

Bridging the Digital Divide: Addressing Inequities in Modern Education Through Technology

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Abstract: The study examines digital inequality across four areas: access and infrastructure, disparities in digital literacy, institutional support, and student engagement in underserved educational environments in both urban and rural settings. Based on qualitative interviews with school administrators, teachers, parents, and students, the research aims to explore experiences in the transition to online learning. Findings prove that unstable internet connectivity, along with limited access to personal devices, tends to hinder participation in digital classrooms. If devices are provided, shortages often force students to share their devices or even miss lessons completely. Gaps in digital literacy extend beyond the students to parents and educators; many of them struggle with the fundamental academic platform functions regardless of their familiarity with social media. Policy guidelines issued during the pandemic lacked practical execution support, which left most of the schools to navigate the adoption of technology independently. Leadership, as well as district-level capacity, evolved as key factors. For instance, the schools with strong institutional backing were modified effectively, whereas the under-resourced schools lagged behind. The engagement outcomes differed; the students with learning differences benefited from the flexible digital tools. However, many others felt isolated, mainly when platforms lacked accessibility features for people with disabilities or when their home environment did not get support from independent learning. This study underscores that bridging the digital divide needs holistic interventions. These include affordable and high-speed internet, adequate device allocation, and digital literacy programs for all the stakeholders, structured institutional support, along with an inclusive technological design.

Keywords: inequities, digital divide, modern education, students, technology, digital learning environments

1. Introduction

In recent years, the integration of technology in education has transformed the way teaching and learning occur on a global scale. The use of digital tools enables remote learning, personalized instruction, and access to a wide range of global resources. This technological advancement holds the potential to revolutionize education systems and improve learning outcomes. However, this transformation has not been uniform or equitable. The emergence of the digital divide, the gap between those with access to modern information and communication technologies (ICTs) and those without, has become one of the most pressing issues in contemporary education (Dijk, 2020). This divide is not just about hardware and internet connectivity; it also encompasses digital literacy, infrastructure, institutional support, and inclusive learning design. The COVID-19 pandemic has brought this issue into sharp focus, exposing the deep-rooted inequalities in educational systems worldwide (UNESCO, 2021). While some students seamlessly transitioned into digital learning environments, others, particularly those from under-resourced and rural communities, were left behind, struggling to keep up due to insufficient access to technology, digital skills, or educational support.

The global response towards the pandemic has led to an unprecedented reliance on digital education. This shift compels educators, students, and policymakers to grapple with the implications of digital exclusion. Eze et al. (2021) noted that millions of students, particularly in developing and deprived regions, have experienced disruptions or loss of education due to school closures, stemming from a lack of technological devices, poor internet connectivity, or



digital skills necessary for online learning. These challenges are not confined to the Global South; even in technologically advanced nations, disparities in access and usage patterns persist, influenced by socioeconomic status, geographic location, and physical disabilities (Chen, 2022). These disparities have widened the learning gap among students, with long-term implications for academic achievement, social mobility, and emotional well-being. The digital divide, therefore, is not just a technological issue, but a deeply entrenched educational and social justice concern with significant societal implications.

A more complicated problem refers to the misconception that access alone is enough. Furthermore, the provision of laptops or access to the internet does not automatically translate to improved learning outcomes when the students and educators cannot utilize such tools effectively. Digital literacy, the competence of using, understanding, and evaluating digital technologies, is an essential factor in maximizing the potential of educational technology (Charles-Zalakoro, 2025). Students may know how to use social media but struggle to navigate learning platforms, complete assignments, or communicate with instructors in an academic digital context. Similarly, teachers unfamiliar with online tools may revert to ineffective teaching methods or fail to engage students in a meaningful way. As Mishra (2020) noted, without professional development and ongoing support, technology becomes a burden rather than a benefit in educational settings.

Institutional policies and leadership significantly influence the equitable implementation of technology, alongside skill gaps. Schools and districts that possess strong leadership and supportive infrastructures are more likely to adopt effective digital learning strategies, provide teacher training, and ensure that all students benefit from technological interventions (Group, 2025). Conversely, schools in low-resource environments often lack the autonomy or capacity to translate national policies into localized action, leading to inconsistent outcomes. Leadership influences not only the technical implementation of digital tools but also the broader pedagogical culture, determining whether digital learning is inclusive, adaptive, and sustainable.

Another dimension of the digital divide relates to inclusive design. Digital learning platforms are often built with ideal users in mind, those with reliable internet, updated devices, and no cognitive or physical disabilities. The assumption tends to marginalize students having diverse learning needs, incapacities, or unstable home environments (Lichy et al., 2014). While the students may have access to tablets or technological devices, they may be unable to use these items effectively because of a visual impairment or a lack of a quiet space at home. Similarly, digital content that lacks cultural relevance or even contextual adaptation might fail at engaging the students from minority or indigenous communities. Bulfin and McGraw (2015) emphasize that equity in digital education involves not only closing access gaps but also ensuring that digital content is culturally responsive, linguistically inclusive, and universally accessible.

Given the complexity of the digital divide, it is clear that a multidimensional approach is necessary, one that considers the infrastructure, skills, institutional practices, and inclusive design collectively. While many studies have examined digital inequity at the macro levels, such as national statistics and global reports, there is a crucial need for more localized, qualitative insights. These insights can provide a more nuanced understanding of how individuals, students, parents, teachers, and administrators experience and navigate these challenges on a day-to-day basis. By examining these lived experiences, we can gain a deeper understanding of how digital inequity manifests and identify potential entry points for sustainable interventions.

This research addresses the need to explore how technology-based inequities in education are perceived and managed by key stakeholders within the local educational context. With the use of a qualitative, thematic analysis approach, the study draws upon semi-structured interviews with 20 participants, which include teachers, parents, administrators, and students, to investigate how digital access, literacy, institutional support, and platform design shape educational outcomes. The study centers on four core themes that emerged from the data: (1) Access and Infrastructure, (2) Digital Literacy Disparities, (3) Institutional Support and Policy Implementation, and (4) Student Engagement and Inclusion.

This research makes a significant contribution to the field of educational equity by offering a nuanced, grounded perspective on the digital divide from multiple stakeholder viewpoints. Unlike quantitative studies that generalize access statistics, this study reveals the layered and context-specific barriers that hinder equitable digital learning. It signifies the interaction between policy, pedagogy, lived experience, and technology design, providing practical and actionable insights for educators, technology developers, and policymakers. Finally, the findings advocate for inclusive and locally adapted, equity-driven strategies to design and deploy the educational technologies in both emergency and non-emergency contexts.

2. Literature Review

2.1 Understanding the Digital Divide in Education

The digital divide in education is the disparity in terms of access to digital technologies, internet connectivity, and the skills needed for using them effectively. Regardless of rapid technological advancements, inequalities continue across the socio-economic, geographic, and demographic lines. At a global level, many students were left behind in the COVID-19 pandemic because of inadequate access to technology and poor internet, which exposed the severity of the divide (AlDabbas et al., 2025; UNESCO, 2021). The digital divide is not only a binary distinction between those who have access and those who do not as shown in Fig 1. It is a multi-layered issue that includes quality of access, functionality of the device, and digital literacy (Dijk, 2020). For example, students in urban areas may have internet access, yet struggle with shared devices, whereas students in rural areas may experience digital exclusion (Liu, 2021).



Figure 1 Digital exclusion in remote communities as two girls using one tab Source: (Liu, 2021)

2.2 The Role of Digital Literacy in Bridging Educational Gaps

Digital literacy is a key component to ensure equitable access to education in the digital age. It is not just the ability to operate digital tools, but also to critically assess, create, and communicate information using digital platforms. In educational settings, digital literacy has an impact on how students tend to interact with the learning content, how teachers design instruction, and how parents support learning from home as shown in Fig 2. Charles-Zalakoro (2025) mentioned that digital literacy is a fundamental skill that determines whether digital access leads to academic success. Despite the common belief that younger generations are inherently digitally literate, research indicates that most students lack the necessary skills to engage effectively in academic digital environments (Chen, 2022).



Figure 2 Professional development skills for teachers regarding digital literacy Spource: Charles-Zalakoro (2025)

For students, digital literacy is an essential skill that includes knowing how to navigate learning management systems, submit assignments electronically, conduct online research, and communicate in academic digital forums. However, many students, particularly those from under-resourced backgrounds, lack exposure to these tasks and therefore struggle to adapt. This challenge was made evident during the shift to online learning during the COVID-19 pandemic, when many students could not engage with digital tools beyond recreational use. As Lichy et al. (2014) and Bsoul et al., (2025) argued, recreational digital use does not equate to educational digital fluency. Thus, there is a pressing need for schools to integrate digital literacy instruction into the curriculum across all grade levels.

Equally important is the digital literacy of educators. Teachers who lack confidence or competence in the use of digital tools are less likely to incorporate the technology meaningfully in their instruction. Studies prove that the professional development paid heed to digital pedagogy, which is critical to building teacher capacity and improving student outcomes (Mishra, 2020). Though such training is unpredictable or superficial, it is mainly in the low-income or rural schools. Charles-Zalakoro (2025) focused on the importance of continuous, context-based training, not one-off workshops, which is essential to foster sustainable change. However, when teachers are not institutionally supported, they might feel overwhelmed or resistant to adopting the new technologies, thus hindering innovation in the classroom.

Parents are key in bridging the digital divide, actively participating in their children's education. However, many parents lack the necessary digital literacy to support their children's online learning (Talib et al., 2024; Assefa et al., 2025). This issue disproportionately affects immigrant families and households where English is not the primary language, exacerbating existing educational disparities (Haif et al., 2023; Chen, 2022). Schools should therefore initiate community outreach and provide multilingual digital literacy programs, recognizing the diversity of the community and the need for inclusive educational initiatives.

Moreover, digital literacy plays a crucial role in the relationship between technology access and educational equity. It is essential to bridge the digital literacy gaps among students, parents, and teachers to fully harness the potential of educational technologies. Without these competencies, digital tools may not only fail to narrow the gap but could also widen it.

2.3 Institutional Policies and Leadership in Digital Equity

Institutional policies, particularly leadership, play a crucial role in either mitigating or exacerbating the digital divide in education (Bandyopadhyay et al., 2021). As technology access is often seen as a logistical issue, the

structures, including decisions behind its execution, are significantly influenced by policy and administrative leadership. Schools and districts that demonstrated proactive leadership during the pandemic, characterized by swift adaptation, transparent communication, and targeted support, showed a higher level of success in maintaining student engagement and minimizing inequities (Darabseh et al., 2022; Eze et al., 2021). Conversely, institutions lacking strategic planning or adequate support from educational authorities found themselves improvising to meet the digital demands of remote learning. This disparity underscores the crucial role of educational leadership in managing technological transitions and promoting equity.

Research by Mishra (2020) underscores that institutional policies should not be mere symbolic gestures. They must have clearly defined objectives, budget allocations, and accountability measures. For instance, a policy aimed at providing digital tools to all students may appear inclusive; however, without considering long-term maintenance, internet subsidies, or training, these policies fall short of achieving true equity (Afzal et al., 2023). Furthermore, schools in low-resource environments often lack the autonomy to act on central policy mandates. Group (2025) argues that decentralized implementation, without consistent support, leads to fragmented responses, thereby widening the urban-rural digital divide. Therefore, policies should be tailored and flexible, allowing for localized adaptation based on the unique needs of schools and their communities.

Leadership, as Khasseh & Jatoi (2022) argue, is the linchpin in building institutional cultures that embrace technological change. Principals and district leaders, by prioritizing professional development and inclusive practices, often serve as catalysts for positive transformation. Bulfin and McGraw (2015) found that when leadership teams invest in teacher training and equitable resource distribution, student outcomes improve significantly. Moreover, distributed leadership models that engage teachers, IT staff, and parents in decision-making are instrumental in creating more sustainable digital ecosystems within schools. This participatory approach ensures that policies are responsive and grounded in real classroom experiences, serving as another critical aspect in monitoring and evaluation.

It is not uncommon for institutions to implement technology policies without the means to measure their impact. As Lichy et al. (2014) stress, data-driven decision-making is not just important; it is essential. It is the key to understanding whether initiatives are closing gaps or unintentionally reinforcing them. Schools, therefore, must collect and analyze data related to device usage, digital engagement, student achievement, and feedback from stakeholders. This data is not just numbers; it is the compass that guides continuous improvement.

Regrettably, institutional neglect and bureaucratic inefficiencies not only hinder but also significantly delay the equitable rollout of educational technology. The consequences are dire, with poorly coordinated efforts leading to duplicated resources in one area, while others remain underserved (Charles-Zalakoro, 2025). This misalignment between policy intention and actual implementation results in wasted resources and missed opportunities to create a lasting impact.

Also, institutional policy and leadership are indispensable in ensuring that technology contributes to educational equity rather than inequality. Effective leadership must anticipate challenges, involve all stakeholders, and ensure continuous professional learning, recognizing the dynamic nature of educational technology. Policy, in turn, should be designed with long-term sustainability, cultural relevance, and measurable outcomes in mind. To address the digital divide, it is not entirely a technological problem, but a matter of leadership, policy vision, and institutional accountability.

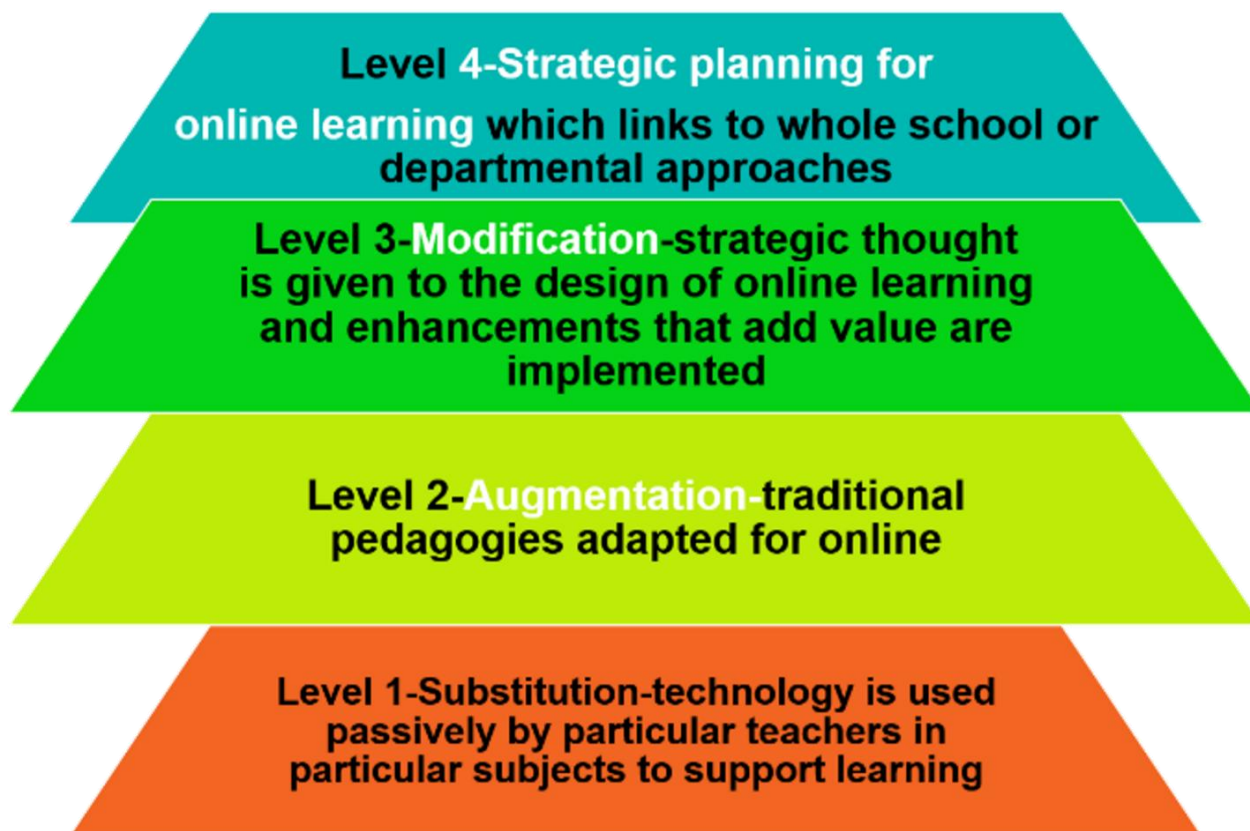


Figure 3 Framework of digital implementation Source: Eze et al. (2021)

2.4 Inclusive Design and Student Engagement in Technology-Enhanced Learning

The potential of technology in education is not limited to access, but also extends to its inclusivity. Inclusive design, the intentional development of digital platforms and content that caters to diverse learners, offers a promising future for education. It accommodates those with disabilities, various learning styles, linguistic backgrounds, and socio-economic constraints. In educational contexts, inclusive design ensures that all students, not just the most digitally equipped or neurotypical, can engage meaningfully with digital content (UNESCO, 2021). However, many digital learning tools currently fall short in considering the full spectrum of learners, perpetuating exclusion and disengagement.

A significant barrier to inclusion is the lack of accessibility features in educational platforms. Chen (2022) pointed out that students with visual, auditory, or cognitive impairments struggle with standard platforms, which lack overall screen reader compatibility, captioning, and customizable interfaces. These design flaws not only hinder academic performance but also signal a wider neglect of marginalized populations. Lichy et al. (2014) emphasized that the exclusion of such learners is not a tech-based inevitability; rather, it is a design failure rooted in the lack of diversity in EdTech development teams and insufficient consultation with education experts. Therefore, it is crucial to incorporate diverse perspectives in EdTech development to ensure that inclusive design is embedded in the initial phases of product development, guided by universal design principles.

Apart from accessibility, student engagement is also affected by the cultural and contextual relevance of digital content. Educational platforms designed for Western contexts often fail to reflect the realities of learners in different countries, resulting in lower engagement and limited learning gains. Bulfin and McGraw (2015) emphasize the importance of "culturally responsive EdTech," which incorporates localized content, language options, and scenarios that reflect students' lived experiences. Without this relevance, technology becomes alienating rather than empowering.

In addition, inclusive design must consider the digital environments in which students operate. As highlighted by Ragnedda and Gladkova (2020), not all students have private, quiet spaces for learning. Many rely on shared

devices in noisy homes or community centers. Digital tools that operate under ideal conditions, such as continuous internet access or personal logins, inherently disadvantage these learners. Flexible, asynchronous learning models, offline access, and mobile-first design are practical ways to accommodate such realities.

Student voice is a pivotal aspect of inclusive design. When students are actively involved in the development and feedback process, tools are more likely to align with their needs and preferences. Participatory design approaches, while still uncommon in mainstream EdTech, have demonstrated significant potential in creating more engaging and effective learning experiences (Charles-Zalakoro, 2025). This potential offers a hopeful outlook, suggesting that students can be more than passive users, but active co-designers of the platforms that shape their learning.

Engagement should not be gauged solely by login rates or time-on-task. Meaningful engagement encompasses emotional, cognitive, and behavioral dimensions, all of which are influenced by how students interact with the learning platform. Tools that are poorly designed can overwhelm, confuse, or frustrate students, often leading to disengagement, even if they are technically 'used.' Inclusive design, therefore, should be guided by an awareness of these dimensions and should incorporate simplicity, clarity, feedback mechanisms, and encouragement elements often overlooked in data-driven educational systems.

Inclusive design is central to ensuring technology acts as a bridge rather than a barrier in education. It tends to demand attention towards accessibility, flexibility, cultural relevance, and user experience. If the digital tools are designed inclusively, they even foster higher engagement, close equity gaps, and affirm the educational rights of learners, creating a more positive and hopeful learning environment.

3. Methodology

3.1 Research Design

This research used a qualitative exploratory research design to gain in-depth insights into how technological interventions can address inequities in modern education. The qualitative approach was selected for exploring the lived experiences of the participants, their perceptions, and suggestions related to the digital divide in educational settings. An exploratory design was highly appropriate, given the evolving nature of the technology integration in education, considering its unequal effect across various communities.

Developing upon the foundation, the study used semi-structured interviews as the primary data collection method, which allowed participants to speak freely about their experiences and led to constant probing across core themes of literacy, access, policy implementation, and inclusion. All interviews were conducted with parents, students, teachers, and administrators to capture an extensive range of perspectives.

In some of the settings, focus groups were employed to foster interaction and refine perspectives among the participants in the same roles. An inductive thematic analysis approach was used as the researcher immersed themselves in the transcripts, coded developing patterns, and found specific themes through the iterative reading and consensus coding. The method enabled flexibility and responsiveness to the new insights as they evolved, which is a hallmark of the exploratory studies.

To enhance trustworthiness, triangulation of the sources was used while comparing the narratives from the different stakeholder groups, which helped in confirming and deepening the understanding of common themes and reducing bias. Hence, this design facilitated a deep, context-sensitive understanding of the phenomena, giving rich qualitative data for informing policy and practice and generating directions for future explanatory or mixed-method research.

3.2 Participants and Sampling

Twenty participants were chosen by purposive sampling, a strategy that targets individuals with direct experience and knowledge of the problems and opportunities presented by educational technology. The participants, including secondary school teachers, administrators, and education policy advisors from urban and rural settings, were selected to ensure a comprehensive range of perspectives on the digital divide and technology use in schools. This diversity in perspectives, captured through the purposive sampling strategy, is a key strength of the study. This non-probability method intentionally targets individuals with direct experience in educational technology interventions, making it particularly suitable for exploratory qualitative research. The focus of this type of research is on understanding rather than statistical generalization (Campbell et al., 2020).

3.3 Data Collection

Data were collected through semi-structured interviews, each lasting approximately 30–45 minutes. Interviews were conducted both face-to-face and via video conferencing tools to accommodate participants' availability and access. The interview guide focused on participants' experiences with technology in education, barriers to equitable access, institutional support, and recommendations for improvement.

3.4 Data Analysis

The transcribed interviews had been analyzed using thematic analysis, followed by the six-step framework that is outlined by Braun and Clarke (2006). Primarily, transcripts were read many times to immerse the research team in the data and record the preliminary observations. Then, the systematic initial coding found the salient features across the dataset. All the codes were then inductively grouped into broader candidate themes by clustering as well as pattern-searching. Themes were refined by the iterative review, contrary to both coded extracts with the overall dataset, which led to clear and well-defined theme names that capture the essence of all the concepts. The last stage included the production of a cohesive analytic narrative that linked themes to research questions and chosen illustrative quotes.

3.5 Ethical Considerations

The study drew on the research by (Hasan et al., 2021) and followed its ethical conduct. Before participating, all the individuals received the informed consent forms, which included details about the study purpose, processes, data uses, and the voluntary nature of participation. The autonomy of the participants was respected, and they can withdraw at any time without consequence. With the teachers, students, parents, and administrators included, confidentiality was maintained by using pseudonyms and anonymization of the identifiable data in transcripts, including reporting.

Specific care was taken while interacting with the significantly vulnerable participants, particularly students or caregivers who were unfamiliar with the digital platforms. Efforts were made to ensure that the participants felt respected and understood in the use of technology in the consent process, with no assumptions made about their digital literacy. This included a clear explanation of the videoconference tools and regular checks for comprehension.

In the interest of data stewardship and reflexivity, the researcher engaged in reflective journaling to identify and address potential biases. This process was vital given the emotional stakes and prior connections with the interviewees. To further enhance credibility, feedback on the interpretation of themes was sought from a subcontract co-researcher, rather than relying solely on direct participant review. Data storage and handling strictly adhered to institutional ethical board protocols, ensuring the integrity and privacy of all materials.

4. Results and Analysis

4.1 Access and Infrastructure

"Most of our students don't have access to stable internet at home. Some even rely on shared mobile data with their parents, which makes attending online classes almost impossible."

The issue of internet connectivity remains a significant barrier to equitable education, particularly in underserved communities. The above given quote shows a common struggle in which the students are unable to completely participate in digital learning because of unreliable or inadequate internet access. These limitations not only hinder academic engagement but also exacerbate existing educational injustices, signifying the urgent need for infrastructural investment in digital access across all regions.

"We got some devices from the education department; however, they were not sufficient. For ten students, there might be a working tablet, but the rest have to share or do without."

Inadequate digital devices compound the digital divide in terms of education. Such a shortage forced many of the students to depend upon shared resources or even miss out on the online learning entirely. Disparity in device distribution shows the systemic inequalities that prevent equitable access to technology-led education for all students.

4.2 Digital Literacy Disparities

"Some of the students know about using social media, but they still struggle with fundamental tasks such as attaching a file or navigating a learning portal."

Digital literacy amongst the students is uneven, which limits their overall ability to engage with educational technologies fully. It highlights a significant gap between recreational and academic digital skills. As the students may

seem tech-savvy on the surface, many do not have the foundational capabilities needed for effective online learning. These disparities hinder their academic progress and underline the urgent need for targeted digital literacy programs that equip learners with the skills needed for meaningful technology usage.

“I wanted to assist my child through online homework, but I did not know about using the platform myself. It was quite frustrating for both of us.”

Parental digital literacy plays a crucial role in supporting the online learning of children, yet many parents face challenges in navigating educational platforms. This statement stresses the urgency of addressing the digital literacy gap, making the audience feel the need for immediate action. When the parents do not have the needed skills for assisting their children, it not only causes stress but also widens the digital divide. Bridging this gap requires inclusive training initiatives that empower students and caregivers, underlining the need for immediate action.

“We had to train the teachers regarding using Zoom and Google Classroom. Many of them were using digital tools for the first time in the pandemic.”

The sudden shift towards online learning in the pandemic has exposed the significant gaps in digital literacy amongst educators. Such a lack of familiarity with fundamental digital platforms created the initial disruptions in terms of the learning process, which added immense stress and pressure on the staff and students. Without proper training and continuous support, teachers struggled to deliver effective instruction, underscoring the need for professional development in digital competence.

4.3 Institutional Support and Policy Implementation

“The government gave guidelines; however, no clear support was provided on implementing them. We were left to figure things out on our own.”

Institutional support is a crucial factor in the effective implementation of educational technology. However, gaps in policy execution often stem from a lack of sustained institutional backing. This disconnect between policy creation and practical application at the school level can lead to the failure of well-intentioned policies to produce equitable outcomes. To address this, effective implementation requires not just directives, but also the necessary tools and guidance, all underpinned by sustained institutional backing.

“Schools having strong leadership as well as district-level backing had quickly adapted. Others, without getting support, fell behind, mainly in the under-resourced areas.”

The effectiveness of schools adapting to technological changes is greatly influenced by strong leadership and district-level support. There is an unequal landscape of institutional preparedness, in which well-supported schools can proactively respond, whereas others struggle due to limited guidance and resources. These disparities contribute to a broadening digital divide and underscore the critical need for equitable policy execution and leadership to ensure all schools benefit from technological advancements.

4.4 Student Engagement and Inclusion

“Some of the students having learning difficulties thrived with the digital tools, which allowed them to work at their own pace, whereas the others were isolated and lost while not having any face-to-face interaction.”

This quote underscores the dual effect of technology on student engagement. While digital tools offer flexibility and autonomy, particularly beneficial for students with learning difficulties, they can inadvertently lead to emotional and academic detachment from others. The lack of personal interaction can impede social learning and engagement, especially for students who thrive on classroom structure and peer interaction. This highlights the pressing need for inclusive design that balances independence with connection, ensuring that all students, regardless of their learning style or needs, are supported and included in digital learning environments.

“Many platforms were not designed with accessibility in mind. The students with visual or hearing impairments faced issues in their online classes.”

Accessibility is one of the main challenges in technology-driven education. The statement above underscores how some digital platforms lack features like compatibility with screen readers, captioning, or even sign language support, which are essential for students with disabilities. When such needs are ignored, technology can inadvertently become an additional barrier. However, with the right approach, technology has the potential to be a powerful tool for inclusion. These oversights strengthen the educational inequalities, whereas the marginalization already significantly

deprives the student populations. For fostering genuine inclusion, educational technologies should adhere to the universal design principles and undergo full accessibility testing before being broadly implemented in schools.

“It felt as if the system was made for the students who know everything already, meaning a good Wi-Fi, a quiet room, and a laptop too. The rest of us only tried at keeping up.”

This reflection of the students reveals the hidden assumptions entrenched in most of the digital learning environments. The technologies are designed for the ideal conditions that not all students have, like stable internet, personal devices, and conducive study spaces. Students who do not have such resources have significant issues, which exclude them from the overall learning experience. It reinforces the systemic inequities, results in frustration, disengagement, and decreased academic performance. For promoting equity, schools and developers should consider the real-world circumstances regarding diverse learners when they design and implement digital education tools.

5. Discussion

This study delved into the intricate dynamics of the digital divide in education, emphasizing the urgent need to address this issue. It underscored how technology, if not implemented with inclusivity and equity in mind, can exacerbate existing inequities. Through qualitative analysis of participant feedback, four key themes emerged: Access and Infrastructure, Digital Literacy Disparities, Institutional Support and Policy Implementation, and Student Engagement and Inclusion.

The theme of access and infrastructure emerged as a stark indicator of digital inequality. Many participants noted that students in rural and low-income communities lack consistent internet access and personal devices, echoing broader research that identifies the infrastructure gap as a primary cause of digital exclusion (Dijk, 2020). This disparity is particularly pronounced in education systems heavily reliant on digital platforms. The COVID-19 pandemic, while accelerating global digital adoption, also starkly revealed the unpreparedness of many regions to support all students equitably (Group, 2025). Without systemic investments in broadband infrastructure and equitable distribution of hardware, the promise of digital education will remain out of reach for marginalized learners.

Infrastructural barriers compound the problem of digital literacy disparities. Participants have reported that students, parents, and educators often lack the necessary digital skills for effective engagement with online learning environments. This aligns with Charles-Zalakoro's (2025) findings, which argue that digital competencies are crucial for meaningful digital access. The ability of students to benefit from online learning is not only dependent on having a device, but also on knowing how to use it for academic purposes. The gap widens significantly when parents, who play a crucial role in supporting their children's learning from home, also lack basic digital literacy (Chen, 2022). Moreover, teachers' unfamiliarity with digital tools can delay effective instruction, highlighting the need for institutional policies that prioritize teacher professional development in digital competencies.

Another key finding concerns the institutional support and policy execution. While the government and educational bodies issued guidelines for digital learning during the pandemic, many participants noted the lack of practical and hands-on support. This disconnect between policy and practice is a common issue. Top-down directives often struggle to translate into meaningful action without the support of localized resources and training (Mishra, 2020). Schools with proactive leadership and district-level support were able to adapt more rapidly, illustrating the central role of educational leadership in crisis response. Conversely, schools without such support have been left to figure things out, increasing the divide between well-resourced and under-resourced institutions. A study by Eze et al. (2021) confirms that the effective integration of educational technology depends not only on funding but also on clear communication channels, which can keep all stakeholders informed and connected, capacity-building, and localized planning at every level of the education system.

Recent studies indicate that socio-economic status is the most significant predictor of digital access in education. More affluent families are likely to afford high-speed internet, up-to-date devices, and learner-friendly environments (Chen, 2022). Thus, the students from low-income backgrounds depend upon mobile phones, community centers, or public hotspots; these conditions are far from ideal regarding sustained academic engagement. Poorly adequate infrastructure in the rural and marginalized communities exacerbates such challenges. Ragnedda and Gladkova (2020) advised that the digital inequality in terms of education mirrors present social and economic inequalities, which makes it essential to frame digital inclusion in a broader social justice context.

Moreover, the digital divide is not a static issue. It evolves with changes in educational technology and policy, and deepens with the introduction of more complex and resource-intensive tools. Understanding the digital divide is of utmost importance, as new technologies like artificial intelligence, including adaptive learning platforms, become

crucial in classrooms. The gap between those who can effectively use such tools and those who cannot is likely to widen unless proactive measures are taken (Lichy et al., 2014). Therefore, it is essential to understand the digital divide, which necessitates an intersectional analysis, including not only access, but also quality, use, and meaningful engagement.

Efforts for addressing the digital divide should recognize the role of institutional and governmental policies in either the mitigation or perpetuation of these disparities. In most of the regions, policy interventions in the pandemic emphasized short-term device distribution instead of sustainable infrastructure development or long-term digital skills training (Charles-Zalakoro, 2025). As these interventions were essential, they were inadequate at producing lasting equity. So, scholars argue for a crucial shift from reactive to proactive digital inclusion strategies, which give priority to equitable access, targeted support, and continuous monitoring of outcomes (Alvi et al., 2025; Ullah and Asghar, 2023; Bulfin & McGraw, 2015).

Even the digital divide in terms of education is a complex, dynamic, and deeply entrenched problem. Addressing it needs a comprehensive, multi-dimensional approach which goes beyond the provision of hardware, including skills development, designing of the inclusive platform, and supportive policies (Ullah and Asghar, 2024).

The final theme, student engagement and inclusion, highlights the dual potential of digital education that can empower as well as marginalize. Some students have benefited from the self-paced learning tools, feeling more in control of their education, particularly those with learning differences. However, others, especially those lacking quiet study environments, adequate guidance, or accessible content, have found it challenging to stay engaged. As Lichy et al. (2014) suggest, educational platforms are often designed with an 'ideal' student in mind, overlooking the complex realities of many learners' home lives. This oversight is particularly detrimental to students with disabilities, who face additional marginalization when platforms are not designed with accessibility in mind, despite global movements advocating for universal design in education (Alqahtani et al., 2025; UNESCO, 2021). Inclusion in digital education should not be limited to access; it should encompass diverse needs, socio-emotional support, and cultural responsiveness, emphasizing the need for awareness and mindfulness in the educational process.

In critical reflection regarding these findings, it is evident that bridging the digital divide needs a multidimensional approach. Provision of devices or internet access is a needed starting point; however, it is inadequate on its own. The policymakers and educators should consider the broader ecosystem that includes training, pedagogical practices, support, and family engagement. Furthermore, systemic inequities like poverty and geographic remoteness, which intersect with disability, make it essential that the interventions be not just context-sensitive, but also equity-driven. This is not just a recommendation, but a crucial and urgent need (Bulfin & McGraw, 2015).

Future policy must be informed by grounded research and community voices to avoid one-size-fits-all solutions. Investment in rural digital infrastructure, continuous professional development for educators, and inclusive platform design are all critical steps toward equitable digital education. Above all, this study underscores the transformative potential of technology, inspiring hope for a more equitable future. However, it also highlights that this potential can only be realized if technology is implemented in a way that is mindful of its impact on equity.

6. Conclusion

This research has identified four critical themes: Access and Infrastructure, Digital Literacy Disparities, Institutional Support and Policy Implementation, and Student Engagement and Inclusion. The analysis underscores the urgent need to address digital inequities, which are deeply rooted. A significant number of students, particularly those in rural and underserved areas, are grappling with poor internet connectivity and inadequate device access, severely limiting their participation in online learning (Albashayreh et al., 2024). Even when devices are provided, the resources are insufficient, leading to students sharing or forgoing them.

Another significant issue is the uneven distribution of digital literacy. While students may be adept at using social media, they often lack the academic digital skills necessary for platforms like learning portals or file attachments. This gap extends to parents and educators, many of whom lack confidence in navigating educational technologies. This lack of digital literacy hampers their ability to support students at home and disrupts instructional delivery.

Institutional, along with the policy-level, creates hurdles and exacerbates the digital divide. Institutional factors, along with policies, create obstacles that worsen the digital divide. Though centralized guidelines had been issued, schools were left without clear implementation support. Leadership quality, along with district backing, significantly varied; those having strong support effectively adapted, whereas the others lagged. Lastly, the students' experiences

regarding engagement were quite mixed. Some of the learners thrived in self-paced digital environments, particularly those with learning differences. Equally, many of them felt isolated, mainly in the inaccessible platforms that lack features for students with disabilities. Thus, the findings show that technology cannot give equitable education on its own. Effective digital inclusion needs systemic investment in the infrastructure, training, devices, policy support, and an accessible design. While not addressing such interconnected dimensions, mainly in the low-resource settings, the promise regarding digital learning is unfulfilled.

7. Recommendations

Based on the key findings of the study, which highlight unequal internet access, limited devices, and low digital literacy, it is clear that equitable online learning is a significant challenge. However, specific recommendations offer hope for improvement in the long run. The expansion of high-speed internet infrastructure in deprived rural and low-income areas is essential. It is needed to ensure that internet connectivity is affordable and reliable. According to Afzal et al. (2023), the rural connectivity gaps limit educational engagement significantly. Alongside the level of connectivity, schools must work with policymakers to drive equitable device distribution programs, which include loan schemes for devices, collaborations for donation, and subsidized access to tablets or laptops (Ibrahim & Jibia, 2024, Alkayed et al., 2023). This will ensure that all students can learn independently, without reliance on shared or limited resources, thereby offering hope for a more equitable and accessible education system.

The implementation of the inclusive digital literacy training, which targets students, parents, and educators, is equally important. Training must extend beyond recreational usage to the academic platform navigation, sharing of files, and online safety (Alzu'bi et al., 2024; Ahmed, 2024). Schools can host workshops, provide curated online resources, and build home-school partnerships to ensure families learn together, addressing parental digital literacy anxiety while reinforcing learning at home (Qusef et al., 2025; Christanti et al., 2024). Professional development for educators must focus on the effective use of various technological tools, including Zoom, learning management systems, and digital pedagogy, which involves utilizing digital technologies to enhance teaching and learning practices (Cressman, 2024).

Additionally, institutional support should be enhanced through localized execution mechanisms, a responsibility that involves educators, policymakers, educational administrators, and stakeholders engaged in digital education. Action-oriented guidance linked with the policy directives, leadership training, daily district-level check-ins, including the structured school support for ensuring the policy uptake tends to function meaningfully. (Miah, 2024).

Digital platforms should follow the universal design principles, which include screen-reader compatibility, captioning, and adjustable interfaces for overall accessibility. (Khan, 2024). It is important to serve learners with disabilities in diverse learning environments. Lastly, adoption of inclusive teaching strategies, which tend to balance the digital autonomy with structured peer interaction, including teacher interaction, can alleviate isolation and enhance overall engagement for the students familiar with in-person instruction. (Chari, 2024). Such measures that span devices, infrastructure, training, policy execution, accessibility, and pedagogy tend to form an equitable, context-based, and sustainable framework regarding digital education.

7.1 Future Implications

The implications of this study extend across policy, practice, and research. Firstly, the educational policymakers must rethink the technology-centered interventions, not considering them as standalone solutions, but entrenched within extensive frameworks that address equity, capacity, and support. Future policies should pay heed to the systemic infrastructure investment, allocation of resources, and capacity building instead of the ad hoc provisions. Educational technology developers play a vital role in this process because they must integrate universal design from the beginning. This approach ensures that the tools are user-friendly, accessible, and suitable for different cultural and contextual settings. It also influences platform procurement strategies, meaning that governments and schools must assess technologies for inclusivity when adopting them.

Furthermore, future research can be expanded beyond the qualitative accounts to include longitudinal and mixed-method designs, which track the effect of infrastructure and literacy interventions on student outcomes across different settings. Investigation of the role of parental and teacher digital training will be essential to understand the family- and school-level impacts on engagement, including achievement. This study underlines the need for context-sensitive innovation, which includes designing interventions that are not based on idealized student profiles, but on

the realistic environments and restraints. Educators and researchers play a crucial role in this process, and their involvement in future initiatives is necessary to ensure relevance, acceptance, and sustainability.

7.2 Limitations

There are several limitations to consider when interpreting this study.

- The findings are based on qualitative data gathered from a limited number of schools, which restricts the generalizability of the identified themes to broader educational contexts or different countries.
- Additionally, participants' perspectives were primarily collected during the pandemic-driven shift to online learning. This situation may reflect temporary emergency measures rather than long-term systemic behaviors or preparedness.
- Although the study included various stakeholders—students, educators, parents, and administrators—the sample lacked diverse demographic representation, particularly regarding socioeconomic status, disability groups, and cultural contexts. As a result, certain inequalities, such as those faced by learners with disabilities, may not be fully captured.

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38. Appendix
39. Interview questionnaire
40. What is the importance of the digital divide, according to you?
41. How does the unstable connectivity affect the participation of students in online classes regularly?
42. How can device scarcity affect learning in the school or classroom?
43. How confident are the students in terms of using the educational platforms, attaching any files, or navigating the online portals?
44. What issues have you faced among parents while supporting online learning for children?
45. How can instructional quality be improved among teachers regarding the use of technology?
46. How did poor implementation support influence the approach of the school to online learning?
47. What are the specific leadership actions that facilitate successful adaptation?
48. Can you share how the student engagement and inclusion varied, mainly for those having disabilities or learning differences?