

Barriers to Digital Access for Girls in Rural Schools

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Abstract— Digital technologies are increasingly central to teaching, learning, and civic participation, yet access to these tools remains deeply unequal across gender and geography. This paper examines the barriers that restrict digital access for girls attending rural schools, situating the discussion within the broader literature on the gender digital divide. Drawing on institutional reports from UNESCO, UNICEF, the International Telecommunication Union (ITU), the GSMA, and the World Bank, together with peer-reviewed studies published between 2014 and 2025, the paper synthesises evidence on the infrastructural, socio-cultural, economic, safety-related, and institutional obstacles that disproportionately limit rural girls' engagement with digital learning. The study adopts a qualitative, literature-based design, reviewing secondary data from global surveys, government publications, and academic journals. The findings indicate that unreliable electricity and connectivity infrastructure, patriarchal social norms, device and data unaffordability, safety and privacy concerns, low digital literacy among teachers, parents, and students, and uneven policy implementation combine to leave rural girls further behind their male peers and urban counterparts in digital competence. The paper concludes with recommendations addressing infrastructure expansion, gender-responsive teacher training, community sensitisation, and targeted subsidy schemes, arguing that closing the rural gender digital divide is essential to achieving inclusive and equitable education systems.

Keywords— *gender digital divide; rural education; girls' education; ICT access; digital literacy; educational inequality*

Introduction

The rapid diffusion of digital technologies has transformed how knowledge is produced, shared, and accessed. Online classrooms, digital libraries, mobile learning applications, and government e-education portals have become routine features of contemporary schooling in many parts of the world. The COVID-19 pandemic accelerated this shift, compelling education systems to move teaching and assessment online almost overnight and exposing, in the process, the scale of digital inequality that had previously remained latent within national education systems. For millions of children, the promise of digital learning has remained largely theoretical, because the basic precondition of a stable internet connection at home or in school does not exist. A joint UNICEF and ITU report estimated that roughly two-thirds of the world's school-age children, some 1.3 billion children aged three to seventeen, had no internet connection in their homes, and that when the wider youth population is included the figure rises to 2.2 billion unconnected children and young people worldwide.

This digital shortfall is not evenly distributed. Data compiled by the ITU show that only around one-quarter of rural children and young people have access to the internet globally, compared with more than two-fifths of their urban counterparts, and that rural households are only about half as likely as urban households to have an internet connection at home. Layered onto this rural-urban divide is a persistent gender gap: the GSMA's Mobile Gender Gap Report for 2025 found that women in low- and middle-income countries remain fourteen percent less likely than men to use mobile internet, leaving roughly 885 million women unconnected, the majority of them



concentrated in South Asia and sub-Saharan Africa, the same regions where rural school enrolment is highest. Girls attending rural schools therefore sit at the intersection of two compounding disadvantages, geographic marginalisation and gender-based exclusion, that jointly constrain their access to digital learning resources, their opportunities to develop digital skills, and ultimately their prospects for participation in an increasingly digitised economy and society.



This paper reviews existing research and institutional data to map the principal barriers that keep rural girls on the wrong side of the digital divide. It examines infrastructural constraints, socio-cultural and patriarchal norms, economic barriers, safety and security concerns, digital skills gaps, and institutional and policy shortcomings, before discussing how these barriers interact and proposing recommendations for narrowing the gap.

Literature Review

The concept of a gendered digital divide has been examined by scholars for over a decade. Antonio and Tuffley, in an influential review published in the journal *Future Internet*, argued that women in developing countries have consistently lower rates of technology participation than men, a pattern they attributed to entrenched socio-cultural attitudes about women's roles rather than to any inherent difference in capability. Their review distinguished between mere physical access to devices and networks and the deeper, more consequential question of whether that access translates into meaningful use, skill development, and empowerment, a distinction that remains central to subsequent research on the topic.

International agencies have continued to document the scale of this divide. UNESCO reports that there remain 244 million fewer women than men using the internet worldwide, and that for many girls in sub-Saharan Africa the barriers extend well beyond infrastructure to include social norms, affordability, security concerns, and restrictions on girls' mobility that limit where and when they can use shared devices. UNESCO's

collaborative programme with Beijing Normal University and the governments of Ghana and the United Republic of Tanzania was designed specifically to address these compounding barriers by training teachers in gender-transformative digital pedagogy, on the premise that girls in mixed classrooms often lack the confidence to engage with digital tools unless teachers actively create space for them to do so.

The GSMA's annual Mobile Gender Gap Report provides some of the most systematic quantitative evidence on this issue. The 2024 edition found that women were fifteen percent less likely than men to use mobile internet across low- and middle-income countries, with affordability, safety and security concerns, and a poor connectivity experience cited as the leading barriers to adoption and continued use. The 2025 edition reported that this progress had stalled, with the gender gap in mobile internet adoption widening slightly to fourteen percent and the gap in mobile money account ownership increasing to thirty-six percent, underscoring that improvements in connectivity do not automatically translate into closing the digital gender gap.

A World Bank working paper analysing the gender digital skills divide in sub-Saharan Africa drew on a UNICEF review of household survey data across thirty-two countries and found that only four countries, Lesotho, Viet Nam, Mongolia, and Samoa, had achieved gender parity in digital skills among adolescents, while in seventeen countries fewer than ten percent of girls possessed basic digital skills. This finding is consistent with UNESCO's own data showing that global efforts to expand girls' access to computing and STEM education remain far from closing the skills component of the digital divide, even where basic connectivity has improved.

Research from India offers a detailed picture of how the digital divide manifests within rural school systems. A study published in the journal *Decision* examined the digital divide among tribal youth in rural Jharkhand during the COVID-19 pandemic and found that the shift to online classes exposed overlapping disadvantages of caste, poverty, and gender, with unstable internet connections affecting both students and teachers and with girls from non-affluent communities facing additional hurdles that had received comparatively little research attention prior to the pandemic. A separate analysis of the pandemic's gendered effects on adolescent schooling in India, drawing on the Annual Status of Education Report, found that thirty-eight percent of enrolled children aged six to fourteen had no access to a smartphone at home, and that children in government schools, where rural and lower-income students are disproportionately enrolled, were far less likely to receive recorded or live online lessons than children in private schools. The same study noted that gender bias in access to digital learning tools was evident even before the pandemic, reflecting

broader patterns of lower investment in girls' education relative to boys within many Indian households.

A quasi-experimental study of a digital literacy training programme in rural India, published in a peer-reviewed public health journal, cited 2018 National Sample Survey data showing that only four percent of rural households owned a computer and that just seven percent of women in these households could operate one. Complementing this, a UNESCO Institute for Lifelong Learning analysis observed that many women in rural India who owned mobile phones could only answer calls, lacking the literacy and numeracy skills needed to dial numbers or read messages independently of their husbands, a finding that illustrates how physical device ownership can mask a much deeper skills and autonomy gap. Research on Tamil Nadu published in the Journal of Social and Economic Development similarly found that state-level interventions such as televised classes helped partially offset rural-urban gaps in access, suggesting that low-technology alternatives can play a meaningful role where broadband infrastructure remains inadequate. A survey of students' experiences with online learning in India during the pandemic, published in the Asian Journal for Public Opinion Research, likewise found that constraints on online education were significantly associated with both gender and caste, with the cost of high-speed internet and inadequate infrastructure identified by respondents as the most frequently cited barriers.

Taken together, this body of literature converges on several consistent themes: that the gender digital divide is compounded rather than caused by rurality, that affordability and infrastructure remain necessary but not sufficient conditions for closing the gap, and that socio-cultural norms, safety concerns, and skills deficits operate as independent and interacting barriers. However, much of the existing research either addresses the gender digital divide at a national or cross-country level or focuses narrowly on the disruption caused by the COVID-19 pandemic, leaving comparatively little sustained, school-level research on how these barriers operate specifically within rural school systems under normal, non-crisis conditions. This paper draws together the available evidence to address that gap descriptively, while noting the need for further primary research at the school and community level.

Objectives of the Study

This study is guided by the following objectives:

To identify the infrastructural and connectivity barriers that restrict rural girls' access to digital learning tools in schools.

To examine the socio-cultural and economic factors that shape household decisions about girls' access to digital devices and the internet.

To assess the role of safety, security, and privacy concerns in limiting girls' engagement with digital technologies.

To review the digital literacy and skills gaps affecting girls, parents, and teachers in rural school settings.

To evaluate existing institutional and policy responses and propose recommendations for narrowing the rural gender digital divide.

Research Methodology

This study employs a qualitative, descriptive research design based on a review of secondary literature. Data were drawn from institutional reports published by UNESCO, UNICEF, the ITU, the GSMA, and the World Bank, as well as peer-reviewed journal articles indexed in sources such as Google Scholar, Semantic Scholar, PubMed Central, and Springer Link. Search terms included combinations of 'gender digital divide', 'rural education', 'girls ICT access', 'digital literacy', and 'online learning gender gap'. Sources were included where they were published by a recognised international organisation, government body, or peer-reviewed academic journal, addressed gender-based or rural-based digital access specifically within an educational context, and were publicly verifiable through an accessible publication record or digital object identifier. Sources that could not be independently verified, or that lacked clear institutional or academic provenance, were excluded.

The review synthesises findings thematically rather than through statistical meta-analysis, given the heterogeneity of methods, geographic scope, and indicators used across the source literature. This approach allows the study to identify recurring patterns across contexts while acknowledging that quantitative findings from one country or region, such as India or sub-Saharan Africa, may not generalise directly to other rural settings. As a literature-based study, this paper does not include new primary data collection; its conclusions are therefore descriptive and synthetic rather than causal, and are intended to inform, rather than substitute for, future field-based research.

Barriers to Digital Access for Girls in Rural Schools

The evidence reviewed above points to a cluster of interacting barriers that together restrict rural girls' digital access. These are discussed in turn below.

Infrastructural and Connectivity Barriers

The most basic barrier to digital access in rural schools remains physical infrastructure: unreliable electricity supply, weak or absent broadband and mobile network coverage, and a shortage of computers or tablets within schools themselves. ITU data show that only around a quarter of rural children and young people worldwide have internet access, compared with over forty percent of urban children, and that rural households are roughly half as likely as urban households to have a home internet connection. In India, researchers studying rural Jharkhand during the pandemic found that even teachers struggled to secure a stable internet connection at home or in school, meaning that infrastructural gaps constrained not only students' access but the ability of schools to deliver digital content in the first place. Where infrastructure is weakest, girls are often the last in the household queue for whatever limited connectivity or device time is available, compounding a structural constraint with a distributional one.

Socio-Cultural and Patriarchal Norms

Beyond infrastructure, deeply rooted social norms shape whether girls are permitted or encouraged to use digital devices at all. UNESCO's work in sub-Saharan Africa highlights how restrictions on girls' mobility, together with prevailing social norms, make it harder for them to access technology even where devices and connectivity exist. In many rural households where a single shared device must be allocated among siblings, sons are reported to be given priority for online classes over daughters, reflecting broader patterns of preferential investment in boys' education and human capital that researchers have documented in the Indian context. Household responsibilities also fall disproportionately on girls, with domestic chores frequently competing with study time and further narrowing the windows in which girls can use available devices.

Economic and Affordability Barriers

Cost remains one of the most consistently cited barriers across the literature. The GSMA identifies affordability of both handsets and mobile data, alongside safety concerns and connectivity experience, as a leading barrier to women's mobile internet adoption and continued use. Within rural households operating under tight budget constraints, the marginal decision to purchase a smartphone or a data plan for a daughter competes directly with other household needs, and research on the gender digital divide notes that women's comparatively lower financial independence further restricts their ability to acquire devices or data independently of male household members. Even where overall device ownership rates have risen, as reflected in India's Annual Status of Education Report data showing an increase in rural smartphone ownership among enrolled children between

2018 and 2020, affordability gaps mean that access remains concentrated in wealthier and better-connected households.

Safety, Security, and Online Harassment Concerns

Concerns about online safety act as a further deterrent, both for girls themselves and for parents deciding whether to allow their daughters unsupervised device use. UNESCO's Global Education Monitoring Report has warned that algorithm-driven platforms, particularly social media, expose young girls to heightened risks of privacy invasion, cyberbullying, and distraction, and the head of the ITU has emphasised that meaningful connectivity requires girls to feel safe in online spaces, not merely to have technical access to them. The GSMA similarly finds that safety and security concerns rank among the top barriers preventing women from using mobile internet more fully even once they are connected. In rural communities where formal digital literacy or cyber-safety education is limited, these safety concerns can translate into blanket parental restrictions on girls' device use, rather than supervised or skill-building engagement with technology.

Digital Literacy and Skills Gaps

Even where access to a device exists, a substantial skills gap limits its educational value. A UNICEF review across thirty-two countries found that in seventeen of them fewer than ten percent of girls possessed basic digital skills, and in some countries almost none did. In rural India, a 2018 national survey found that only seven percent of women in device-owning households could operate a computer, and a related study found that many rural women who owned mobile phones could only answer incoming calls, lacking the confidence or literacy to dial numbers or read messages without assistance. This skills gap extends to teachers as well as students: research on India's pandemic-era shift to online learning found that only half of teachers surveyed had received any training in online instruction, limiting schools' capacity to deliver effective digital lessons even where connectivity was available. UNESCO's teacher-training initiatives in Ghana and the United Republic of Tanzania were designed explicitly around this finding, on the observation that girls in many classrooms lack the confidence to engage with digital and STEM subjects unless teachers are equipped to actively challenge these patterns.

Institutional and Policy Gaps

Finally, uneven policy implementation and weak monitoring mechanisms limit the effectiveness of efforts to close the rural gender digital divide. Government initiatives such as India's PM eVIDYA and Samagra Shiksha programmes, and Tamil Nadu's televised Kalvi TV classes, illustrate how targeted state investment can partially offset infrastructural gaps, while



UNICEF and ITU's Giga initiative aims to connect every school globally to the internet. Yet the literature also points to gaps in gender-disaggregated monitoring: the UNESCO Institute for Lifelong Learning notes that robust, disaggregated data on digital skills by gender remains limited in many countries, making it difficult for policymakers to track whether interventions are actually narrowing the gap for girls specifically, as opposed to improving average access levels that continue to mask underlying gender disparities.

Discussion

The barriers identified above do not operate in isolation; they interact and compound one another in ways that are particularly acute for girls in rural schools. A girl in a household without reliable electricity or an affordable data plan is already at a disadvantage before socio-cultural norms about device-sharing or safety concerns about internet use are even considered; conversely, even where infrastructure and affordability improve, entrenched norms and skills gaps can continue to constrain girls' meaningful use of the technology that is nominally available to them. This intersection of geographic, economic, and gender-based disadvantage is consistent with Antonio and Tuffley's original observation that closing the digital divide requires attention not only to access but to capability and meaningful use.

At the same time, the literature offers evidence that coordinated, multi-pronged interventions can produce measurable improvements. UNESCO's 2024 programme in Kenya, for example, connected nineteen schools serving over 8,600 learners, half of them girls, to digital resources, while parallel initiatives provided dedicated online and offline learning materials to girls' schools and ran ICT bootcamps reaching hundreds of girls directly. Such results suggest that infrastructure expansion, when combined with deliberate gender-responsive programming and teacher training, can shift outcomes for rural girls more effectively than infrastructure investment alone. This reinforces the conclusion that the rural gender digital divide is best understood, and best addressed, as a multi-dimensional problem rather than a single connectivity gap.

Recommendations

Based on the barriers and evidence reviewed, the following measures are recommended to narrow the digital access gap for girls in rural schools.

Expand rural school connectivity and electricity infrastructure, including low-cost and offline alternatives such as solar-

powered digital libraries, to reach schools where grid-based broadband remains unavailable.

Introduce or expand targeted subsidy and device-lending schemes that specifically prioritise girls from low-income rural households, rather than relying solely on general household device ownership to close the gap.

Invest in community sensitisation programmes that engage parents and community leaders on the value of girls' digital education, addressing the mobility restrictions and device-sharing norms documented in the literature.

Mandate gender-responsive digital pedagogy training for rural school teachers, building on models such as UNESCO's teacher-training programmes in Ghana and the United Republic of Tanzania, so that classroom practice actively counters girls' lower confidence in digital and STEM subjects.

Strengthen online safety education and reporting mechanisms within schools, so that safety concerns are addressed through supervised skill-building rather than blanket restrictions on girls' device use.

Improve gender-disaggregated monitoring of digital access and skills at the school level, enabling policymakers to track whether interventions are narrowing the gap for girls specifically.

Scale proven low-technology and blended-learning models, such as televised or radio-based instruction, in areas where broadband expansion will take longer to reach.

Conclusion

Girls attending rural schools face a distinctive combination of infrastructural, economic, socio-cultural, safety-related, and skills-based barriers that jointly restrict their access to digital learning. The evidence reviewed in this paper shows that these barriers are mutually reinforcing rather than independent, and that closing the rural gender digital divide requires coordinated action across infrastructure investment, affordability, community engagement, teacher training, and online safety, rather than any single intervention in isolation. As education systems continue to integrate digital tools into everyday teaching and learning, the risk is that rural girls, already contending with geographic and economic marginalisation, fall further behind unless deliberate, gender-responsive measures are built into digital education policy from the outset. The initiatives reviewed here, from teacher-training programmes to community-based sensitisation and targeted connectivity projects, demonstrate that meaningful progress is achievable,



but sustained investment and monitoring will be required to ensure that the benefits of digital learning reach rural girls as fully as they reach their male peers and urban counterparts.

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