2.8, those with smartphone + computer averaged 3.6, students with home internet averaged 3.9, and students with no access averaged 2.1. This supports H<sub>2</sub> that device and connectivity access significantly influence literacy.

## 6. Conclusion and recommendations

### 6.1.1 Interpreting access patterns

High smartphone ownership alongside low computer and broadband access reflects national trends where mobile-first internet adoption is prevalent but insufficient for education tasks that demand larger screens, stable broadband, and interactive labs. NEP 2020's vision for virtual labs and adaptive platforms presupposes connectivity and devices that many rural students lack, creating a structural mismatch between policy ambition and ground realities.

### 6.1.2 Digital literacy as a mediator of learning

The significant association between digital literacy and academic performance suggests that digital competencies facilitate learning through improved access to content, enhanced research skills, and familiarisation with digital assessment modalities. However, literacy is uneven; with only a third achieving moderate or higher levels, the policy risk is that digital initiatives may reinforce pre-existing inequalities. Digital literacy's role appears both enabling and exclusionary depending on access and teacher support.

### 6.1.3 Teacher Support in Digital Learning

Only 36.0% (n = 162) of teachers reported receiving training in digital tools, while 44.9% (n = 202) of students received regular guidance on digital learning; availability of digital resources at school was 42.0% (n = 189). These figures point to a clear gap between students' exposure to digital learning and the proportion of teachers formally prepared to support that exposure. The low share of trained teachers implies that much of students' guidance may be ad hoc, uneven in quality, or dependent on a few digitally confident staff rather than systemic capacity. Meanwhile, with less than half of schools having adequate digital resources, even trained teachers face constraints in delivering consistent, curriculum-aligned digital instruction.

### 6.1.4 Socioeconomic and gendered barriers

Marked SES and gender gaps reveal the intersectional nature of digital exclusion. Girls and lower-SES students face compounded barriers — affordability, restricted mobility, and cultural norms that may limit device usage — which policy must explicitly address through targeted provisioning (subsidies, device lending, safe community spaces) and gender-responsive outreach.

## 6.2 Policy and implementation gaps

While NEP 2020 and related initiatives (DIKSHA, PM eVIDYA, PMGDISHA) create a favourable architecture, evidence suggests gaps in last-mile delivery: unreliable school internet, insufficient power, limited localized and multilingual content, and lack of rigorous monitoring on equity indicators. Public-private partnerships may expand resources, but governance, accountability, and alignment with curricular needs remain essential.

Policy Recommendations based on results and literature, the following recommendations align with NEP 2020 objectives and rural realities:

Invest in resilient foundational infrastructure: Prioritise electrification reliability (solar microgrids where grid is unreliable), and last-mile broadband (fibre-to-school, community Wi-Fi, and subsidised mobile broadband plans for students). Public investment is indispensable for equitable access.

Scale affordable device strategies: Implement device-lending programmes in schools, subsidised low-cost laptops/tablets for low-SES students, and community digital hubs (school-based or panchayat-run) that provide supervised access beyond school hours.



Transforming teacher professional development into a more contextualized experience involves designing modular, practice-oriented training that blends in-service learning with hands-on application. The focus should be on digital pedagogy, effective use of DIKSHA and SWAYAM resources, formative digital assessments, and efficient classroom management techniques that incorporate various modalities. It is essential to complement training with instructional coaching and foster peer-learning communities to strengthen the learning experience. Localised, multilingual digital content: Commission regional-language resources and low-bandwidth versions of platforms (offline packages, USB/SD card distribution), and promote open educational resources aligned with the regional curriculum to ensure cultural and linguistic relevance.

Strengthen community engagement and supervised digital spaces: Collaborate with panchayats, parent-teacher associations, and NGOs to create safe learning spaces (community learning centers) that provide supervised internet use and basic digital literacy training for parents and students.

Equity-focused monitoring and accountability: Include disaggregated digital inclusion indicators (device access, connectivity, teacher training, gender differentials) in District Education Monitoring and Learning dashboards to direct funding, remedial action and ensure transparency.

Promote cost-effective pedagogies: Encourage mobile-first microlearning modules, SMS/IVR based content for low-bandwidth contexts, and asynchronous blended models that reduce dependency on real-time connectivity.

Targeted support during transitions: For high-stakes examinations and higher secondary transitions, ensure candidates from low-access backgrounds receive remedial training and device access to avoid reinforcement of inequities.

## Limitations

This study has several limitations. **First**, reliance on self-reported academic performance may introduce reporting bias; objective school records would strengthen validity. **Second**, the cross-sectional design precludes causal inference; longitudinal studies are needed to assess how changes in access and training affect learning over time. **Third**, sample is limited to rural schools in West Bengal; while indicative, findings may not generalise across India's diverse rural contexts. **Finally**, teacher reports were second-hand (student reports of teacher training) rather than direct teacher surveys; triangulation with teacher interviews would provide a fuller picture.

## Future Research Directions

Future work should include:

Longitudinal evaluations of NEP-aligned digital interventions to measure learning gains and equity impacts. Mixed-methods studies incorporating teacher interviews, classroom observation and ethnographic insight into household constraints and gender norms.

Impact evaluations of specific policies (device distribution, rural broadband rollouts, teacher CPD programmes) using experimental or quasi-experimental methods.

Cost-effectiveness analyses of alternative delivery models (community hubs vs household provisioning).

## Conclusion

NEP 2020 offers a transformative vision for integrating technology into Indian education, but this study's findings underscore that rural implementation must confront structural, pedagogical and socio-cultural constraints. High smartphone ownership coexists with scarce computers, limited home internet, unreliable school connectivity, and uneven teacher preparedness; only about a third of students achieve moderate-to-high digital literacy. Digital literacy correlates positively with academic performance, suggesting that



investments in digital competencies can yield educational benefits — but only if access, teacher capacity, content localization, and equitable monitoring accompany technological expansion. Policymakers must therefore prioritise foundational infrastructure, targeted device strategies, contextual teacher development, locally relevant content, and community engagement to ensure NEP 2020's digital goals do not widen existing inequities. Equitable digital transformation requires sustained public investment and governance that aligns technology with the lived realities of rural learners.

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