

Digital Transformation and Inclusive Access in Indian Universities: Challenges, Reforms, and Future Pathways

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Abstract: Digital transformation now plays a central role in governance and pedagogy in Indian higher education. Equity outcomes depend on whether institutions and households can participate on roughly comparable terms. National statistics for the sector indicate total enrolment of about 4.33 crore students in 2021–22 and a gross enrolment ratio (GER) of 28.4 for the 18–23 age group, with female GER at 28.5 and male GER at 28.3. Infrastructure indicators tell a more uneven story. Shares of institutions that report connectivity to the National Knowledge Network are much higher for universities than for colleges. The same pattern appears for reported connectivity under the National Mission on Education through Information and Communication Technology. Household conditions introduce another layer of constraint that rests on geography and gender. Recent survey data show much lower reported internet use for women in rural areas than in towns and cities, and large gaps in women’s personal control of mobile phones between rural and urban settings. More recent telecom statistics record high reported household possession of an internet facility within premises, yet much weaker rural penetration of optical fibre connections. Basic availability can thus coexist with thin and fragile bandwidth. This study brings together official statistics and published research to pursue two linked aims. The first is to map how many institutions and households are digitally ready. The second is to argue for an equity-first reform agenda that treats connectivity, devices, skills and accessibility as core elements of educational infrastructure rather than optional extras.

Keywords: higher education, blended learning, ICT readiness, gender equity, caste inequality, policy, implementation

Introduction

Digital technologies now influence how universities teach, assess and manage learners. The rapid turn towards online delivery during the pandemic hastened that process across many systems. In India, digital transformation (Government of India, 2025) reaches beyond administrative efficiency or smoother classroom management. It also connects to questions about entry into education, institutional strength and the capability of the state to support meaningful participation. National policy acknowledges

the promise of online and digital modes and, at the same time, accepts that unequal technology access and uneven preparedness can drive sharply different learning outcomes (Ministry of Education, 2020).

The size of the higher education system magnifies these tensions. In 2021–22, total enrolment stood at about 4.33 crore students, and the GER for the population aged 18–23 reached 28.4 (Department of Higher Education, 2024; Press Information Bureau, 2024). Participation in higher education does not automatically translate into

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participation in digital higher education. A student may hold a place on the rolls yet face binding constraints that weaken the value of online learning. Device sharing within a household, limited privacy for study, unstable electricity and network connections, or learning design that does not suit students with disabilities all restrict the educational benefit of digital offerings. The focal question shifts from whether universities ought to digitise to how they can shape digitalisation in ways that reduce long-standing inequities rather than deepen them.

Policy and Institutional Context

India's agenda for digital higher education grows from the interaction of two forces. One is a set of national commitments to technology-enabled learning. The other is a cluster of connectivity programmes that seek to link institutions and expand broadband reach. The National Education Policy (NEP 2020) calls for public digital infrastructure that can interoperate across platforms and sectors. The same document also warns that online modes raise testing integrity concerns and may run into interruptions in power and network services (Ministry of Education, 2020).

The National Knowledge Network forms the institutional backbone for this vision (University Grants Commission, 2021). Government documentation describes NKN as a high-bandwidth, low-latency network that links universities and research organisations. Official reports describe connectivity for more than 1,800 institutions (National Knowledge Network, n.d.). In parallel, the National Mission on Education through Information and Communication Technology (Department of Telecommunications, 2025) appears as a centrally sponsored plan that uses ICT resources to support teaching and learning in higher education (Ministry of Education, 2023).

International studies add a regional perspective. A recent UNESCO report on South Asia notes that digital transformation in higher education moves at different speeds across institutions and countries. The report links this uneven motion to persistent gaps in both internet access and digital skills (UNESCO, 2025).

Data sources and approach

This paper uses a descriptive method and blends official statistics with academic research to identify the central barriers to digital inclusion. These barriers arise within institutions, across households and within the development of digital skills. The analysis rests on the All India Survey of Higher Education (AISHE) 2021–22 for data on enrolment and institutional infrastructure, including reported connectivity measures (Department of Higher Education, 2024).

Household-level information comes from the National Statistical Office (NSS) 80th Round Comprehensive Modular Survey for Household Internet Access and Optical Fibre Connectivity: Telecom (CMS: T), together with NFHS-5 key indicators on internet use and women's access to and control over mobile phones (Ministry of Health and Family Welfare, 2021; National Statistical Office, 2025). Caste-linked inequalities in access and skills draw on a nationally representative survey-based analysis that finds large caste differentials in both first-level digital access and second-level digital capabilities. More than half of the caste-related digital gap arises from differences in education and income between disadvantaged groups and others (Vaidehi et al., 2021).

The work also notes a methodological constraint. Some ICT readiness indicators do not appear in a consistent, disaggregated form that would support detailed state-wise

comparisons across all institutional types and regions. In that setting, the paper places greater weight on plausible national-level patterns and refrains from speculative rankings across states (Government of India, 2025).

Findings

Scale and participation: enrolment growth does not guarantee digital inclusion

AISHE reporting indicates that higher education enrolment reached nearly 4.33 crore students in 2021–22. The figure rose from 4.14 crore in 2020–21 and from 3.42 crore in 2014–15 (Press Information Bureau, 2024; Department of Higher Education, 2024). AISHE records substantial enrolment from Scheduled Castes, Scheduled Tribes and Other Backward Classes (OBCs). That pattern heightens the importance of digital inclusion. Expansion in numbers alone cannot assure equal digital access for groups that face long-term disadvantage (Department of Higher Education, 2024).

Institutional readiness: uneven connectivity across the university–college hierarchy

AISHE infrastructure indicators show wide gaps in connectivity across types of institutions. In 2021–22, 56 per cent of universities reported NKN connections, while only 24 per cent of colleges and 23 per cent of stand-alone institutions did the same. For NMEICT connectivity, reported shares reached 41 per cent for universities, 22 per cent for colleges and 21 per cent for stand-alone institutions (Department of Higher Education, 2024).

This vertical digital divide matters because a large share of undergraduate teaching takes place in colleges, including many affiliated institutions that operate with tighter budgets and weaker infrastructure than

universities. Students in those settings depend on campuses that start from a lower base for connectivity and equipment (Government of India, 2025).

Rural concentration increases the stakes of college connectivity

A Government of India release on AISHE 2020–21 reported that 43 per cent of universities and 61.4 per cent of colleges are located in rural areas (Press Information Bureau, 2023). Rural location often coincides with weaker digital infrastructure both on campus and in nearby communities. When that pattern overlaps with the connectivity gaps in AISHE 2021–22, students in rural colleges face a double burden. They encounter thin campus bandwidth and, at the same time, live in households with fragile or costly access (Ministry of Education, 2023).

Household access: Internet availability and usable connectivity are not the same

NFHS-5 records sharp rural–urban and gender gaps in internet use. For adults aged 15–49, 24.6 per cent of women in rural areas report that they have ever used the internet. The share for women in towns and cities reaches 51.8 per cent. For men in the same age group, the survey records 48.7 per cent in rural areas and 72.5 per cent in urban areas (Ministry of Health and Family Welfare, 2021).

NFHS-5 also shows large differences in women’s control of devices. Among women aged 15–49, 46.6 per cent in rural locations report that they use a mobile phone that they regard as their own. In urban locations, the share stands at 69.4 per cent (Ministry of Health and Family Welfare, 2021).

CMS:T 2025 sketches a more recent picture of household connectivity. The survey

records internet facilities within premises for 83.3 per cent of rural households and 91.6 per cent of urban households. Fibre connections appear much less common. Only 3.2 per cent of rural households report optical fibre within premises, compared with 14.0 per cent of urban households (National Statistical Office, 2025). For higher education, that fibre gap matters. Activities such as live online classes, remote proctored assessments, multimedia-rich content and virtual laboratories place a premium on stable, low-latency connections rather than mere nominal access (Ministry of Statistics and Programme Implementation, n.d. 2024).

Caste-linked digital divides: access and skills gaps are structurally produced

Survey-based research on caste and digital access in India points towards deep inequities. Vaidehi and co-authors use nationally representative data and find large caste-related gaps in both physical access to devices and networks and in the skills required for effective use. More than half of this difference traces back to gaps in education and income between disadvantaged caste groups and others (Vaidehi et al., 2021).

Digital transformation in higher education can shift financial and cognitive costs towards those least able to absorb them. When students from historically marginalised caste groups need to secure devices, data plans and informal support on their own, digital reforms risk transferring burdens instead of easing them. Reforms that combine platform expansion with targeted support for devices, local facilitation and skill development reduce that danger.

Policy pathways and implementation priorities

An equity-first perspective treats digitisation as inclusion infrastructure rather than

as a simple roll-out of platforms. NEP 2020 sections on online and digital education stress teacher preparation, redesigned assessment and resilience in the face of unstable power or networks. Those concerns carry special weight for institutions and households that work with limited resources (Ministry of Education, 2020).

A grounded reform strategy would set explicit minimum service standards for bandwidth, uptime and campus Wi-Fi in colleges and rural campuses. Colleges enrol large shares of learners yet report much lower connectivity than universities in AISHE. Targeted upgrades in those locations would support students who rely most heavily on campus-based digital access (Government of India, 2025).

National platforms can scale content, but cannot remove access barriers on their own. SWAYAM course statistics show very large enrolment volumes in recent semesters. Reported figures include about 4.98 million enrolments in July 2025 and about 5.21 million in January 2026, which suggests strong uptake wherever connectivity and institutional support are reasonably strong (SWAYAM, 2026).

At the same time, the University Grants Commission Credit Framework Regulations for SWAYAM (2021) permit higher education institutions to allow up to 40 per cent of programme courses in a semester through SWAYAM. The regulations also state that parent institutions should maintain essential physical infrastructure, including computer facilities, for students who pursue such courses (University Grants Commission, 2021). Policy thus already assumes a campus-support role. Equity risks rise where that expectation about local infrastructure cannot be met in practice (University Grants Commission, 2021).

Virtual Labs offer another example. The initiative targets institutions that lack physical laboratory facilities and reports more than 175 virtual labs and roughly 1,590 web-enabled experiments (Virtual Labs, n.d.). Those resources still depend on reliable connectivity and active local facilitation. Content platforms, even at a large scale, remain necessary but insufficient elements of an inclusive digital ecosystem (Ministry of Education, n.d.).

Broadband missions shape the outer boundary of meaningful connectivity. National Broadband Mission 2.0 (Ministry of Education, 2020) positions itself as a successor to earlier mission efforts and emphasises

expansion of high-speed broadband and stronger connectivity in rural and remote areas (Department of Telecommunications, 2025). A government release in February 2026 reports that nearly 2.14 lakh gram panchayats came online under BharatNet Phases I and II (Press Information Bureau, 2026).

For higher education, the greatest impact arises when these investments translate into reliable last-mile service for campuses and student homes, not only backbone coverage across administrative units (Department of Telecommunications, 2025).

Table 1: Higher-education scale and participation (selected national indicators)

Indicator (India)	Value	Source
Total enrolment (2021–22)	4.33 crore	AISHE 2021–22; PIB release
Female enrolment (2021–22)	2.07 crore	PIB release
GER, ages 18–23 (2021–22)	28.4	AISHE 2021–22
Female GER, ages 18–23 (2021–22)	28.5	AISHE 2021–22
Enrolment composition (SC / ST / OBC)	15.3% / 6.3% / 37.8%	AISHE 2021–22

Table 1 summarises the size of the higher education system and key participation indicators for the academic year 2021–22, as reported in AISHE and in the official press release. The table records total enrolment of 4.33 crore students in higher education in 2021–22. It also notes female enrolment at 2.07 crore students in that year.

The GER in higher education for the 18–23 age group stands at 28.4 in 2021–22, and the female GER for that age range reaches

28.5, as recorded in the table. AISHE makes it explicit that GER figures for 2021–22 relate to youth aged 18–23 who are eligible for higher education and that the population base rests on projections from the 2011 Census. Table 1 also presents the social composition of enrolled students in 2021–22. Among the 4.33 crore students, 15.3 per cent come from Scheduled Castes, 6.3 per cent from Scheduled Tribes and 37.8 per cent from Other Backward Classes (OBC).

Table 2: Institutional connectivity gap (reported, AISHE 2021–22)

Connectivity indicator	Universities	Colleges	Stand-alone institutions
NKN connectivity	56%	24%	23%
NMEICT connectivity	41%	22%	21%

Note. Per cent shares are institutional responses reported in AISHE 2021–22.

Table 2 reports institutional connectivity indicators from AISHE 2021–22 as percentages of institutions that report the presence of the relevant infrastructure or feature. The table uses the three standard AISHE categories. The first covers universities and university-level institutions. The second covers colleges affiliated with or recognised by universities. The third covers stand-alone institutions that do not fall under university affiliation or recognition.

Within that schema, Table 2 records that 56 per cent of universities, 24 per cent of colleges and 23 per cent of stand-alone institutions report NKN connectivity. For

NMEICT connectivity, 41 per cent of universities, 22 per cent of colleges, and 21 per cent of stand-alone institutions report connections. To clarify the programme labels, official documentation describes the National Knowledge Network as a pan-India network that connects knowledge and research institutions through high-bandwidth, low-latency links. The National Mission on Education through ICT appears in government descriptions as a centrally sponsored scheme that brings ICT resources into teaching and learning and includes both a connectivity component and content generation.

Table 3: Household digital access constraints relevant to higher-education participation

Domain	Indicator	Ru- ral	Ur- ban	Source
Internet use (15–49)	Women who have ever used the internet (%)	24.6	51.8	NFHS-5
Internet use (15–49)	Men who have ever used the internet (%)	48.7	72.5	NFHS-5
Device control (women)	Women with a mobile phone they themselves use (%)	46.6	69.4	NFHS-5
Household connectivity	Internet facility within premises (%)	83.3	91.6	CMS:T 2025
Broadband quality	Optical fiber within premises (%)	3.2	14.0	CMS:T 2025

Table 3 presents rural–urban splits for selected household- and adult-level digital access indicators taken from two official survey products. NFHS-5 contributes measures of internet use for adults and mobile phone access for women. CMS:T 2025 contributes measures of household internet facilities and optical fibre connections.

In the NFHS-5 India Key Indicators tables for adults aged 15–49, the percentage of

women who have ever used the internet stands at 24.6 per cent in rural locations and 51.8 per cent in urban locations. For men in the same age group, the corresponding shares reach 48.7 per cent and 72.5 per cent. In relation to women’s access to personal devices, NFHS-5 records that 46.6 per cent of women in rural areas and 69.4 per cent in urban areas use a mobile phone that they treat as their own.

The NSS Comprehensive Modular Survey: Telecom (CMS:T) 2025 records that 83.3 per cent of rural households and 91.6 per cent of urban households report an internet facility within premises. The same report notes that 3.2 per cent of rural households and 14.0 per cent of urban households report optical fibre internet within premises.

Conclusion

Digital transformation in Indian higher education offers opportunities and, at the same time, raises questions about redistribution. Patterns across AISHE, NFHS-5 and CMS:T show that universities and colleges begin from different levels of digital capacity, while households encounter gendered and rural constraints that determine who can gain from online or blended learning at scale (Department of Higher Education, 2024; Ministry of Health and Family Welfare, 2021; National Statistical Office, 2025).

An equity-first approach to implementation directs attention towards durable campus broadband for colleges, support for devices and data for students who lack personal control over equipment, accessible content that works under low-bandwidth conditions and teacher development efforts that match NEP concerns about pedagogy and assessment (Ministry of Education, 2020; University Grants Commission, 2021). Without such measures, digitalisation risks turning into a new gatekeeping mechanism that deepens existing economic and caste-linked divides (Vaidehi et al., 2021).

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