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Article

The Unequal Architecture of Digital Education: Gendered Access, Intersectional Exclusion, and the Reproduction of Social Inequality in India

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Abstract:

The rapid digitalisation of education in India has expanded opportunities for flexible and remote learning, but it has also reproduced inequalities embedded in gender, caste, class and geography. Official data show the transition's differential material basis: In 2017-18, only 4.4% of rural households reported having computers and internet, compared with 23.4% and 42.0% in urban households, respectively (NSO, 2019). However, connectivity does not indicate whether women have access to devices, autonomy over their use, the capability to use the devices, time to learn, institutional support, or safety in online environments. This paper uses critical narrative review and theory-informed qualitative analysis of official surveys, institutional reports and policy documents, as well as interdisciplinary scholarship, to explore the unequal organisation of digital education in India. It brings together intersectionality, multidimensional digital-inequality scholarship, the capability approach and feminist approaches to technology to examine the way in which the conversion of technological resources into educational participation and benefit is mediated by social location and household power. The analysis also assesses the National Education Policy 2020 through the lenses of redistribution, recognition, representation, and capability conversion. It concludes that while the policy recognises the digital divide and its integration of technology, there is a lack of operational guidance to address intra-household inequalities, gendered control of technology, digital safety and overlapping forms of exclusion. Drawing on the structural learnings of the Towards Equality report, the paper argues that gender-equitable digital education is more than just technology provision. This requires redistributing digital resources, identifying differentiated disadvantage, enabling women to make choices, and including them in decision-making processes around the governance of educational technologies.

Keywords: Digital Education, Digital Gender Divide, Intersectionality, Educational Inequality, Women's Agency, NEP 2020

1. INTRODUCTION: DIGITAL EDUCATION AND THE REPRODUCTION OF SOCIAL INEQUALITY

Education, technology and social inequality are not distinct areas but rather are mutually constituted. Education can increase knowledge, agency and substantive freedom, but the benefits of education depend on the social and institutional processes by which educational opportunities are transmitted (Sen, 1999; Drèze & Sen, 2013). These conditions are still linked to caste, class, gender, tribe, disability, language and geographical area in India. For instance, the All-India Survey on Higher Education 2021–22 indicated that the Gross Enrolment Ratio for the age group of 18-23 is 28.4% while the Gross Enrolment Ratio is 25.9% and 21.2% for the Scheduled Castes and Scheduled Tribes respectively in the country (Ministry of Education, 2024). While these overall statistics do not reflect the range

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of experiences in social groups, they do indicate that despite the growth of educational opportunities, there remain structural disparities in participation. With the digitalisation of education, this unequal situation adds another layer. Digital platforms can enhance learning opportunities beyond the classroom, enhance access to learning resources and provide flexible learning opportunities to those who are geographically isolated, working women and those who are not able to attend traditional schools. But new technologies come into homes and schools that are already set up, in unequal ways, with unequal resources and unequal power relations. It is thus not solely an internet-connected digital device that provides its educational value. Whether formal access leads to sustained educational participation depends on various factors such as affordability, quality of device, electricity, digital competence, language, disability accessibility, pedagogical support, discretionary learning time, and privacy and personal control over the technology.

Official evidence demonstrates that the problem is one of a gendered nature. According to the National Family Health Survey-5, at the time of the survey, 33.3% of females and 57.1% of males reported using the internet ever (International Institute for Population Sciences & ICF, 2021). This indicator is not a measure of the use, the frequency, the competence or self-sufficiency of educational use, but it shows an important disparity of the access to an ever more necessary technological resource. The evidence from rural youth also shows that the concept of household availability cannot be equated with the concept of being included. ASER 2023 shows that while nearly 9 out of 10 respondents aged 14-18 stated that their household had a smartphone, only 43.7% of males and 19.8% of females reported owning a smartphone in their household. This can result in a digitally connected household and girls and women who have irregular and supervised or conditional access. Availability and control are important distinctions, especially in the case of technology that is integrated in the domestic gender/generational and authority relations. Doron and Jeffrey (2013) demonstrate that the use of mobile phones in India is not merely an individual choice, but is also influenced by notions of family authority, reputation and social norms. Devices may be shared based on educational need or employment needs and/or gendered assumptions of appropriate use. This can lead to women and girls having less access, time, and control in their day-to-day use of technology, despite its availability. Safety and sexuality and the reputation of the family can also be used to monitor and limit their involvement. Digital exclusion is thus not a binary phenomenon of connection and disconnection, but is about who has a device, who has control over its use, what it can be used for and who benefits from it educationally. These inequalities are intersectional because women's experiences of digital exclusion are shaped by the interaction of gender with caste, class, tribal identity, disability, language, and geographical location. Gender is not an entity in isolation to poverty, caste, tribal location, disability, language or geography. For instance, a rural Adivasi learner might also face poor connectivity, low family income, shared devices, lack of access to dominant language content, institutional barriers to technology use, and gender barriers to technology use. These conditions are simply not additive as risk-factors. Their interaction creates a qualitatively different type of participation: access is sometimes limited, depends on other household members, and is not supported by accessible institutions and/or relevant content. This means that national averages or general groups of learners like 'women' or 'rural' can mask significant variations in autonomy, continuity, safety and educational outcomes. Shifting from an access-centred view of the digital divide to a meaningful examination of digital inclusion is needed in this problem. The current literature has shown that digital inequality is not just about physical access to digital technologies, but also about digital skills, use, institutional support, and benefits of technology (Warschauer, 2003; van Dijk, 2005; van Deursen & Helsper, 2015). Furthermore, feminist and intersectional scholarship has revealed that technologies are far from being socially neutral and are not necessarily lived in the same way by different social locations (Crenshaw, 1989; Wajcman, 2004). However, studies and policy discourses on digital education in India often assume that connectivity and availability of devices and digital literacy are parallel shortcomings, and fail to analyse the role of household power, educational institutions, and overlapping forms of inequalities in shaping these factors.

There is also a gap in the analysis of digital-education policy. The National Education Policy 2020 acknowledges that such digital disparities in access to devices, connectivity and digital literacy can further exacerbate the inequalities in education and that technological integration is an integral part of the education reform (Ministry of Education, 2020). Recognising the digital divide, however, does not imply that policy instruments will redistribute the resources needed, that they will account for differentiated forms of exclusion, that they will allow affected learners to have a voice in governance or that they will facilitate the translation of access to technology into learning gains. This is significant, as a policy may increase the platforms, repositories and registrations but not necessarily the inequalities in terms of control over devices, learning time, accessibility, safety, and institutional support. This paper fills these lacunas by critically exploring the available official surveys, policy documents, institutional reports and interdisciplinary scholarship in a narrative review and qualitative analysis, drawing from theory. It engages multidimensional digital-inequality research with intersectionality, feminist technology studies, capability approach and theories of empowerment. There are two contributions of the paper. First, it builds a relational perspective on digital educational inequality based on access, capability, autonomy, safety and benefit. Second, it assesses NEP 2020 and the broader digital-education-policy context in the interwoven facets of redistribution, recognition, representation and capability conversion. It does so by taking a step back from the structural analysis of the Towards Equality report, which suggests that formal provision, on its own, doesn't necessarily lead to substantive equality where social and institutional barriers are still in place.

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The study thus aims to answer two research questions:

1. How are gender, caste, class and geography intersecting in shaping women's access to, control over and meaningful use of digital education in India?

2. To what extent does India's digital-education policy framework recognise and address these intersecting inequalities?

Based on this analysis, the paper proposes policy avenues to promote gender-equitable digital education. It argues that technological provision alone is insufficient to achieve meaningful inclusion. Digital resources must be redistributed, differentiated forms of disadvantage recognised, women's substantive agency and educational participation strengthened, and the public governance of educational technologies made accountable.

2. TOWARDS EQUALITY AND THE STRUCTURAL REFRAMING OF WOMEN'S EDUCATION IN INDIA

Towards Equality: Report of the Committee on the Status of Women in India was a turning point in the post-independence era regarding gender and development. The Committee (set up by Government of India in 1971 and reported in 1974), reviewed women's constitutional position, demographic status, education, employment, political participation and access to law. Its importance was not just in the fact that it brought to light the disadvantage faced by women, but also because it questioned the idea that constitutional equality and development planning by itself automatically improves women's social position. However, the report identified inequality in historically established relationships of the family, community, the economy and the state (Committee on the Status of Women in India, 1974).

2.1. Educational Deficit to Structural Disadvantage

One of the key arguments that Towards Equality made was that there were no individualised explanations for girls' and women's educational disadvantage. Parental ignorance and lack of aspiration were not alone responsible for low enrolment, discontinuation and limited progression. These are linked to poverty; child marriage; domestic labour; limited mobility; safety concerns; insufficient infrastructure in institutions; and a lower perceived social worth of girls' education. The report thus shifted the focus from the assumed inadequacies of girls and women towards the unequal structure of the provision of educational opportunity. This structural approach also helped to make sense of the difference between 'formal provision' and 'substantive participation'. Schools, legal rights or universal education programmes alone cannot ensure equality if school attendance and progression are hindered by distance, transport, sanitation, discrimination, unpaid care work and the fear of being harassed in the school. Advice on scholarships, accommodation, and a greater range of institutional offers and targeted assistance to disadvantaged groups acknowledged that equal treatment of learners with unequal social starting points can result in the reproduction of inequality. Differential public support should, as such, be not thought of as a form of compensation for individual disadvantage, but rather as a condition of substantive equality.

The report also highlighted the disparities between rural and urban women, and the interplay of poverty, agricultural work, household duties, gender norms and lack of institutions. Its categories were not exhaustive in capturing the caste, tribe, religion, disability and region in the intersectionality language that has evolved later. However, its structuring orientation proved to be an important basis for the analysis of the multiple relations of power that affect women's participation in education. Gendered disadvantage is inextricably linked to the economic, geographical, linguistic, and discriminatory disadvantage that rural Dalit and Adivasi girls have to endure. Towards Equality also helped to usher in a policy shift from women as welfare recipients to women as citizens with the right to equality, development and participation. This direction was later echoed in the National Policy on Education 1986 which made education as a tool of equality for women and the educational system pledged to tackle accumulated inequalities and gender stereotypes (Ministry of Human Resource Development, 1986). It is important to recognize that this is not necessarily to be interpreted as simply an intellectual and policy continuity as a direct result of a single report. The report also provided impetus to the institutional and intellectual building of Women's Study, and made it quite clear that the mainstream data and disciplinary framework were insufficient to reflect women's experience. As John (2008) states, Women's Studies came about in a productive relationship between scholarship, feminist movements and the state, and its job was to challenge whose experiences count and whose knowledge is policymaking.

2.2. Current Relevance to Digital Education

What makes the book Towards Equality so relevant is its methodological perspective, which considers visible inequalities as the products of social and institutional relations. However, applied to digital education, this is not a definitive proof of the educational inclusion of women if women do not have access to the internet or a device at home. It is also important to consider who is in control of the device, who is being served by the technology and who is learning, whether the device is being used regularly and privately, and whether there are learner time, knowledge and safety and institutional support to make effective use of technology. Digitalisation has made the medium in which educational exclusion is lived in different, but it has not taken away its structural bases. While affordability and infrastructure are fundamental, today's inequality finds expression in a number of other factors, such as household gatekeeping, unequal learning time, content that is inaccessible or linguistically inappropriate, online harassment, data extraction and commercial structuring of educational platforms. It does no longer simply ask the question if girls and women can enter learning institutions. It's also about whether they can use the technological systems

in which education is increasingly structured, and access its benefits, in a safe way. Towards Equality's contribution is not only historical then. It offers a framework for assessing digital inclusion that goes beyond counting the number of people who are participating and focuses on the distribution of resources, institutional authority and decision-making power. In extending this to digital education, accessibility needs to be considered in conjunction with capability, autonomy, safety, representation and learning benefit. This structural analysis represents the historical link between women's educational inequality and the current analysis that is offered in the rest of the paper.

3. METHODOLOGY

3.1. Research Design

This study employs a critical narrative review combined with theory-informed qualitative policy analysis. A critical narrative review is suitable as the study does not aim to compute a pooled effect or estimate prevalence, nor does it aim to comprehensively list all publications on digital education. It rather brings together diverse types of evidence to investigate the conceptualisation, measurement, experience and action on digital educational inequality in India. This strategy allows for the inclusion of theoretical, scholarly research, official statistics, qualitative research, institutional reports and policy documents which cannot be meaningfully synthesized through meta-analysis or considered as equivalent sources of evidence.

The review is "critical" in the sense that it dissects the premises of prevailing definitions and metrics of digital inclusion, which are often defined as the availability of a internet connection in the home or a device. It is "narrative" because evidence is used relationally and thematically not statistically. The methodological rigour was achieved through explicit selection criteria, comparisons between types of evidence, acknowledging limitations of the datasets, and consistently applying a theory-informed analytical framework. It is therefore interpretive and explanatory, but it differs from a commentary that relies on opinion because it has an overt process for selecting sources, uses a thematic synthesis to organize the data and employs systematic criteria for evaluating the policy. The review and policy analysis were structured around the two research questions as outlined in the Introduction. Evidence relevant to the first question was explored to look at how social inequalities intersect to affect women's access to, control of, and capacity to effectively use digital education. The second question was responded to by looking at the degree of recognition and response to these inequalities that exists in the digital-education policy framework in India.

3.2. Identification and Selection of Source

Sources have been identified using general purposive selection and not by systematically searching a database. This was done to consolidate conceptually important scholarship and a variety of evidence-based material relevant to the research questions from an Indian perspective. No deadline was set for the publication. This allowed the integration of foundational literature including the Towards Equality report and existing literature on intersectionality, capabilities, empowerment and digital inequality, as well as recent statistics, qualitative and policy evidence on digital education today. There were four types of material included: Theoretical and interdisciplinary scholarship was first selected when it helped to understand digital inequality, educational reproduction, intersectionality, gender and technology, capabilities, and women's agency. Second, peer-reviewed empirical and qualitative research was included when the study looked at digital access, the control of technology within the household, women's experiences of digital participation or the inequalities in the access to technology in education. The selection of empirical scholarship also considered studies examining gendered access to resources, household decision-making, women's agency and structural social discrimination (Agarwal, 1994; Chattopadhyay & Duflo, 2004; Deshpande, 2011; Duflo, 2012). Research on gender and ICT indicators was particularly relevant for understanding the limitations of conventional measures of technological access and participation (Hafkin & Huyer, 2007).

Thirdly, using official statistical sources a broader material and social context for digital and educational inequality was put into place. These encompassed NSS 75th Round on Education, NFHS-5, All India Survey of Higher Education 2021-22 and ASER 2023: Beyond Basics. Fourth, policy and institutional documents were chosen if they referred to education, digital infrastructure, digital literacy or technology-enabled learning. These documents included the National Policy on Education (1986), the Right of Children to Free and Compulsory Education Act (2009), the National Education Policy (2020), and relevant reports published by international organisations such as UNESCO (2021;2023)and GSMA (2021;2024). Recent institutional publications, including the India Employment Report 2024, International Telecommunication Union's Facts and Figures 2024, and the Periodic Labour Force Survey 2023-24, were also considered for contextualising the relationship between education, skills, employment and broader digital inequalities.

The selection of these sources was guided by their substantive relevance of the source to one or more of the following areas: Indian context, gender or intersecting social inequalities, access, capability, autonomy, safety, or educational benefit, women's experiences of digital participation, or design and implementation of digital-education policy. Further, empirical and institutional sources were evaluated on the transparency of their data, populations, methods, and evidentiary bases. When the source was more of a promotional one, had no identifiable evidentiary basis, was a copy of a more complete version of the same publication, or spoke about technology without any real educational or social inequality related content, it was excluded. Preference was given to official publications, peer-reviewed scholarship, basic research documents and institutional reports with identifiable evidence. As it was a purposive selection, the review does not claim to have been exhaustive of the literature on digital education in India.

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3.3. Thematic Synthesis

The selected evidence was organised through a theory-informed thematic synthesis. Initial categories were derived from the research questions and theoretical framework and were subsequently refined through repeated engagement with the literature. Relevant findings, arguments, and policy provisions were grouped under six interconnected themes: (1) material access and affordability; (2) digital skills and capability; (3) device control, autonomy, and discretionary learning time; (4) linguistic, disability-related, and pedagogical accessibility; (5) online safety, privacy, and institutional support; and (6) educational participation and benefit. Evidence within each theme was compared across theoretical scholarship, statistical reports, qualitative studies, and policy documents. Convergences were used to identify recurring structural barriers, while differences were retained where they reflected variations in population, location, methodology, or institutional context. Qualitative studies were used particularly to interpret mechanisms that aggregate statistics cannot adequately reveal, including intra-household control over devices, unequal allocation of learning time, familial surveillance, negotiation, and women's use of community networks. The six themes were not treated as independent variables. Intersectionality was used to examine how gender interacts with caste, class, tribal identity, disability, language, and geography to produce differentiated conditions of digital participation. Sen's (1999) capability approach informed the distinction between possessing a technological resource and having the substantive freedom to convert it into a valued educational outcome. Kabeer's (1999) resources–agency–achievements framework was used to analyse the relationship between technological provision, control over its use, and the educational benefits obtained. The synthesis also attended to women's agency, including how learners negotiate restrictions, mobilise social networks, and use collective or community institutions to navigate digital constraints. Official statistical sources were used as contextual indicators rather than as directly comparable datasets. NSS, NFHS-5, ASER, and AISHE cover different populations, reference periods, units of analysis, and definitions of access. Their estimates were therefore neither pooled nor interpreted as measurements of an identical phenomenon. Household internet availability, individual internet use, personal device ownership, and educational participation were treated as analytically distinct indicators. No new statistical analysis, hypothesis testing, or causal inference was undertaken.

3.4. Policy-Analysis Framework

Theory-informed qualitative policy analysis was done on NEP 2020 and other digital education programmes. Five elements of policy problem framing, proposed policy instruments, implementation arrangements, monitoring provisions, and accountability mechanisms were analysed. Provisions of NEP 2020 were explored in depth, such as the mention of the digital divide, the recommendations concerning the National Educational Technology Forum, digital infrastructures, online learning systems, virtual laboratories, teacher preparation, assessment, and blended learning. Four explicit dimensions were used to measure policy responsiveness. Redistribution refers to the provision and/or enabling access to devices, connectivity, electricity, affordable data, accessible educational content and institutional support as per Fraser (2008). Recognition relates to whether policy acknowledges differentiated inequalities relating to gender, caste, tribe, disability, language, geography and intra-household power. Representation relates to involvement in design, implementation, monitoring and evaluation of digital-education systems, and to accessible accountability and grievance mechanisms. Capability conversion, based on Sen, (1999) and Kabeer (1999), refers to the capacity for formal technological inputs to be translated into autonomous participation, continuing learning and valued education outcomes. The framework has been used for relevant provisions of NEP 2020 and associated programmes and platforms such as DIKSHA, SWAYAM, PM e-VIDYA, PMGDISHA, BharatNet and Common Service Centres. These were differentiated between formal policy recognition, the instruments proposed to address identified inequalities, and the mechanisms by which implementation and outcomes are monitored. State-level efforts were believed to be necessary to recognize that NEP 2020 is being executed in a federal education system with significant differences in language, infrastructure, institutional capacity, and administrative priorities. This analysis was not intended to calculate causal impacts of NEP 2020 or the programmes. Instead, it judged if their reported aims, tools, action plans and monitoring plans address the structural obstacles from the evidence reviewed.

3.5. Limitations

This study has some limitations. First, interpretive judgements are made during purposive source selection and results cannot be reproduced nor are they exhaustive as they would be in a systematic review. The paper therefore endeavours to offer a critical and theory-based synthesis and not a complete picture of the scholarship on digital education in India. Secondly, secondary evidence has a limited ability to capture experiences that are dynamic and context specific in the field of digital education. While the figures at the national level may mask significant variations between states, districts, institutions and social groups, the qualitative studies cited here cannot capture the complexities of the range of women's experiences across India. Third, different population, definitions, reference periods and units of analysis in the datasets. Their results are used to shed light on unique aspects of digital inequality, and should not be viewed as directly comparable estimates or evidence of temporal change without qualification. Fourth, NEP 2020 is rolled out in an education system that is federally and institutionally divided. It is being implemented unevenly and is still developing at the state and local level. The policy analysis therefore does not provide a final evaluation of the long-term effects of the policy, but rather its framing, instruments and institutional provisions. Lastly, since the study is based on secondary data and does not involve independent statistical analyses, the conclusions of the study are related to patterns, relationships and mechanisms that were found in the existing evidence. They do not establish causal relationships or claim to represent the lived

experiences of all women participating in digital education in India.

4. THEORETICAL FRAMEWORK: FROM DIGITAL ACCESS TO INTERSECTIONAL CAPABILITY

This study integrates multidimensional digital-inequality theory, intersectionality, feminist technology studies, the capability approach and a multidimensional theory of justice. These perspectives are not considered to be independent bodies of literature, but are employed as complementary analytical lenses. They collectively contest technologically determinist discourses in which connectivity is presumed to bring educational inclusion. The integrated framework, rather, looks at four interconnected questions: What technological resources do learners have available? How are social relations constructed with respect to the use of these resources? Do learners have any meaningful agency in the process? What are the educational outcomes? It thus associates the access to materials to capability, autonomy, safety, participation and institutional accountability.

4.1. Multidimensional Digital Inequality

The first writings about the digital divide differentiated between individuals who had access to technology versus those who did not (Norris, 2001). Later research found that this dualistic view masks inequalities that continue to be present when connectivity is present. The "second-level digital divide" is defined as having different digital skills and using the internet differently (Hargittai, 2002) and the "third-level digital divide" is a "digital divide in outcomes", referring to unequal social, economic, and educational consequences of using the internet (van Deursen & Helsper, 2015). These differences focus the gaze away from simply the presence of technology towards the conditions and consequences of its use. Warschauer (2003) also posits that digital inclusion requires the interplay of physical, digital, human and social resources to make it meaningful. A device or internet connection is not going to be very educational if the students are not provided with related content, lack digital competence, accessible language, pedagogical support, and/or institutional support. van Dijk (2005) also theorises access as a cumulative process, where there are four stages: motivation, material access, skills and usage. A disadvantage at one stage may lead to a disadvantage at the next and socially advantaged learners are generally more likely to be able to make the best use of technological opportunities for their learning.

This view underpins the differentiation between household connectivity, personal access, autonomous use and educational benefit that is at the heart of this paper. A family can own a smartphone and a woman or girl can only access it occasionally and under a parent's supervision or on a low priority basis. Material provision is therefore viewed as a prerequisite, but not a condition. The empirical analysis interprets differences in devices, connectivity, affordability, skills, content, institutional support and outcomes using the lens of multidimensional digital-inequality theory. It is used in the policy analysis to evaluate whether programmes focus on connections and registrations, and/or continuity of use, learning completion and educational benefit.

4.2. Intersectionality and Feminist Technology Studies

Digital-inequality theory defines various kinds of exclusion but not alone provides an explanation for the unequal distribution. Intersectionality seeks to remedy this shortcoming by examining the ways in which the systems of power interact and don't simply compound each other (Crenshaw, 1989). Gendered digital inequality in India is formed by its intersectionality with caste, class, tribe, religion, disability, language, age and geographical location. Normally, the categories like "women" or "rural learners" or "disadvantaged groups" can therefore not be assumed to be internally homogeneous. For instance, the digital constraints of an urban, middle-class female user of a personal device are vastly different from that of a rural Dalit/Adivasi learner who relies on a shared device with inconsistent Internet access and a lack of availability of educational materials in the language of their choice. In the latter, economic deprivation, infrastructural inequality, linguistic exclusion and gendered household authority interact with each other. Intersectionality is thus not just meant to add to a list of disadvantages. It is used to account for the unique ways their interaction impacts learning participation. In this respect, the concept of feminist technology scholarship can be interpreted as extending the analysis to avoid assuming that technology is a neutral tool that has even effects. Wajcman (2004) considers that gender and technology are mutually constitutive, that technologies are designed and used in the framework of social relations, and that their use can reproduce or change these relationships. While digital education can create opportunities for learning, it can also help re-enforce household surveillance, put women at risk of harassment, and reproduce gender stereotypes and a presumed user urban, literate, able-bodied, linguistically dominant. In this view, control is an analytical issue, separate from access. A woman can use a family device only when its ownership, timing and its legitimate uses are decided by male members of the family and the monitoring is done by men. Meanwhile, women are not just passive victims of digital exclusion. They can negotiate access to devices, tap into peer and community networks, use low-bandwidth resources and learn new skills and mobilise digital platforms in learning and collective action. The analysis of structural constraints and situated agency are thus guided by feminist technology studies.

4.3. Capability, Agency and Digital Justice

The normative link between technological resources and substantive educational freedom is provided by Sen's (1999) capability approach. Resources are valuable not only for being available, but for being usable in the sense that individuals can transform them into 'functionings' (i.e. activities and achievements which they have reason to value, such as learning, finishing a course, gaining a recognised qualification). These are influenced by the personal, social and institutional conditions, referred to as "conversion factors". They are part of the elements in digital education, and are: literacy, language, disability accommodation,

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available time, household permission, privacy, safety, pedagogical support and institutional recognition. Thus, the same technology can create various learning experiences for learners in various social locations. It may be possible for one learner to attend classes and complete assessment if they have personal smartphone, uninterrupted electricity and family support. Having to share a device, doing unpaid domestic duties or lack of mobility and fear of harassment can hinder regular participation for another learner. The analysis uses the capability approach to show how equal provision of technology does not lead to equal substantive freedom. The process by which access may or may not lead to empowerment is further explained by Kabeer (1999) resources–agency–achievements framework. Resources include devices, data and digital skills. Making decisions around when, how and for what to use technology is agency. Potential outcomes are learning, qualifications, employment and involvement in public life. Transitions are not seamless between these dimensions. Formal access does not automatically translate to educational autonomy, and resources that lack decision-making authority can result in nominal access, but limited learning, while agency can be undermined by lack of recognition of learning acquired digitally, or by a lack of protection from the harmful effects of the online environment. The individual capabilities are linked to institutional justice in Fraser's (2008) framework of redistribution, recognition and representation. Redistribution involves equitable access to devices, connectivity, electricity, as well as affordable data and public education support. Recognition involves identifying gender based, caste based, linguistic, disability, cultural exclusion. Representation is about the power of affected learners to design, govern and evaluate digital-education systems. It is a framework that is directly applied to policy analysis: policy, NEP 2020 and related policy, is assessed in terms of the degree to which it redistributes resources, acknowledges differentiated disadvantage, promotes and supports participation and conversion of technological provision to educational benefit.

Taken together, these perspectives generate the paper's central analytical proposition: digital inclusion exists only when technological resources can be converted, under substantively equitable conditions, into autonomous, safe and educationally valuable participation. The empirical analysis therefore examines material access, conversion conditions, agency and outcomes, while the policy analysis evaluates redistribution, recognition, representation and capability conversion. This integrated framework ensures that theory is used to interpret evidence and assess policy rather than functioning as a detached literature review.

5. THE DIGITAL GENDER DIVIDE IN INDIA: FROM CONNECTIVITY TO MEANINGFUL EDUCATIONAL PARTICIPATION

India's digital gender divide isn't just one of technology. It represents disparities in the distribution of resources, capabilities, time, institutional support and decision-making. Digital technologies can also facilitate learning outside of traditional schools and can have a positive impact on geographically, occupationally, or physically restricted learners. However, the extent to which they have educational value depends on the social and institutional context within which they are used. The operative analytical issue is thus not simply one of connectivity, but also one of whether women have the control, capability and support they need to make technological access lead to ongoing participation in education.

5.1. Material Access and Unequal Capability

Official statistics prove that there are unequal material bases for digital education. According to the NSS 75th Round, the internet connectivity in the households of India in 2017-18 was found to be 23.8%. Forty-two per cent of urban households and 14.9 per cent of rural households had access. There were still limitations in computer availability: 23.4% of urban households had a computer versus 4.4% of rural households (National Statistical Office, 2019). These numbers are from before the connectivity increase that has occurred with and since the COVID-19 pandemic and should not be interpreted as indicative of current access. However, they show the different infrastructural conditions of the transition to online learning. Household connectivity also masks inequalities among household members. Among all women and men included in the survey, 33.3% and 57.1% respectively had previously used the internet (International Institute for Population Sciences & ICF, 2021). The indicator does not assess frequency or quality of digital education, as well as purpose, competence, autonomy and participation in digital education. The point is that its use is highly gendered and it is a technology on the rise for education, employment and public services. ASER 2023 also makes a distinction between household availability and household ownership. Nine out of ten rural respondents (14-18 years) said there was a smartphone available in their home. However, only 19.8% of the female respondents reported personal ownership while 43.7% of male respondents did (ASER Centre, 2024). Qualitative research too reveals that having a smartphone does not guarantee ongoing education. Pattnaik et al. (2023) noted that sometimes remote learning was disrupted because the home did not have a device, parents needed the device for work and/or multiple kids in the house were using the same device. The availability of the device should then be considered in conjunction with the predictability of the device, timing of device use, quality of the use of the device and autonomy of the device.

It is important to note that the NSS and NFHS-5 and ASER indicators are not directly comparable, as they refer to distinct populations and time periods and to different units of analysis and definitions of access. They are analytical, not arithmetical, in that they allow for the distinction of household connectivity and individual internet use/personal device ownership. Capability: a connected device is a resource, but its value as an educational resource is dependent on the learner's ability to engage with it to generate participation and achievement. There are conversion factors from technological provision to educational functioning: affordability, skills, a time factor,

privacy, language, and safety and pedagogical support.

5.2. Intersectional Conditions of Digital Exclusion

The process of the transformation of the technological resources into educational capability is different for various social locations. Gender is not an isolated disadvantage, but is combined with income, caste, tribe, disability, language and geography. There are ongoing expenses for devices, repairs, data, electricity, subscriptions and technical assistance that low-income households must cover. Device use can be determined by gendered evaluations of which education or job is more valuable, if there is a limited supply of resources. Rural and remote learners might experience poor connectivity, power outages, inadequate institutional support, and a lack of face-to-face support at the same time. These conditions are exacerbated by caste and tribal inequalities, which interact with economic deprivation, geographical isolation, unequal schooling, discrimination and a lack of representation of local languages and knowledge in digital content. A qualitative study of Scheduled Tribe students in rural Kashmir showed that during the pandemic, the absence of technological infrastructure and limited access to technology exacerbated educational marginalisation (Malla et al., 2024). The disadvantages are not clearly comprehended as distinct factors. In the case of a rural Adivasi woman, the type of device she has access to might depend on her family's income, the reliability of the network might depend on the geographical location, the content available might be limited by language barriers, and the access time might be negotiated by gendered power in the household. Their interaction results in qualification of their participation that is qualitatively different, intermittent, linguistically limited, and institutionally unsupported. A focus on intersectionality thus moves away from the mode of thinking of marginalised learners as deficient users. If a learner is struggling to use a platform, it can be a sign that they have little experience using it, that the design is inaccessible for them, that they do not have enough instruction in how to use it, that they do not have enough time, that they have to share the device, or that there is a mismatch between the digital content and the language and social context of the learner. If exclusion is only a problem of purported lack of women's confidence, interest or capability, then the roles of institutions and technology providers get overlooked. Not only are women's digital skills a question, but so too are the material, pedagogical and social conditions that educational systems offer to develop and exercise such skills.

Regional inequality should also be viewed not as a dichotomy of digitally advanced states vs. digitally lagging states. State averages can mask variations between districts, institutions, caste/tribal and rural/urban. The mix between Public Investment, Administrative capacity, School Quality, Language, Household resources and Connectivity varies across locations. Implementation of a uniform platform or national technological intervention may thus yield differential impacts when delivered with vastly different state and local institutional capacities.

5.3. Household Gatekeeping, Safety and Women's Agency

Social authorisation is also a prerequisite for technological access for women and girls. Mobile-phone use in India is enmeshed in gender, generational, reputation and family authority relations (Doron & Jeffrey, 2013). Legitimate fears of sexuality, exposure to allegedly inappropriate influences, and safety or family honour may be used to justify monitoring or controlling women's use of devices. Barboni et al. (2018) similarly show that adoption of mobile phones by women depends on the interplay of affordability, social norms and household gatekeeping. Access can thus be a form of conditional permission instead of an individual right. This distinction can be made more specific by the qualitative evidence from rural Madhya Pradesh. Scott et al. (2021) discovered that women's seemingly liberated use of the mobile phone was subject to firm gender boundaries. Women were often reliant on men's use of the device, were often given lower quality phones, had less free time and were required to use their phones for socially sanctioned uses. These results confirm that patriarchal domination does not necessarily manifest itself in an explicit prohibition. It can work by ownership, proximity to devices, time allocation, or differential functionality and norms about legitimate use. Time is an important conversion factor, therefore. Even if connectivity is technically possible, regular use can be hindered by domestic work, taking care of siblings, children or participating in paid work, and/or by restrictions on the use of screens. Mediated by gendered household conditions, the provisioning of digital education in secondary education during the pandemic in Delhi was not uniform, as revealed by a qualitative analysis by Kundu and Ambast (2022). This vaunted flexibility of digital education might then shift the burden onto women, as it becomes their responsibility to fit learning into unequal care roles and to make space for shared devices to be used. Safety also has an impact on substantive freedom to participate. Harassment, impersonation, unauthorised recording, sexualised abuse and non-consensual circulation of images can lead to self-censorship or withdrawing from interactive digital environments. The issue can be exacerbated by institutional or familial response, which may be to limit women's participation rather than the responsibility of perpetrators, platforms and accessible redress. Digital security needs to be considered as a prerequisite for access education, rather than an issue of individual caution (UNESCO, 2023). Women should not, however, only be seen as passive victims of exclusion. They arrange device schedules, ask for help from peers and relatives, utilise asynchronous or low bandwidth materials, utilise educators and community organisations and utilise digital platforms to learn and participate together. These practices, however, can be understood within the framework of Kabeer (1999) concept of agency as operated within unequal structures. While these approaches can expand the educational opportunities, they will not be able to replace the institutional responsibility. Asking women to constantly adjust to the lack of infrastructure, unsafe platforms and inequitable relationships within the household turns resilience into an unrecognized price of participation.

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5.4. EdTech, Marketisation and Unequal Outcomes

The use of education technology can increase access to lectures, open educational resources, skills training and flexible learning. Learners who are limited by geographical location, disability, work or caring responsibilities can benefit from low bandwidth content, downloadable lessons, multilingual resources and assistive technology and asynchronous formats. These potentialities do not however prove that EdTech equals educational outcomes. Technological solutionism involves reducing education issues to problems that can be solved with technology, as Selwyn (2016) puts it. The UNESCO Global Education Monitoring Report 2023 also calls for the adoption of educational technologies to address educational needs and based on credible evidence, taking into account the appropriateness, sustainability and equity (UNESCO, 2023). Technology can be used to teach and learn, but it cannot replace a lack of public institutions, the lack of teacher training, or the lack of access to curricula, or the lack of social equity. There are also distributive and governance issues with the commercialization of EdTech. Subscription fees, data needs, proprietary systems and device needs might shift learning expenses to family homes. Data-intensive platforms can simultaneously risk learners' exposure to profiling and surveillance, and commercial data extraction, and standardised systems can privilege dominant languages and specific ways of learning. Algorithmic systems are not social inequality-free: they can perpetuate biases found in data, institutional priorities and design practices (D'Ignazio & Klein, 2020; Noble, 2018). Where there are inequalities in bargaining power, women and learners who are marginalised are particularly at risk because they have less ability to refuse unwanted data collection, to challenge automated decisions, or to secure effective redress. The number of platform registrations, enrolments and content volume are therefore insufficient proxies for inclusion. Continuity of participation, autonomy of access, accessibility, course completion, learning outcomes, safety and benefit distribution across social groups must also be evaluated. The institutional aspects of this assessment are defined by the framework of Fraser (2008), which posits that redistribution involves both the availability of reasonably priced resources and the provision of supported public institutions; recognition involves the focus on differentiated gender, caste, language and disability-based exclusion; and representation involves the involvement of marginalised learners in the design and governance of educational technologies. It is therefore important to conceptualise the digital gender divide as a continuum from access to material, to capability, to autonomy, to safety and to educational benefit. While infrastructure is essential, it can't be the sole enabler of the re-distribution of authority over technology or the ability to create value from it. Failing to consider digital policy for household power, institutional quality, accessible design, unequal time of learning, and online harm, EdTech can modernise educational delivery while reinforcing the hierarchy of the current educational system.

6. NEP 2020 AND THE GOVERNANCE OF DIGITAL EDUCATION: POLICY ANALYSIS

The National Education Policy (NEP) 2020 assigns technology a substantial role in widening educational access, improving teaching and assessment, supporting multilingual learning, and increasing flexibility across school and higher education. Its approach is not wholly technologically deterministic. Paragraph 24.2 acknowledges that the benefits of online education "cannot be leveraged unless the digital divide is eliminated" (Ministry of Education, 2020, para. 24.2). Paragraph 24.3 further recognises infrastructural limitations, difficulties associated with online assessment, and the pedagogical limits of simply transferring conventional classroom practices to digital environments. The central policy question is therefore not whether NEP 2020 recognises digital inequality, but whether that recognition is translated into differentiated, enforceable, and measurable interventions. Drawing on the analytical framework developed in Sections 3 and 4, the policy is evaluated through four related criteria: redistribution, referring to the provision of technological and institutional resources; recognition, concerning the policy's responsiveness to differentiated and intersecting forms of exclusion; representation, referring to the participation of affected learners in technological governance; and capability conversion, denoting the conditions through which formal access is transformed into autonomous participation and educational benefit. These criteria provide a systematic basis for assessing the extent to which India's digital-education framework responds to gendered and intersectional inequalities.

6.1. Institutional Architecture and the Redistribution of Digital Resources

NEP 2020 proposes an institutional architecture for integrating technology into education. Paragraph 23.3 recommends establishing the National Educational Technology Forum (NETF) as a platform for exchanging evidence and ideas concerning the use of technology in learning, assessment, educational planning, and administration. Paragraph 23.4 envisages the NETF as a mechanism for collecting and analysing information from researchers, educators, practitioners, and technology developers (Ministry of Education, 2020, paras. 23.3–23.4). These provisions recognise that technological adoption requires continuing evaluation and institutional coordination rather than a one-time infrastructural intervention. Paragraph 24.4 identifies a broader set of measures for online and digital education, including pilot studies, digital infrastructure, teaching platforms, content creation, digital repositories, virtual laboratories, teacher preparation, online assessment, blended learning, and standards for content, technology, and pedagogy (Ministry of Education, 2020, para. 24.4). Public platforms such as DIKSHA and SWAYAM can widen access to school resources, teacher development, and online courses. PM e-VIDYA complements internet-based provision through television, radio, and other modes of delivery, thereby recognising that a platform-dependent model cannot reach

every learner. From the perspective of redistribution, these commitments are significant but incomplete. Although NEP 2020 identifies devices and connectivity as necessary conditions of equitable online education, it does not create an individual entitlement to a device or specify how recurring costs associated with data, electricity, maintenance, and technical assistance will be met. Its emphasis on infrastructural availability also pays insufficient attention to the social allocation of technological resources within households. Household connectivity does not establish that women and girls possess regular, private, or autonomous access to a device when classes, assessments, or other educational activities occur. Redistribution must therefore be evaluated in terms of the regularity and quality of access, rather than the numerical expansion of connections. Platform registrations, course numbers, and the volume of digital content demonstrate the scale of provision but not its distribution or educational consequences. A gender-responsive assessment must ask who owns or controls the device, who uses it regularly, who completes learning activities, and who converts participation into recognised educational outcomes. Without disaggregation by gender, caste, tribe, disability, income, language, and location, aggregate measures of "reach" may conceal substantial inequalities in participation and benefit.

6.2. Recognition of Intersectional Exclusion and Capability Conversion

NEP 2020's identification of Socio-Economically Disadvantaged Groups acknowledges that educational disadvantage is multidimensional. Its support for Indian-language content, accessible learning materials, and targeted measures for historically marginalised groups represents an important departure from formally uniform provision. Nevertheless, broad administrative categories cannot adequately explain how social inequalities interact or how they produce qualitatively different experiences of digital exclusion. Rural women, Dalit and Adivasi learners, women with disabilities, linguistic minorities, and women from low-income households encounter distinct combinations of infrastructural, institutional, and social constraints. These inequalities are not merely cumulative. For example, a rural Adivasi woman may encounter unreliable connectivity alongside linguistic exclusion, geographical isolation, restricted device ownership, unpaid domestic work, and institutional discrimination. These conditions interact to shape whether she can access, understand, control, and benefit from digital education. Treating such learners as members of a single disadvantaged population may therefore produce policies that appear inclusive at the categorical level but remain insufficiently differentiated in implementation. The capability approach reveals a related gap between resource provision and substantive educational freedom. NEP 2020 gives limited attention to intra-household allocation, gendered control of devices, discretionary learning time, privacy, and familial surveillance. A shared device controlled by another household member may be unavailable during scheduled classes or assessments. Similarly, multilingual content has limited educational value when a learner lacks sufficient time, privacy, digital competence, pedagogical assistance, or social permission to use it. The availability of technology is therefore not equivalent to the capability to learn through it. Digital safety is also insufficiently developed as a dimension of educational inclusion. Harassment, impersonation, sexualised abuse, non-consensual image circulation, and reputational harm may discourage women's participation or lead families to restrict their access. When online safety is treated primarily as a matter of individual caution, responsibility is displaced from institutions and platforms onto learners. A gender-responsive digital-education policy must instead establish accessible reporting procedures, time-bound redress, privacy protections, platform accountability, and institutional support for those experiencing technology-facilitated harm. Safety is not supplementary to digital access; it is one of the conditions under which access becomes educationally meaningful.

6.3. Representation, Monitoring, and Platform Accountability

NEP 2020 envisages consultation among governments, educational institutions, researchers, teachers, and technology practitioners through the NETF. However, it provides less clarity about how students particularly women and learners from marginalised communities—will participate in the design, evaluation, and governance of digital-education systems. Fraser's concept of representation exposes this limitation. Learners should not be positioned merely as recipients of technologies designed elsewhere. Those most affected by digital exclusion should participate in identifying problems, establishing design priorities, and evaluating proposed interventions. Representation is also connected to monitoring and accountability. India's digital-education ecosystem comprises programmes administered across different ministries, agencies, and levels of government. DIKSHA and SWAYAM provide educational content and courses; PMGDISHA focuses on digital literacy; BharatNet supports broadband infrastructure; and Common Service Centres can facilitate assisted access. Although these initiatives address different dimensions of the digital divide, their administrative separation produces fragmented objectives, beneficiary categories, and indicators of success. Infrastructure programmes typically report connections established, digital-literacy programmes count individuals trained, and educational platforms record registrations, courses, or certifications. These indicators are administratively useful, but they do not reveal whether women retain access after training, use acquired skills independently, participate continuously, complete educational activities, or obtain educational and economic benefits. A learner may therefore be recorded as digitally included while lacking continuing access to a device or the autonomy to use it. A capability-sensitive monitoring framework should measure regularity of participation, autonomy of use, accessibility, course completion, learning outcomes, online safety, and subsequent educational or occupational benefit. These outcomes should be disaggregated across relevant social locations while protecting individual privacy. Monitoring should also incorporate qualitative evidence concerning women's experiences of household control, institutional support, platform design, and online harm. This would

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connect administrative indicators with the lived conditions under which digital education is accessed. Public reliance on commercial EdTech platforms additionally raises questions concerning subscription costs, data extraction, opaque algorithms, proprietary control over content, and institutional dependence. The UNESCO Global Education Monitoring Report cautions that educational technology should be adopted according to demonstrated educational need, appropriateness, sustainability, and equity rather than novelty or commercial availability (UNESCO, 2023). Public policy must consequently ensure that technology supplements well-resourced educational institutions and trained teachers rather than becoming an inferior or lower-cost substitute for marginalised learners.

6.4. Federal Variation in Policy Implementation

NEP 2020 operates within India's federal education system, in which state capacity, language, infrastructure, and administrative priorities shape implementation. It should therefore be understood as a national framework whose consequences are mediated by state and local institutions, rather than as a uniform intervention producing identical outcomes across India. The India Report: Digital Education 2021 documents considerable variation in state responses. Kerala's First Bell initiative combined television broadcasting through KITE-VICTERS with online resources and community efforts to identify learners without digital equipment. Tamil Nadu used Kalvi TV and state-supported digital resources, while Rajasthan's SMILE and Chhattisgarh's Padhai Tuhar Dwar adopted different combinations of messaging applications, broadcast media, digital content, and community-based delivery (Ministry of Education, 2021).

These initiatives demonstrate the value of multimodal and context-sensitive implementation. They also show why the existence of a national platform cannot be taken as evidence of uniform inclusion. States differ in electricity coverage, connectivity, public broadcasting capacity, institutional reach, teacher preparation, linguistic requirements, and local-government capacity. Substantial disparities may also exist between districts and communities within the same state. State-level initiatives should therefore be assessed not only by their nominal reach but also by whether they provide accessible content, assisted participation, teacher interaction, regular feedback, and targeted support for excluded learners. Comparative state-level evaluation should examine which combinations of technological provision, public institutions, community participation, and teacher support produce more equitable outcomes. Federal variation also creates possibilities for policy learning. Effective practices developed by particular states may inform national standards, but their transfer requires attention to institutional context. A model supported by established public broadcasting, strong local institutions, and extensive school infrastructure cannot be reproduced merely by adopting the same platform in a state where these supporting conditions are weaker. Institutional capacity is itself a critical conversion factor between policy commitment and educational outcome.

6.5. Comparative Insight and Overall, Policy Assessment

Uruguay's Plan Ceibal provides a limited but instructive international comparison. The programme initially prioritised public provision of devices and connectivity but subsequently expanded its attention to educational content, platform use, teacher support, and institutional integration. UNESCO's assessment indicates that early investment in devices did not automatically generate improved learning outcomes, demonstrating the importance of pedagogy, teacher preparation, and continuing institutional support (UNESCO, 2023). Plan Ceibal cannot be directly transferred to India because the two countries differ substantially in population, federal organisation, linguistic diversity, and the scale and character of social inequality. Its analytical relevance lies instead in demonstrating that public provisioning is most effective when devices and connectivity are embedded within a wider educational ecosystem. International comparison therefore reinforces, rather than replaces, the need for context-specific state and local analysis in India. Overall, NEP 2020 provides an important policy foundation by recognising the digital divide, supporting multimodal provision, and proposing institutional mechanisms for technology-enabled education. Its principal limitation lies in the distance between recognising inequality and operationalising substantive equality. Redistribution remains oriented predominantly towards infrastructure rather than predictable individual access. Recognition does not consistently address intersecting and intra-household inequalities. Representation of marginalised learners in technological governance remains weakly specified. Monitoring continues to privilege administrative outputs over autonomy, safety, capability conversion, and educational benefit.

In response to the study's second research question, intersecting inequalities are acknowledged within India's digital-education policy framework, but they are not yet translated into sufficiently differentiated entitlements, implementation mechanisms, or accountability measures. Moving towards gender-equitable digital inclusion therefore requires predictable access to devices and data; multilingual, accessible, and low-bandwidth design; institutional protection from digital harm; capability-based monitoring; state-sensitive implementation; and the meaningful participation of marginalised women in technological governance. Digital education can challenge existing social hierarchies only when policy addresses the social relations through which technology is allocated, controlled, and used. Otherwise, digitalisation risks reorganising established inequalities within new technological systems.

7. PATHWAYS TOWARDS GENDER-EQUITABLE DIGITAL EDUCATION

The preceding analysis demonstrates that gender-equitable digital education cannot be achieved through connectivity or platform expansion alone. Policy must address the conditions under which technological resources are

accessed, controlled, and converted into educational benefits. Accordingly, the following recommendations translate the principles of redistribution, recognition, representation, and capability conversion into actionable policy measures. Because this conceptual review does not include programme-level expenditure data, feasibility is assessed in institutional and comparative terms rather than through unsupported monetary estimates.

7.1. Redistributing Digital Resources through Predictable Access

Public investment in broadband connectivity, electricity, devices, and affordable data remains indispensable, particularly in rural, tribal, and other underserved regions. Household connectivity, however, should not be treated as evidence of equitable access because shared devices are frequently allocated according to gendered household priorities. Union and state education departments should therefore complement infrastructure expansion with targeted device-lending schemes, subsidised data packages, and institutional device banks for learners from socio-economically disadvantaged groups. Eligibility should be determined through transparent criteria that account for gender, caste, tribe, disability, household income, and geographical location. Where individual device provision is not immediately feasible, assisted digital-learning centres should be established or strengthened through schools, colleges, libraries, Common Service Centres, Panchayati Raj institutions, and self-help-group networks. Their effectiveness will depend on safe and accessible locations, suitable operating hours, trained facilitators, disability accommodation, and confidential use. Women and girls must be able to use these facilities without intrusive supervision or restrictions on the subjects they may study. These interventions require sustained public investment, but their institutional feasibility can be improved by using existing educational and community infrastructure. Progress should be measured through individual access, frequency and duration of use, participation, and course completion rather than through the number of household connections alone.

7.2. Building Capabilities through Sustained Local Support

Digital-literacy initiatives should move beyond short-term instruction in device operation and application use. Critical digital capability includes evaluating information, protecting privacy, recognising misinformation and online fraud, creating digital content, understanding data practices, and reporting technology-facilitated harm. Training must also be connected to learners' educational, occupational, and civic objectives; otherwise, certification may not translate into sustained or beneficial use. State education departments, teacher-education institutions, universities, and community organisations should develop continuing mentorship and peer-support arrangements for first-generation digital learners. Women teachers, self-help groups, and community facilitators can act as trusted intermediaries, particularly where social norms discourage women from approaching formal technology centres. Such work, however, should be remunerated and institutionally supported rather than treated as an extension of women's unpaid community labour. These programmes can be integrated into existing educational and community networks, making them institutionally feasible without requiring the creation of entirely new delivery structures. Evaluation should examine demonstrated competence, continued use after training, progression to further learning, and educational outcomes rather than relying exclusively on the number of individuals certified.

7.3. Requiring Accessible, Multilingual, and Public-Interest EdTech

Inclusive digital education requires platforms designed around learner diversity rather than an assumed generic user. The Ministry of Education, state education departments, educational institutions, and public procurement bodies should incorporate accessibility, affordability, and inclusion standards into the approval and procurement of educational technologies. Platforms should support regional and minority languages, low-bandwidth access, downloadable and offline materials, audio formats, captions, transcripts, and interfaces accessible to persons with disabilities. Gender-responsive design extends beyond the visual inclusion of women in educational materials. Curricula and platforms should challenge occupational stereotypes, recognise women as knowledge producers and technological actors, and incorporate digital rights, consent, safety, and gender equality. Women from different caste, tribal, linguistic, disability, income, and regional backgrounds should participate in platform design, user testing, and evaluation. Consultation conducted only after implementation is unlikely to correct exclusions already embedded within technological systems. Public procurement can make these principles enforceable by requiring accessibility testing, transparent data practices, and evidence of inclusive user consultation as conditions for awarding and renewing contracts. Monitoring should assess language coverage, accessibility compliance, participation and completion across social groups, and learner experience. Although inclusive design may involve additional initial expenditure, incorporating accessibility at the design stage is more feasible and less costly than retrofitting exclusionary platforms.

7.4. Institutionalising Safety, Privacy, and Effective Redress

Online safety should be treated as a condition of educational participation rather than as the individual responsibility of women learners. Educational institutions and platform providers must establish visible, accessible, confidential, and time-bound procedures for responding to harassment, impersonation, unauthorised recording, image-based abuse, and misuse of personal information. Complaints should be addressed through survivor-centred processes that protect confidentiality, prevent retaliation, and enable continued educational participation. Teachers, administrators, and platform personnel should be trained to respond to digital harm without blaming women or restricting their subsequent use of digital spaces. Privacy-

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by-design should be mandatory for publicly supported EdTech. Platforms should collect only the data necessary for clearly defined educational purposes, explain consent in accessible language, and disclose how learner data are stored, processed, and shared. Access to essential educational services should not be made conditional on the unnecessary disclosure of personal information. Institutional performance should be assessed through response times, complaint resolution, recurrence of harm, learner satisfaction, and independent privacy and safety audits. These measures have relatively modest technical costs when integrated during platform development, although credible enforcement requires trained personnel, regulatory oversight, and institutional accountability.

7.5. Strengthening Participatory Governance and Gender-Responsive Monitoring

Women and marginalised learners should participate in digital-education governance as decision-makers rather than merely as beneficiaries of programmes designed elsewhere. The National Educational Technology Forum, state education departments, educational institutions, and local governments should establish consultative mechanisms that include women from Dalit, Adivasi, minority, disability, low-income, and geographically disadvantaged communities. Their participation should extend to decisions concerning content, platform procurement, accessibility, privacy, grievance mechanisms, and programme evaluation. Monitoring systems should move beyond aggregate indicators such as registrations, downloads, connections, and certifications. Subject to appropriate privacy safeguards, data should be disaggregated by gender, caste, tribe, disability, income, language, and rural–urban location. Indicators should capture regular access, control over devices, discretionary learning time, course completion, safety, educational achievement, and the subsequent use of acquired capabilities. Independent evaluations should also examine whether publicly funded or commercially supplied platforms generate exclusion through cost, language, inaccessible design, or opaque data practices. Because education is governed through India's federal system, national standards should coexist with state-level adaptation and experimentation. The Union government should establish minimum requirements relating to accessibility, privacy, gender responsiveness, procurement, and accountability, while states should develop delivery models suited to their linguistic, infrastructural, and institutional contexts. A structured mechanism for documenting, sharing, and independently evaluating state innovations would allow effective practices to be adapted without assuming that a single technological model can address all regional circumstances.

Taken together, these pathways conceptualise digital inclusion as a chain connecting resources, capabilities, agency, and educational outcomes. Failure at any stage can prevent formal access from becoming substantive inclusion. In Fraser's (2008) terms, redistribution must provide the material conditions of access, recognition must address the differentiated experiences of marginalised learners, and representation must enable their participation in technological governance. Sen's capability approach and Kabeer's resources–agency–achievements framework further demonstrate that technological provision becomes empowering only when learners possess the substantive freedom to control and benefit from it. Digital technology should therefore supplement sustained public investment in educational institutions rather than substitute for qualified teachers, accessible campuses, and social support. Gender-equitable digital education will ultimately depend not on the quantity of technology introduced but on whether differently situated learners can access it predictably, exercise meaningful control over its use, participate safely, influence its governance, and convert technological participation into valued educational and social outcomes.

8. CONCLUSION

This paper examined how gender, caste, class, and geography interact to shape women's access to, control over, and meaningful use of digital education in India. It also evaluated the extent to which India's digital-education policy framework responds to these intersecting inequalities. The analysis demonstrates that digital exclusion cannot be adequately understood as a binary distinction between those who are connected and those who are not. Rather, it operates through a cumulative chain of inequalities involving device ownership, affordability, connectivity, digital competence, language, disability access, discretionary learning time, institutional support, online safety, and control over technological use. These disadvantages are neither isolated nor merely additive. The consequences of gender inequality vary according to caste location, household income, rurality, disability, language, and institutional context. A rural Adivasi woman with intermittent connectivity, restricted access to a shared device, and little educational content in her preferred language does not experience the same form of digital exclusion as an urban, middle-class woman possessing an individual device. Intersectionality therefore changes both the diagnosis of digital inequality and the design of appropriate policy responses. Although national averages and household-level indicators reveal broad disparities, they may conceal the qualitatively different conditions under which differently situated women participate in digital education. The paper's central argument is that technological availability does not automatically generate educational capability. Sen's capability approach demonstrates that resources become educationally valuable only when learners possess the substantive freedom to convert them into valued functioning's. Kabeer's distinction among resources, agency, and achievements further establishes that access without control may reproduce dependence rather than produce empowerment. Women nevertheless remain active agents: they negotiate household restrictions, draw upon community networks, pursue informal learning, and appropriate digital platforms for educational and collective purposes. Such agency, however, should not be romanticised or treated as a substitute for institutional responsibility. The analysis of NEP 2020 reveals both normative progress and an operational deficit. The policy recognises that inequalities in devices, connectivity, and digital literacy may intensify educational disparities and proposes an

institutional architecture involving public platforms, digital repositories, virtual laboratories, teacher preparation, and multimodal provision. Nevertheless, its response to inequality remains stronger at the level of recognition than at the levels of enforceable redistribution, differentiated implementation, and participatory governance. Intra-household gatekeeping, individual control over devices, unequal learning time, online harassment, privacy, and women's participation in technological decision-making receive insufficient operational attention. Implementation also occurs within a federal and institutionally fragmented environment in which states possess unequal administrative, fiscal, educational, and digital capacities. Fraser's framework consolidates these findings. Redistribution requires affordable connectivity, predictable device access, and adequately resourced public institutions. Recognition requires policy to address gendered, caste-based, linguistic, cultural, geographical, and disability-related forms of exclusion. Representation requires women and other marginalised learners to participate meaningfully in designing, governing, and evaluating digital-education systems. None of these dimensions is independently sufficient. Resource provision without recognition may leave discriminatory social relations intact; recognition without material investment may remain symbolic; and both may reproduce paternalistic governance when affected communities lack an effective voice. The paper contributes to digital-education scholarship by integrating multidimensional digital inequality with intersectionality, the capability approach, feminist technology studies, and theories of empowerment. Rather than treating these perspectives as parallel explanations, it uses them to develop a relational account of digital inclusion connecting resources, social conditions, institutional arrangements, agency, and educational outcomes. This framework shifts the evaluative question from whether technology has been provided to whether learners can access it predictably, control its use, participate safely, influence its governance, and convert it into valued educational achievements. From this perspective, EdTech is neither inherently emancipatory nor inevitably exclusionary. It may reduce certain geographical and institutional barriers, provide flexible learning opportunities, and support women's educational agency. Yet it can also reproduce existing hierarchies when introduced into unequal households, educational institutions, and technology markets without adequate public investment, institutional safeguards, and democratic oversight. The effects of educational technology therefore depend on the social relations and governance arrangements through which it is designed, allocated, and used.

Future research should extend this conceptual analysis by combining disaggregated quantitative evidence with qualitative and longitudinal inquiry into women lived experiences of digital education. Particular attention should be given to how gender intersects with caste, class, tribal identity, disability, language, and geographical location in shaping technological access, autonomy, continuity of learning, online safety, and educational outcomes. Comparative state-level research is especially important for examining how differences in institutional capacity, digital infrastructure, linguistic context, and programme design influence policy implementation. Such inquiry should move beyond aggregate measures of connectivity to investigate how differently situated women negotiate digital constraints, exercise agency, and convert technological access into sustained educational and social benefits. Ultimately, digital technology should strengthen rather than displace the public responsibility to provide equitable education. The success of educational digitalisation must not be measured solely by platforms launched, courses uploaded, or households nominally connected. It must be judged by whether historically marginalised learners acquire greater capability, autonomy, safety, educational benefit, and influence over the systems through which education is delivered. Digital education becomes transformative only when technological innovation is governed by substantive equality, public accountability, and democratic participation.

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Author(s) Contribution

Conceptualization, M.I. and N.M.; methodology, M.I.; validation, M.I., N.M., and S.S.; formal analysis, M.I.; investigation, M.I.; resources, M.I.; writing original draft preparation, M.I.; writing review and editing, M.I., N.M., and S.S.; supervision, N.M.; project administration, M.I.; funding acquisition, M.I. All authors have read and approved the final version of the manuscript.

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those of the authors and may not reflect the views of ICSSR or the Government of India.

Availability of Data and Materials

No new data were collected for the purposes of this study and no data were analysed independently. The paper draws upon a critical review of the literature including published research, official data, policy texts and institutional evaluations. The manuscript identifies and cites all sources used in the analysis.

Competing Interests

The authors have declared no competing interests. There are no competing financial or non-financial interests that could have influenced the research presented in this manuscript.

Clinical Trial Registration (if applicable)

Not Applicable

Human Ethics and Consent to Participate

Not applicable. This paper relies solely on published literature, publicly available reports, policy documents and secondary statistics in aggregate. No institutional ethics approval and informed consent was required because it didn't involve human participants or identifiable personal information or primary data collection.

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