

Digital Inclusion in Liberia's Education Sector: Review of Barriers, Policy Gaps, and Strategic Interventions

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Abstract The digital divide remains a significant barrier to equitable education in Liberia, disproportionately impacting students in rural and low-income areas. A comprehensive narrative review was conducted to examine the infrastructural, socio-economic, and policy-related obstacles to digital inclusion in Liberia's education sector. Furthermore, existing interventions, including the Liberia ICT Policy (2019–2024), the Liberia National Development Plan (2025–2029), and various government and private-sector initiatives were also critically examined. The review identified significant barriers to digital inclusion in Liberia's education sector. Key challenges include insufficient funding, lack of sustainability, and weak coordination, worsened by the absence of a national ICT-in-education strategy. Inadequate broadband infrastructure, high internet and device costs, unreliable electricity, and low digital literacy among educators and students further hinder access. Socio-cultural factors, including gender disparities and inadequate teacher training, also contribute to digital exclusion. This study contributes to the body of knowledge by adopting a holistic approach that integrates socio-economic and cultural dimensions, offering a more comprehensive analysis of digital inequalities in Liberia's education sector. Addressing these systemic barriers requires a multi-faceted strategy emphasizing infrastructure expansion, affordable internet access, teacher training, and gender-sensitive digital policies. Strengthening public-private partnerships and developing and implementing a national ICT-in-education framework are crucial for fostering digital literacy, enhancing learning outcomes, and promoting socio-economic mobility. By prioritizing these efforts, Liberia can narrow the digital divide and ensure that all students, regardless of their geographic or economic background, have access to quality digital education.

Keywords: Digital divide, ICT policy, Liberia, educational equity, digital literacy, public-private partnerships, digital inclusion

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1. Introduction

The digital divide is a critical challenge that perpetuates educational inequality, especially in developing countries like Liberia, where it limits students' access to essential learning tools and opportunities. Defined as the gap between those who have access to digital technologies and the internet and those who do not [1], is a significant barrier to achieving educational equity, especially in developing countries like Liberia. Digital technologies play a crucial role in developing problem-solving, critical thinking, and process comprehension skills essential for future careers. Additionally, artificial intelligence and automation can help bridge the digital divide in developing nations by improving access to key services and addressing infrastructure, skills, and policy gaps [2,3]. Without access to these technologies, students are at a disadvantage, making it harder for them to prepare for a future where technology plays a dominant role in professional environments. This gap, therefore, not only hinders educational outcomes but also limits the socio-

economic advancement of students in digitally underserved areas.

Research highlights that the consequences of this divide are far-reaching, influencing both academic performance and long-term socio-economic mobility [4]. As digital tools are increasingly integrated into education globally, the urgency of addressing the digital divide becomes even more pressing. For Liberia, a country struggling with socio-economic challenges, poor infrastructure, and limited resources, bridging the digital divide is not simply a matter of technological progress but an essential component of achieving equity and social justice in education [5,6,7].

Despite some progress made by the government and international organizations to address these challenges, many students, especially those in rural regions, remain excluded from the benefits of digital learning. Studies have underscored several factors that contribute to this divide, including poor internet connectivity, a lack of affordable devices, and insufficient teacher training in digital technologies [8,9]. Moreover, the absence of a

comprehensive national policy for integrating ICT into education further hinders progress, particularly in terms of uniformity and scalability of digital inclusion efforts [10,11].

Research on digital inclusion in education emphasizes that bridging the digital divide goes beyond providing devices or connectivity. It also involves fostering digital literacy, addressing sociocultural barriers, and enhancing teachers' digital skills [12,13,14]. These efforts are crucial for ensuring that digital tools are effectively integrated into the classroom and for maximizing the educational potential of technology. The gendered nature of the digital divide, where women and girls are disproportionately affected by limited access to technology, adds another layer of complexity, necessitating gender-sensitive strategies to ensure equitable access [15]. Addressing these key areas will ensure that technology is used to its full potential, enhancing both the learning experience and educational outcomes. This review critically assessed the key barriers to digital inclusion within Liberia's education system, evaluated the effectiveness of existing policies and interventions, and proposed actionable recommendations for overcoming these obstacles. The objective was to identify practical solutions that can help narrow the digital divide gap, ensuring that all students in Liberia, regardless of geographic location or socio-economic status, can access quality digital education.

2. Methodology

This study employed a narrative literature review to examine the barriers, policy gaps, and strategic interventions related to digital inclusion in Liberia's education system. This approach was chosen due to its flexibility in synthesizing diverse sources, enabling a comprehensive analysis of infrastructural, socio-economic, and policy-related challenges. Unlike a systematic review, which follows a strict inclusion and exclusion framework, a narrative review allows for a broader exploration of academic literature [16]. This method ensured a holistic understanding of Liberia's digital divide by integrating perspectives from multiple sources and contextualizing findings within the country's specific challenges.

To ensure a thorough and well-rounded review, literature was sourced from peer-reviewed journals, policy documents, international reports, and reputable news sources covering the period 2013–2025. The selection process involved targeted searches using academic databases such as Google Scholar, ResearchGate, Springer, Elsevier, and Taylor & Francis, focusing on digital education, ICT policies, and socio-economic barriers. Additionally, government repositories such as the Ministry of Education Liberia, Ministry of Posts and Telecommunications, and Ministry of Finance and Development Planning were consulted for official policy documents, while reports from UNESCO, the World Bank, and the United Nations provided insights into broader digital inclusion initiatives. To refine search results, Boolean operators (AND, OR) were employed, combining keywords such as "Digital Divide" AND "Liberia" AND "Education", and "ICT policy" AND "Liberia" AND "challenges" to enhance the precision of relevant findings. [17] highlight the importance of

refining Boolean queries to enhance the accuracy and efficiency of reviews by improving study identification while reducing irrelevant results.

The information collected was analyzed using thematic analysis, identifying and categorizing recurring themes such as infrastructural challenges, socio-economic disparities, ICT policies, digital literacy, and gender-related barriers to digital access. This method allowed for a contextual evaluation of Liberia's ICT policies and educational strategies, highlighting both progress and persistent obstacles. By synthesizing insights from multiple sources, this review provides a critical and evidence-based assessment of digital inclusion efforts, offering well-informed recommendations to enhance ICT accessibility and promote educational equity in Liberia. The narrative review approach was particularly valuable in accommodating diverse data sources and enabling an in-depth interpretative analysis.

3. Barriers to Digital Inclusion in Liberia's Education System

Liberia's education system is beset by several barriers to digital inclusion, many of which are deeply interwoven with the country's socio-economic and infrastructural challenges. These barriers can be grouped into four broad categories: infrastructural challenges, socio-economic disparities, access to digital devices, and socio-cultural factors.

3.1. Infrastructural Barriers

One of the most significant barriers to digital inclusion in Liberia is its underdeveloped ICT infrastructure, which severely limits both access to and the effective use of digital educational resources. [18] points out the digital challenges faced by least-developed countries, emphasizing barriers such as poor infrastructure, high costs, and low digital literacy.

Internet penetration remains low, with only 30.13% of the population having Internet access in 2022 [19], a figure that highlights the substantial digital divide between urban and rural areas. Rural regions face significant challenges, as broadband access is scarce, making it difficult for students and educators to engage with online educational content. Although there were efforts outlined in the Government of Liberia's ICT policy (2019) to expand broadband access across the country, infrastructure limitations and geographic challenges continue to impede progress in reaching remote areas. [20] highlight several obstacles exacerbating the digital divide in rural school libraries in Zimbabwe, such as insufficient ICT infrastructure, prohibitive costs, low digital literacy levels, inadequate governmental backing, economic inequalities, and sociocultural constraints. In addition to the lack of internet access, unreliable power supply exacerbates the digital divide. Power outages, particularly in rural areas, disrupt the use of digital learning tools, making it challenging for students and educators to depend on technology for education. The absence of affordable and stable electricity further compounds the issue, preventing the consistent use of ICT resources

[5,21]. As [7] points out, the erratic power supply has hindered the establishment of sustainable ICT infrastructure in universities and even in areas that have received some technological support.

While urban schools, especially in Monrovia, have made some progress in integrating ICT facilities into their educational systems, access to modern ICT resources remains inconsistent across the country. [22] notes that several schools in urban areas have been equipped with computer labs and internet access, largely supported by government and international aid. However, many rural schools continue to lack these essential resources, underscoring the stark contrast in digital access between urban and rural areas.

Moreover, while some educational institutions have adopted digital tools, the integration of ICT in teaching and learning remains in its early stages. As highlighted by [7], the lack of trained faculty proficient in digital pedagogy, combined with low levels of technological literacy among students, limits the effective use of ICT resources in the classroom. Although urban schools have made strides in integrating ICT, challenges related to maintenance, consistency, and effective utilization persist, further hindering the potential of these resources.

Despite some improvements in mobile connectivity, Liberia's Internet infrastructure remains insufficient to support widespread digital access. In early 2023, there were 1.80 million internet users, representing 33.6% of the population, [23], and mobile phone penetration was relatively high, with 1.65 million mobile subscribers in 2021 [19]. However, mobile network coverage reached only 60% of the population as of 2016, highlighting the disparity in access between urban and rural regions. The country's internet bandwidth, which stood at just 6.31 kilobits per second in 2016, remains inadequate for efficient digital connectivity [19].

Despite an increase in mobile connectivity, with 4.77 million active cellular connections in early 2024, representing 87.1% of the population [24], internet access continues to be hindered by slow speeds and low-quality service. This is reflected in the drop in the number of internet users to 1.65 million by early 2024 [24], indicating persistent barriers to access despite some improvements in mobile network infrastructure. These infrastructure gaps, including limited bandwidth and inconsistent service quality, contribute to Liberia's ongoing digital divide, impeding the country's progress in digital education, economic development, and equitable access to online services.

To address these barriers, Liberia must invest significantly in both telecommunications and energy infrastructure. This would involve expanding broadband access to rural areas, improving the reliability of the power supply, and increasing the availability of digital resources in schools. Without these critical improvements, Liberia will continue to face significant challenges in bridging the digital divide and ensuring that all students have equal access to the opportunities offered by digital technologies.

3.2. Socio-Economic Disparities

Socioeconomic disparities in Liberia significantly

contribute to the digital divide in education, particularly about internet access and the affordability of digital devices. A major obstacle for many households, especially in rural areas, is the prohibitively high cost of Internet service. According to [25], the cost of mobile data and broadband remains a significant barrier, limiting students' ability to engage with online learning platforms. This issue is compounded by low-income families, who often struggle to afford not only the cost of high-speed internet but also basic mobile data services. [1] highlight the phenomenon of the "homework gap," where students without reliable internet access are left behind and unable to complete assignments or participate in digital learning opportunities. The financial burden associated with digital access perpetuates educational inequality, especially during periods when digital learning is critical.

In addition to the high cost of internet access, the affordability and availability of digital devices pose another major challenge. Many students in Liberia lack personal computers or smartphones, which are essential tools for engaging with digital content. While some schools may offer limited access to computer labs, these resources are often outdated, insufficient, or poorly maintained. As noted by [26], the ability of students to engage with digital curricula is highly contingent on the availability of affordable devices. In many cases, schools' provision of ICT resources is inadequate, especially in rural settings where infrastructure is already limited.

The issue of device affordability is further exacerbated by the cost of maintenance and the limited lifespan of existing devices. [22] suggests that even when some schools manage to procure computers or other digital learning tools, a lack of technical support and ongoing maintenance hampers their effectiveness. This means that despite some schools having access to ICT resources, these tools are often underused or ineffective due to poor maintenance, further deepening the digital divide.

Furthermore, the socio-economic gap in Liberia is not just a matter of access to hardware and connectivity but also extends to the quality of digital content and training available to students and educators. Many students in low-income households have limited exposure to digital literacy programs, which impacts their ability to navigate and benefit from digital learning platforms. [4] emphasizes the need for digital literacy initiatives to address the socioeconomic factors that impede access to technology, particularly in low-income communities. Without such support, students in these communities are at a further disadvantage, unable to make full use of the limited digital resources available to them. [11] and [27] found disparities persist due to inadequate infrastructure, socio-economic inequalities, digital literacy gaps, and inconsistent policy implementation, highlighting the urgent need for targeted interventions to bridge the digital divide and promote educational equity.

Narrowing this divide will require targeted efforts to reduce the cost of internet services, increase the availability of affordable devices, and enhance digital literacy initiatives, particularly in rural and underserved communities. Without addressing these socio-economic challenges, Liberia's education system will continue to struggle to provide equitable digital opportunities for all students.

3.3. Access to Digital Devices

Access to digital devices represents a significant barrier to digital inclusion in Liberia, particularly within the education system. A key challenge is the limited availability of personal computers, laptops, and tablets for students and educators. The lack of affordable devices, compounded by the relatively small digital market in Liberia, makes it difficult for many families to purchase the necessary tools for digital learning [6,4]. This issue is further exacerbated by high costs and low device availability, which hinder the widespread adoption of technology, particularly in rural areas where economic constraints are more pronounced [1,28].

Even in schools where devices are available, many teachers face difficulties in using them effectively due to insufficient training and technical support. Bridging the digital divide in education requires comprehensive teacher training, structured instructional strategies, and a digital literacy-focused curriculum to effectively integrate technology and enhance student learning [9,29]. Without appropriate training, the potential of available devices remains underutilized, limiting their impact on students' learning outcomes.

Moreover, while some schools in urban areas have been able to procure basic ICT infrastructure, including computer labs and internet access, these resources are not uniformly distributed across the country [7]. Rural schools face a stark lack of access to such resources, further deepening the divide between urban and rural educational opportunities [21]. Thus, the availability of digital devices in Liberia's schools is not only restricted by cost and accessibility issues but also by the insufficient support systems necessary for effective utilization.

It is essential to improve both the affordability and availability of digital devices while also ensuring that teachers receive the necessary training to integrate these tools into their teaching practices effectively. Only through these measures can Liberia begin to leverage the full potential of digital education and ensure equitable access to the benefits of digital technologies for all students.

3.4. Socio-Cultural Factors

In Liberia, socio-cultural factors, particularly gender disparities, significantly contribute to the digital divide. Cultural norms and societal expectations often restrict women's access to digital education and technology. As [15] highlight, in many developing countries, including Liberia, the digital gender gap is exacerbated by cultural attitudes that discourage women from pursuing technology-related fields. In Liberia, girls are often less likely to have access to digital devices or the internet, which limits their educational opportunities. This is compounded by gender biases and societal views that confine women to traditional roles, which, in turn, reduce their participation in ICT-related activities [2,15]. These socio-cultural constraints not only restrict women's ability to access digital education but also marginalize them from the broader benefits of technological advancement.

Additionally, the absence of gender-sensitive policies in Liberia further limits the opportunities for women and girls to engage with technology. [26] emphasizes that

overcoming these sociocultural barriers requires more than just providing access to digital tools. It involves creating supportive environments where women and girls can thrive in the digital space. This includes addressing the unique challenges they face in accessing and using technology, which range from limited access to digital devices and internet connectivity to a lack of encouragement and support from family and community structures.

Liberia must focus on developing gender-sensitive policies that provide equal access to digital education and encourage the participation of women and girls in ICT fields. These efforts should be complemented by community awareness programs to challenge traditional gender norms and promote digital literacy among women and girls. Only through these concerted efforts can Liberia ensure that its digital landscape is inclusive, empowering all segments of society, particularly women, to benefit from the opportunities offered by digital technologies.

4. Policy and Other Interventions

Liberia has made significant strides in addressing the digital divide through various policy and partnership initiatives, most notably with the Liberia ICT Policy (2019-2024) and the Liberia National Development Plan (2025-2029). These policies highlight the crucial role of ICT by focusing on expanding broadband, increasing access to digital devices, and promoting digital literacy. Their broader goal is to ensure inclusive and equitable access to education, particularly in rural and underserved areas [30,31]. However, the success of this policy will depend largely on its effective implementation and the availability of adequate resources.

While the current ICT policy provides a national framework, it is not specifically designed for education, even though it includes some provisions for the sector. To date, Liberia has yet to develop a comprehensive ICT in education policy that clearly defines how ICT should be integrated into the education system [9]. Such a policy would need to address key challenges, including infrastructure gaps, capacity building, socioeconomic disparities, and limited access to digital devices.

4.1. The Liberia ICT Policy (2019-2024)

The Liberia ICT Policy (2019-2024) sets out a strategic framework to bridge the digital divide and foster socio-economic development through ICT. The policy emphasizes inclusivity by targeting marginalized groups, including women and youth, to ensure universal access to digital technologies [30]. Key objectives outlined in the policy include expanding broadband access across all counties, reducing the cost of internet services, and developing local digital content for educational purposes. These initiatives aim to enhance access to digital education, improve the digital literacy of citizens, and prepare Liberia's youth for the digital economy [5].

While the policy's inclusivity focus is a notable strength, there are significant challenges related to its implementation. The reliance on public-private partnerships to expand infrastructure and digital services

requires effective collaboration between the government, private telecom companies, and educational institutions [25]. However, without clear accountability mechanisms, these partnerships may not deliver the desired results, leaving critical gaps in infrastructure, particularly in rural areas. Additionally, while the policy addresses infrastructure development, it does not sufficiently tackle the economic barriers to access, such as the high cost of digital devices, which continue to impede equitable access to digital learning [5,4].

The Liberia ICT Policy also emphasizes the development of local digital content and e-services, along with cybersecurity and the promotion of ICT innovation. It aims to foster a knowledge-based society by improving the quality of education through ICT integration, enhancing teaching methodologies, and increasing access to educational resources. As part of this effort, the policy outlines the establishment of a National Education and Research Network (NREN) to connect educational institutions and promote digital literacy campaigns targeted at students and educators [30].

Furthermore, the policy encourages collaboration between the public and private sectors to strengthen ICT education, vocational training, and digital skills development, thereby contributing to a more inclusive and digitally capable society [30]. [2] and [26] underscore the importance of multi-sector collaboration in bridging the digital divide. They assert that effective partnerships between government, educational institutions, the private sector, and NGOs are vital for improving ICT access, advancing digital literacy, and ensuring that marginalized groups, such as women and rural communities, gain access to digital education and skills training, thereby promoting a more inclusive and digitally proficient society.

However, the policy's success will depend on overcoming these implementation barriers. While broadband expansion and infrastructure improvements are critical, the affordability of digital devices and services must be prioritized to ensure that all students, particularly those from economically disadvantaged backgrounds, can fully participate in digital education. This requires not only infrastructure investment but also targeted subsidies or support for students and teachers to access necessary technology [6,8]. Additionally, policies that address the socio-cultural factors limiting women's participation in ICT must be integrated to ensure that gender disparities in digital education are reduced [15].

While Liberia's ICT policy provides a comprehensive roadmap for bridging the digital divide, its success hinges on addressing both infrastructural and socio-economic challenges. By fostering partnerships, improving affordability, and integrating gender-sensitive strategies, Liberia can create an inclusive digital education ecosystem that provides equal opportunities for all citizens.

4.2. The Liberia National Development Plan (2025–2029)

The Liberia National Development Plan (2025–2029) presents a strategic vision for enhancing digital inclusion in education through broadband expansion, digital literacy programs, and public-private partnerships (PPPs) to improve ICT access [31]. The policy underscores the role

of ICT in transforming education, outlining initiatives such as mobile broadband expansion, fiber-optic deployment, and digital training programs aimed at equipping young people with technological skills [31]. However, despite these ambitious goals, the plan lacks a clear implementation framework, making it challenging to ensure the equitable distribution of ICT resources, particularly in rural areas. Additionally, while PPP-driven investments are encouraged, there are no specific accountability mechanisms to prevent these initiatives from benefiting urban areas disproportionately, thereby risking further exclusion of marginalized communities.

The policy further acknowledges that as of 2023, internet penetration in Liberia stood at approximately 25%, with mobile broadband coverage reaching only 30% of the population, exposing the digital divide between urban and rural areas. While the ACE cable system has improved international connectivity, fixed broadband subscriptions remain critically low at just 2.5%, and competition among service providers has not resulted in significant cost reductions for consumers [31]. This suggests that while efforts to expand digital infrastructure are underway, affordability remains a major challenge, particularly for students and educators who rely on digital access for learning. However, the policy does not introduce concrete affordability measures, such as subsidies for digital devices or reduced internet costs for educational institutions, despite recognizing high costs as a significant barrier to digital education. This omission raises concerns about the policy's ability to translate its vision for digital inclusion into practical and equitable solutions.

Moreover, the policy prioritizes digital literacy as a key pillar of education reform but lacks a structured approach to integrating ICT into the national curriculum, which could lead to fragmented and inconsistent adoption of digital education across schools. This gap is particularly concerning given the limited digital competency among educators, a challenge that remains unaddressed in terms of large-scale teacher training initiatives. While the Liberia National Development Plan (2025–2029) sets a broad vision for digital transformation in education, its lack of concrete implementation strategies, affordability measures, and structured accountability mechanisms undermines its effectiveness. Although the policy's emphasis on ICT expansion and digital literacy is commendable, it requires a more targeted, well-funded, and inclusive approach to bridge the digital divide. To achieve equitable digital inclusion, Liberia must develop a dedicated ICT-in-education policy that includes affordable access to digital resources, structured teacher training programs, and gender-sensitive interventions. Without these critical elements, the policy may fail to achieve its intended impact, potentially deepening rather than narrowing Liberia's digital divide.

4.3. Other Interventions and Initiatives

Bridging the digital divide in Liberia's education system requires a comprehensive approach to enhance youth access to ICT tools and training. The government has outlined plans to expand ICT centers nationwide, collaborating with key agencies to train five hundred thousand youths in digital skills over the next three years,

building on the successful training of ten thousand youths by 2024 [32].

In addition to government initiatives, several international organizations and NGOs have launched programs aimed at bridging the digital divide in Liberia's education system. These initiatives typically focus on providing digital devices to schools, offering digital literacy training for students and teachers, and improving internet access in rural areas. Organizations such as the United Nations and the World Bank have supported these efforts, complementing government strategies. However, these interventions face significant challenges, including limited funding, sustainability concerns, and a lack of coordination with government efforts. As a result, many of these initiatives remain localized and disconnected from the broader national educational framework, which diminishes their overall impact.

To address these challenges, public-private partnerships (PPPs) have been proposed as a viable solution. The Liberia ICT policy (2019-2024) encourages collaboration between the government, private sector companies, and international donors to enhance internet infrastructure, provide digital devices, and offer affordable internet services, especially in underserved areas [31]. However, PPPs have faced hurdles such as unclear policy frameworks and insufficient incentives for private companies to invest in rural regions. These issues complicate the equitable distribution of benefits, limiting the effectiveness of these partnerships in reaching the most underserved communities [25].

Despite these challenges, initiatives such as the UNESCO-China initiative, Harnessing Technology for Quality Teacher Training in Africa, along with the Enhancing Teacher Education Project through ICT Pedagogy, have significantly contributed to digital inclusion in Liberia's education sector. These efforts focus on strengthening Teacher Training Institutes by integrating ICT infrastructure, enhancing educators' digital skills, and promoting ICT-based education policies. By doing so, these initiatives aim to reform the education system and foster socio-economic progress in the country [33,34].

The "Enhancing Liberia Teacher Education Program through ICT Pedagogy" targets teacher-educators, pre-service teachers, and in-service teachers across four major Teacher Training Institutes: Zorzor Rural Teacher Training Institute (ZRTTI), Webbo Rural Teacher Training Institute, Kakata Rural Teacher Training Institute (KRTTI), and the W.V.S. Tubman Teacher College at the University of Liberia. This project, in collaboration with key education and development partners like UNESCO, the EU, USAID, the World Bank, and UNICEF, aims to expand the capacity of Liberia's educational system to integrate ICT-based teaching and learning [35]. Through these partnerships, the project seeks to enhance teacher training, improve ICT access, and contribute to the development of a knowledge-driven society.

Bridging the digital divide in Liberia's education system requires coordinated efforts at multiple levels, including government initiatives, international support, and public-private partnerships. While significant progress has been made in providing ICT infrastructure and training, challenges related to funding, sustainability, and coordination persist. Properly structured public-private

partnerships have the potential to address these challenges by ensuring equitable access to digital resources, particularly in rural areas. By aligning efforts across various sectors and investing in the ICT skills of both educators and students, Liberia can develop a more inclusive, digitally proficient society, positioning itself to thrive in the global economy.

5. Discussion

A combination of governmental policies and international interventions shapes Liberia's attempts to bridge the digital divide in its education system. While these efforts have made some progress, several persistent challenges undermine their effectiveness. These challenges include inadequate infrastructure, high economic barriers, limited digital literacy, gender disparities, and the inefficiencies of public-private partnerships (PPPs). Although the government's ICT policy and various external initiatives present promising frameworks, they must more comprehensively address these challenges to fully realize the potential of ICT integration in Liberia's education system.

One of the most significant barriers to closing the digital divide is the lack of adequate ICT infrastructure, particularly in rural areas. In many parts of Liberia, schools lack reliable internet access and sufficient digital devices, severely limiting opportunities for teaching and learning. As [9] argues, while improving infrastructure is crucial, it is insufficient in isolation. The high cost of Internet services and digital devices also poses a significant economic barrier. For many families, especially in rural communities, access remains unaffordable [5]. Thus, efforts to expand ICT infrastructure must be accompanied by strategies that reduce the cost of digital tools and internet access, ensuring affordability for all segments of society.

In addition to infrastructure, the lack of digital literacy among both students and educators further exacerbates the divide. [7] asserts that without adequate training, digital tools cannot be effectively integrated into the educational process. Liberia's ICT policy, while focusing heavily on infrastructure, has insufficiently prioritized the development of digital literacy programs. As [13] note, digital literacy programs are essential for empowering educators and students to utilize technology effectively in the classroom. However, Liberia has yet to implement comprehensive programs that equip educators with the necessary skills to incorporate ICT into their teaching practices.

Gender disparities also present a significant socio-cultural challenge to bridge the digital divide. Cultural norms in many developing countries, including Liberia, often discourage girls and women from pursuing careers or education in technology [15]. Despite the mention of gender inclusivity in the ICT policy, there has been little concrete action to ensure that women and girls benefit equally from digital education initiatives. [36] advocate for developing nations to adopt supportive policies, enhance infrastructure, promote sustainable technological advancements, and improve market accessibility to establish a secure and competitive cloud services sector. Similarly, [2] highlight the importance of moving beyond broad inclusivity by implementing targeted policies that

address the unique barriers women and girls face in digital education. Integrating targeted digital policies with inclusive technological advancements is vital for ensuring equitable access, while a gender-sensitive approach is crucial to preventing the exclusion of women in Liberia's ICT integration efforts.

Public-private partnerships (PPPs) are often touted as a solution to address infrastructure and affordability challenges. The Liberia ICT policy (2019-2024) and the Liberia National Development Plan (2025-2029) encourage collaboration between the government, private companies, and international donors to expand digital access. However, PPPs have faced significant challenges, particularly in ensuring equitable access to ICT resources in rural areas. As [25] points out, private companies often prioritize urban centers where the profit potential is higher, resulting in the concentration of digital resources in these areas. [4] argues that stronger regulatory frameworks are needed to ensure PPPs effectively address the needs of underserved communities, particularly those in rural areas. These regulations should incentivize private companies to invest in less profitable areas, promoting a more equitable distribution of digital resources.

International organizations and NGOs have also played a critical role in addressing the digital divide in Liberia's education system. Many of these initiatives focus on providing digital devices, improving internet access, and offering digital literacy training [5]. Although support from organizations such as the United Nations and the World Bank has been valuable, these interventions often suffer from limited funding, lack of sustainability, and fragmented coordination with national efforts. The piecemeal nature of these initiatives often results in a lack of alignment with Liberia's broader educational strategy, preventing their widespread impact. Moreover, many of these programs are concentrated in urban areas, further exacerbating the disparity between urban and rural schools.

One of the most promising interventions is the UNESCO-funded Enhancing Teacher Education Project through ICT Pedagogy, which aims to provide ICT infrastructure and training for teacher educators. The first phase of the project successfully trained 78 teachers in the use of digital tools such as PowerPoint and Excel to enhance teaching and assessment. The second phase focuses on improving teachers' digital pedagogical skills, aligning with Liberia's ICT education policy [34]. However, as [7] notes, despite some progress in universities, many teachers still lack the necessary digital skills to fully integrate technology into their teaching practices. Consequently, the impact of ICT initiatives remains limited.

To effectively bridge the digital divide in Liberia's education system, a multi-faceted approach is required. This approach must address infrastructural, economic, socio-cultural, and capacity-building challenges. The [37] report underscores the ongoing digital gap between urban and rural areas in G20 nations, calling for policies that enhance competition, boost infrastructure investment, foster public-private partnerships, and implement funding strategies to ensure fair broadband access for economic and social growth. While the government's ICT policy, development plan, international interventions, and PPPs offer promising frameworks, they must be complemented by targeted initiatives that focus on affordability, digital

literacy, and gender inclusivity. The government must ensure that PPPs are properly regulated to ensure equitable access to digital resources, particularly in rural areas. Additionally, comprehensive teacher training programs and the formulation and adoption of a comprehensive ICT in education policy are essential for enhancing educators' digital pedagogical skills and reducing the digital divide in Liberia. By aligning efforts across various sectors and prioritizing inclusivity, Liberia can make meaningful strides toward bridging the digital divide and fully realizing the potential of ICT in education.

6. Conclusion

Addressing the digital divide in Liberia's education system requires a comprehensive and coordinated approach to overcome key obstacles, such as inadequate infrastructure, socio-economic inequalities, limited access to digital devices, and socio-cultural barriers. Despite efforts like the Liberia ICT Policy (2019-2024), which aims to improve broadband access and digital literacy, challenges remain, particularly in rural areas where infrastructure and affordability issues persist. For the policy to be successful, collaboration among government agencies, international organizations, private companies, and local communities is essential.

Liberia must adopt a more holistic strategy that not only increases access to technology but also addresses socio-economic disparities by focusing on digital literacy for both students and educators. Gender-sensitive policies are also necessary to ensure that women and girls have equal access to digital education. Public-private partnerships can play a significant role in expanding the infrastructure and providing affordable devices, but they must be carefully structured with clear accountability mechanisms to ensure equitable resource distribution.

Furthermore, Liberia must develop a clear and comprehensive ICT in education policy that integrates technology across all levels of the education system, addressing infrastructure, teacher training, digital content creation, and access to affordable devices. A well-funded, robust policy will ensure that digital inclusion becomes a central focus of the education system, overcoming the fragmented implementation currently seen.

Ultimately, bridging the digital divide in Liberia's education system requires ongoing collaboration from all sectors. By focusing on infrastructure, reducing costs, enhancing digital literacy, and implementing inclusive policies, Liberia can create an equitable education system that equips its youth with the skills necessary to thrive in the digital economy and contribute to long-term socio-economic development.

Recommendations

Development of Clear and Comprehensive ICT in Education Policy

The government must develop a clear, comprehensive ICT in education policy. This policy should outline a detailed strategy for integrating technology into the education sector, addressing key areas such as

infrastructure, teacher training, digital content, and access to devices. A robust policy would provide the necessary guidance and funding mechanisms, ensuring that digital inclusion is prioritized at all levels of the education system. This approach will help to overcome the current challenges of fragmented efforts and slow implementation, fostering a more equitable and effective digital education environment across Liberia.

Infrastructure Development

The government should prioritize the expansion of broadband infrastructure in underserved regions, particularly rural areas, to ensure that all students and educators have access to the Internet. Partnerships with private telecom companies should be leveraged to subsidize costs for educational institutions and low-income families.

Addressing Socio-Economic Barriers

Efforts should be made to reduce the cost of internet access and digital devices, perhaps through subsidies or the provision of low-cost devices for students. Public-private partnerships should be structured to ensure that digital education is affordable for all.

Gender-Sensitive Programs

Targeted initiatives for girls and women should be developed to encourage their participation in digital education. Gender-sensitive curricula, mentorship programs, and digital literacy training should be integrated into national educational strategies.

Teacher Professional Development

Continuous teacher training programs are essential to ensure that educators are equipped to effectively integrate ICT into their teaching practices. These programs should focus not only on technical skills but also on pedagogical strategies for using digital tools to enhance learning outcomes.

Strengthening Public-Private Partnerships

The government should create clear and robust frameworks for public-private partnerships, ensuring that these collaborations contribute to the equitable distribution of digital resources and infrastructure across the country.

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