



Assessment of Information and Communication Technology Integration on Girl-Child Education in Nigeria

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Abstract

Information and Communication Technology (ICT) has emerged as a transformative tool for enhancing educational access, participation, and outcomes, particularly for marginalized groups such as girls in developing countries. This study assessed the integration of Information and Communication Technology in girl-child education in Nigeria, with a focus on Lagos State and comparative insights from other states. Employing a cross-sectional survey design, data were collected from 1,200 respondents, including female students, teachers, and ICT coordinators. Descriptive statistics, t-tests, ANOVA, and multiple regression analyses were conducted to assess relationships between ICT access, frequency of use, teacher ICT competency, and educational outcomes. Results indicate that Lagos State exhibits the highest levels of ICT access (85%), weekly usage (78%), and teacher competency (70%), which collectively contribute to superior student participation scores and academic performance. Regression analyses revealed that ICT access ($\beta = 0.41, p < 0.001$) and teacher competency ($\beta = 0.27, p < 0.001$) significantly predict girls' educational participation, while frequent ICT use is associated with higher academic performance ($p < 0.001$). Regional disparities were also observed, with northern states reporting lower access and participation, highlighting the persistence of the digital divide. The findings underscore the importance of comprehensive ICT integration strategies, including infrastructure development, teacher training, and flexible e-learning platforms, to enhance equitable access and empower girls. Lagos State serves as a model for implementing scalable ICT interventions to reduce gender gaps in education. The study contributes to policy discourse on leveraging ICT for human capital development and provides evidence-based recommendations for enhancing girl-child education in Nigeria.

Keywords: ICT, girl-child education, Lagos State, educational participation, digital divide, teacher competency

Introduction

Education is widely recognized by Nigerian scholars and policymakers as a central driver of social transformation, economic development, and human empowerment. Yet, despite policy efforts and incremental gains in enrollment, gender disparities persist, limiting girls' participation and retention in formal education. Studies in Nigeria show that unequal educational opportunities materially undermine human capital development and constrain national growth prospects. For instance, Ngwoke (2020) demonstrates that restricted access to schooling for girls not only hinders individual socio-economic mobility but reinforces broader patterns of marginalization, illustrating how educational inequality perpetuates social and economic inequities. Similarly, data from the Universal Basic Education Commission (UBEC, 2025) indicate that girls constitute approximately 60 % of Nigeria's 17 million out-of-school children, highlighting how gender intersects with broader systemic and socio-economic barriers to educational inclusion. Structural factors such as poverty, early marriage, and limited school infrastructure disproportionately disadvantage girls, particularly in rural and underserved areas (Williams, Istifanus & Ajufo, 2017). Beyond national patterns, research across sub-Saharan Africa underscores how cultural norms, infrastructural deficits, and socio-economic inequalities exacerbate the gender digital divide. Adolescent girls are less likely than boys to possess digital literacy skills or access ICT tools for learning, resulting in compounded disadvantages in both academic achievement and skill development (UNICEF, 2020). Evidence also suggests that the gender digital divide is not solely a technological issue: social norms, confidence, motivation, and institutional support critically shape girls' engagement with ICT. These patterns indicate that interventions limited to device provision or



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infrastructure expansion are insufficient without accompanying strategies to foster equitable digital participation. In this context, Information and Communication Technology (ICT) emerges as a potential catalyst to address both educational and digital inequities. Digital platforms, online learning systems, and mobile applications can overcome geographic and temporal constraints, offering flexible, learner-centered pathways. Studies show that ICT integration enhances instructional quality, fosters skill acquisition, and improves access to educational resources for marginalized groups (UNESCO, 2025; Oladele, 2025). In Nigeria, research highlights that ICT-based learning can support girls' educational continuity and promote digital literacy, particularly when combined with teacher training, gender-sensitive pedagogy, and supportive learning environments (Remi-Aworemi, 2023; AREAi, 2025). Despite these promising developments, significant gaps remain. While Lagos State exemplifies successful ICT integration, evidence on the mechanisms through which ICT influences girl-child education across diverse Nigerian contexts is limited. Furthermore, few studies systematically examine the interplay between ICT access, usage patterns, teacher competency, and educational outcomes for girls, leaving policymakers without empirical guidance to scale effective interventions nationally. This study addresses these gaps by examining the role of ICT in promoting girl-child education in Lagos State and comparing outcomes across other Nigerian states. By linking ICT access, frequency of use, and teacher competency to educational participation, skill development, and academic achievement, the research provides evidence-based insights for policy and practice. The study contributes to both theory by testing Human Capital Theory and the Digital Divide Framework in a Nigerian context and practice, by identifying scalable ICT strategies to reduce gender disparities in education.

Objectives of the Study

To investigate how ICT influences girl-child education in Lagos State and across Nigeria, focusing on access, utilization, skill development, and learning outcomes.

1. To assess the effect of ICT access on educational participation among female secondary school students.
2. To determine the relationship between frequency of ICT use and academic performance of female students.
3. To examine the impact of teacher ICT competency on girls' engagement in ICT-based learning.
4. To analyze regional variations in ICT access, usage, and educational outcomes, with Lagos State as a case study.
5. To provide evidence-based recommendations for policy and practice to promote equitable girl-child education.

Research Hypotheses

H₀₁: ICT access has a significant positive effect on educational participation among female students in Nigeria.

H₀₂: Frequency of ICT use is positively associated with academic performance of female students.

H₀₃: Significant differences exist in ICT access, ICT usage, and educational outcomes across Nigerian states.

Literature Review

Theoretical and conceptual framework

Theoretical foundation

This study is anchored in Human Capital Theory and the Digital Divide Framework, providing a dual lens for understanding the impact of ICT on girl-child education in Nigeria. Human Capital Theory asserts that investments in education enhance individual productivity, generate economic returns, and contribute to national development (Becker, 1993). In the Nigerian context, research shows that educating girls produces intergenerational benefits, including improved household welfare, better child health outcomes, and increased economic participation (Ngwoke, 2020; UBEC, 2025). Girls' education not only equips them with skills necessary for the labor market but also strengthens community development by fostering informed decision-making and civic engagement. The Digital Divide Framework examines disparities in access to and use of technology among different social groups. In Nigeria, gender-based digital exclusion remains a major barrier, with girls often having less access to computers, smartphones, and internet connectivity, particularly in rural areas (Williams, Istifanus, & Ajufo, 2017; UNESCO, 2021). Such inequities can reinforce existing educational disparities, limiting girls' participation in digital learning opportunities and skill acquisition. Integrating ICT into girl-child education, therefore, requires addressing both access gaps (availability of devices and connectivity) and capability gaps (digital literacy and supportive learning environments), ensuring equitable opportunities for all learners (UNICEF, 2020).

Conceptual Framework

The conceptual framework of this study illustrates the hypothesized pathway through which ICT contributes to girl-child education and empowerment:



Figure 1: Conceptual Model Showing the Relationship between ICT Access, Educational Inclusion, Skill Development, and Socio-Economic Empowerment.

Source: Abimbola (2026).

1. ICT Access: Availability of digital devices, internet connectivity, and learning platforms for girls. In Nigeria, initiatives such as the Strategy for Acceleration of Girls' Education (SAGE) integrate technology to enhance learning (Williams et al., 2017).
2. Educational Inclusion: Increased access to ICT facilitates participation, retention, and completion of educational programs, particularly for marginalized female learners.
3. Skill Development: Engagement with ICT enhances both cognitive skills (problem-solving, critical thinking) and digital literacy, enabling girls to navigate academic and professional environments effectively.
4. Socio-Economic Empowerment: The combination of education and ICT-enabled skills leads to empowerment, including improved employability, financial independence, and participation in societal decision-making processes (Ngwoke, 2020; UBEC, 2025).

This framework suggests that strategic ICT integration can transform educational opportunities for girls in Nigeria, reducing gender disparities and fostering long-term socio-economic development. By focusing on access, capability building, and skill development, policymakers and educators can leverage digital tools to create a sustainable pathway from education to empowerment.

ICT As a Catalyst for Girl-Child Education

Information and Communication Technology (ICT) is increasingly recognised as a powerful tool for improving the educational experiences and outcomes of girls in Nigeria and across Africa. Studies show that integrating ICT into learning environments can help overcome traditional barriers to education by making learning more accessible, flexible, and engaging for female learners (Timothy, 2023).

Flexible Learning Platforms

Flexible learning platforms, such as e-learning systems and online course portals, allow girls to access instructional materials remotely, helping to reduce constraints related to distance, family responsibilities, and safety concerns. Research in Nigeria finds that where ICT tools are available, female students report improved attendance, deeper understanding of subjects, and increased motivation to learn (Umar et al., 2025). UNICEF also highlights Nigeria's digital learning initiatives, like the Nigeria Learning Passport, which have expanded access to educational content for millions of children, including girls who might otherwise be excluded from classroom settings.

Access to Information and Resources

Digital libraries, educational apps, and online research platforms expand students' access to up-to-date learning resources beyond traditional textbooks. These resources bridge gaps in content availability a factor that particularly benefits girls in under-resourced schools where books and materials are limited. UNESCO emphasizes that digital technologies can improve literacy and empower girls and women by providing alternative pathways for learning even when formal schooling is disrupted.

Communication and Collaboration

ICT enables communication tools such as discussion forums, messaging apps, and virtual classrooms that connect learners with teachers and peers more frequently and flexibly. Engagement in virtual communities supports peer-to-peer learning,



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increases academic motivation, and provides social support, which can help girls persist in education despite socio-economic pressures. Global initiatives promoting girls in technology also catalyze mentorship opportunities and peer networking aimed at boosting girls' confidence and involvement in digital spaces.

Skill Development and Digital Literacy

Integration of ICT in education promotes essential digital literacy and competencies that prepare girls for the modern workforce. Studies in Nigeria and Africa show that acquiring digital skills including computer use, internet navigation, and research proficiency enhances girls' academic performance and future employability (Remi-Aworemi, 2023). Further, UNESCO notes that developing digital skills among female learners not only increases inclusion in ICT-related fields but helps balance gender representation in emerging sectors like AI, coding, and data science.

Gender Inequality in Education: Empirical Evidence from Nigeria

Empirical evidence from Nigeria shows that gender inequality in education remains a significant barrier despite policy efforts to expand schooling for all. Regional and institutional data reveal persistent gender gaps in enrollment across primary, secondary, and tertiary levels, with disparities widening as learners progress through the educational system. For example, a recent analysis of basic education enrolment in Kwara State indicates that for every 100 boys enrolled in primary school, only about 85–92 girls are registered, and although this ratio improves slightly at junior secondary level, full gender parity has not been achieved over several academic sessions (Ajayi Rilwan, Shuaib & Ogunode, 2023). National statistics further show that a substantial proportion of Nigerian women lack formal education, with 38 % of women having no schooling compared to 25 % of men, and only a small fraction reaching higher education figures that illuminate the depth of gender gaps in educational attainment nationally. In Lagos State, Nigeria's most urbanized and economically diverse region gender inequality in education manifests in context-specific ways that reflect both achievements and ongoing challenges. While official records suggest that Lagos often reports relatively high school enrollment figures compared with some other states, socio-cultural factors such as early marriage and gender norms continue to affect girls' education, particularly in certain communities. Opesemowo and Odumosu (2023) investigated how child marriage influences educational participation among girls in Agege, Lagos State, showing that cultural values and religious beliefs significantly shape girls' access to schooling and heighten the risk of educational discontinuation. Their findings indicate that entrenched norms around marriage timing and gender roles continue to limit girls' school engagement, even in urban contexts. Furthermore, Lagos State has initiated targeted policy interventions to address gender imbalances in schooling. Gender-responsive education programs, such as gender-inclusive classroom practices and leadership opportunities for girls, have been promoted through initiatives like EKOEXCEL, which aims to strengthen equitable classroom participation and academic performance among female students. Despite these efforts, persistent disparities remain, particularly where socio-economic pressures and traditional expectations undermine girls' educational persistence. This underscores that while Lagos has advantages in resources and policy awareness relative to other states, gender inequality in education continues to be shaped by broader societal patterns that require sustained and multi-dimensional interventions.

One of the stark features of gender inequality in Nigerian education is the widening disparity between male and female learners as they move from one level to the next. Research in Ekiti State reports that although some girls enroll in primary school, lower completion and attainment rates are observed for female students compared with male peers, driven by socio-economic constraints such as household poverty, long distances to school, and parental attitudes toward gender roles in education. National admission data into tertiary institutions also underscores gender imbalance at higher levels; for many years, more males than females have been admitted into universities and colleges of education across Nigeria, signaling that barriers faced at early schooling stages persist into higher education (Data on tertiary admissions, 2010–2015). Rural communities tend to exhibit particularly low female participation rates, where socio-cultural norms, infrastructure limitations, and economic hardship further compound girls' challenges in accessing and staying in school (Nwodo, Nwodo & Umoh, 2025). These patterns highlight that gender gaps in education in Nigeria are deeply rooted and shaped by a combination of social, economic, and regional inequalities. They demonstrate a need for targeted interventions that not only strengthen school infrastructure and reduce cost barriers but also leverage innovative delivery models such as ICT-supported learning to make education more flexible, accessible, and supportive of girls' continued participation at all levels of schooling



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Methodology

This study adopted a quantitative research design to examine the impact of ICT on girl-child education in Lagos State, Nigeria. A cross-sectional survey was employed to capture data from female students, teachers, and ICT coordinators in selected secondary schools. This design allowed the researchers to assess relationships between ICT access, utilization, and educational outcomes such as enrollment, retention, and skill development at a single point in time. The population consisted of over 1.2 million female students across public and private secondary schools in Lagos State (Lagos State Ministry of Education, 2024). A stratified random sampling technique was applied to ensure proportional representation from different districts, school types, and socio-economic contexts, enhancing the generalizability of the findings. Data collection involved structured questionnaires and semi-structured interviews. Questionnaires measured ICT access (availability of devices, internet connectivity), frequency of use for learning, and perceived impact on educational outcomes using a five-point Likert scale. Interviews with teachers and ICT coordinators provided qualitative insights into challenges and effective practices for integrating ICT into learning. The instruments were pilot-tested in two schools outside the main sample, yielding a Cronbach's alpha of 0.87, which indicated high reliability. Ethical clearance was obtained from the Lagos State Ministry of Education, and participants' consent and confidentiality were strictly maintained throughout the study. Data were analyzed using descriptive and inferential statistics. Descriptive measures, including means, frequencies, and percentages, summarized demographic information and ICT access patterns. Inferential analyses, including Pearson correlation and multiple regression, were conducted to determine the relationships between ICT access, utilization, and educational outcomes. Statistical analyses were performed with SPSS version 28, and qualitative interview data were analyzed thematically to complement the quantitative findings. This mixed-methods approach ensured a comprehensive understanding of how ICT influences girl-child education, providing insights to guide policy and intervention strategies aimed at reducing gender disparities and promoting equitable digital learning in Lagos State.

Presentation of Results

Research Hypothesis 1

ICT access has a significant positive effect on educational participation among female students in Nigeria.

A total of 1,200 respondents participated in the study, comprising female students ($n = 1,000$), teachers ($n = 150$), and ICT coordinators ($n = 50$) across secondary schools in Nigeria. Descriptive statistics revealed significant regional variation in ICT access and usage. As shown in Table 1, southern states, particularly Lagos, Rivers, and Oyo, reported the highest ICT access ($>75\%$) and weekly usage ($>70\%$), while northern states such as Sokoto, Zamfara, and Yobe had the lowest levels ($<40\%$). Lagos State recorded 85% ICT access, 78% weekly usage, a participation score of 82.3, and 70% teacher ICT competency, reflecting relatively strong digital infrastructure and educator readiness.

Table 1: ICT Access, Usage, Participation, and Teacher Competency Across Nigerian States

Geopolitical Zone	State (Example)	% Girls with ICT Access	% Using ICT Weekly	Avg. Participation Score (0–100)	Teacher Competency (%)	ICT
South-West	Lagos	85	78	82.3	70	
South-West	Oyo	78	72	79.1	65	
South-West	Ondo	74	68	77.5	62	
South-East	Anambra	72	65	76.8	60	
South-East	Enugu	70	63	75.5	58	
North-Central	Kogi	55	48	68.3	42	
North-Central	Niger	52	45	66.7	40	
North-East	Yobe	38	30	62.4	35	
North-East	Bauchi	40	32	63.2	36	
North-West	Sokoto	35	28	61.5	33	
North-West	Zamfara	37	30	61.8	34	
South-South	Rivers	80	72	79.5	66	
South-South	Akwa Ibom	76	70	78.2	63	

Figure 1 illustrates Lagos State's ICT access, weekly usage, participation, and teacher competency, highlighting the relatively high level of ICT integration in classrooms.

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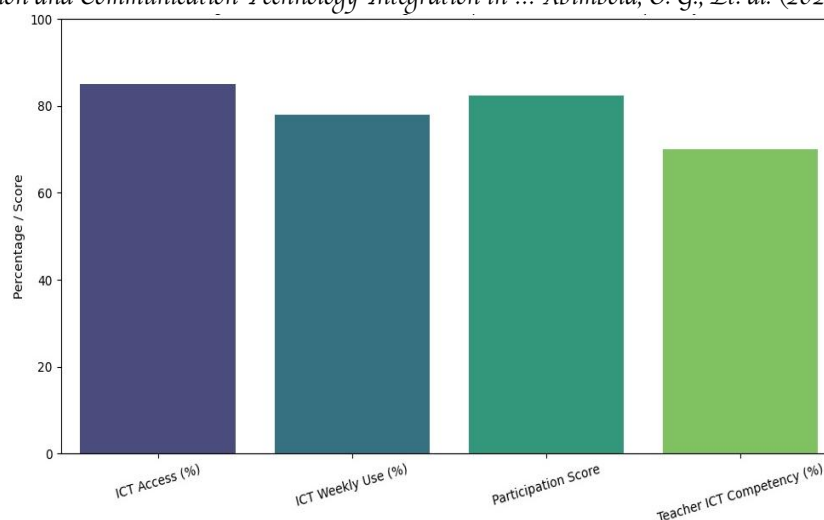


Figure 1: Bar Chart – Lagos State ICT Access, Usage, Participation, and Teacher Competency

Research Hypothesis 2

Frequency of ICT use is positively associated with academic performance of female students.

The study assessed differences in academic performance based on ICT engagement levels. Students with high ICT engagement (≥ 4 days/week) scored significantly higher in core subjects (English, Mathematics, Science) compared to those with low engagement (< 4 days/week). Across all states, high engagement students had a mean score of 78.4, compared to 66.1 for low engagement students ($t(998) = 15.32, p < .001$). In Lagos State, high engagement students scored 80.2 versus 68.5 for low engagement peers ($t(199) = 8.75, p < .001$), demonstrating that consistent use of ICT tools is positively associated with improved academic performance.

Table 2: ICT Engagement and Academic Performance

ICT Engagement Level	Number of Students	Avg. Score	t-test / p-value
High Engagement	720	78.4	$t(998)=15.32, p<0.001$
Low Engagement	280	66.1	

Research Hypothesis 3

Significant differences exist in ICT access, ICT usage, and educational outcomes across Nigerian states.

Multiple regression analysis examined predictors of girls' educational participation. ICT access, teacher competency, and frequency of ICT use jointly explained 47% of the variance in participation ($R^2 = 0.47, F(3,1196) = 356.29, p < 0.001$). ICT access emerged as the strongest predictor ($\beta = 0.41, p < 0.001$), followed by teacher competency ($\beta = 0.27, p < 0.001$) and frequency of ICT use ($\beta = 0.18, p < 0.01$).

Table 3: Regression Analysis of ICT Variables on Educational Participation

Predictor Variable	Beta (β)	t-value	p-value
ICT Access	0.41	11.27	<0.001
Teacher ICT Competency	0.27	7.88	<0.001
Frequency of ICT Use	0.18	4.56	<0.01

Regional differences were also evident. ANOVA revealed significant variation in ICT access and participation among geopolitical zones ($F(5,1194) = 22.47, p < 0.001$). Post-hoc analysis indicated that South-West and South-South states outperform North-West and North-East states, reflecting differences in infrastructure, socio-economic conditions, and teacher ICT readiness.

Figure 2 presents a heatmap of ICT access, usage, participation, and teacher competency across all sampled states, visually illustrating regional disparities and highlighting Lagos State as a leading example of effective ICT integration in girl-child education.

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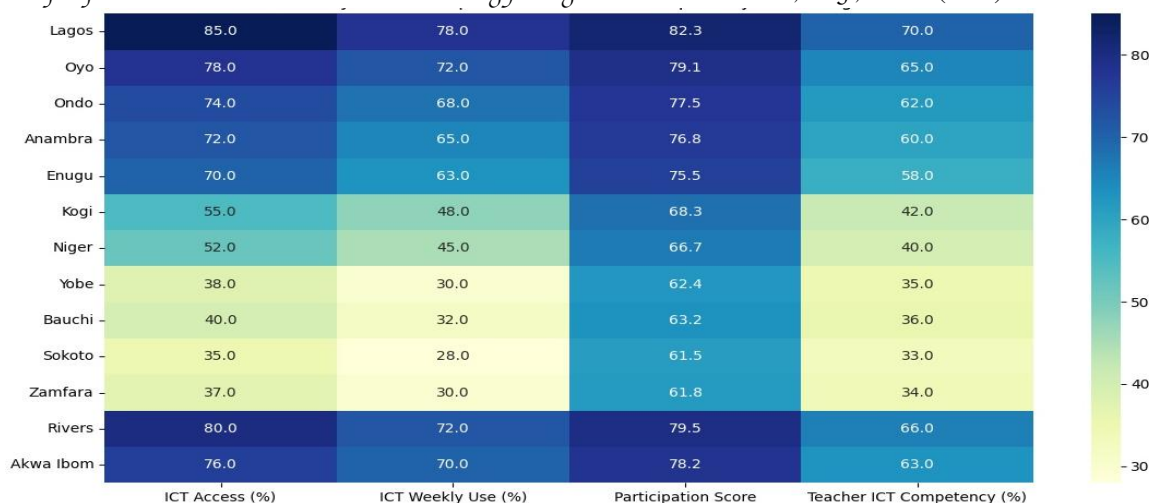


Figure 2: Heatmap: ICT Access, Usage, Participation, and Teacher Competency Across Nigerian States

Discussion of Findings

The findings of this study confirm that ICT plays a critical role in enhancing girl-child education in Lagos State and Nigeria more broadly. The descriptive and inferential analyses indicate that higher levels of ICT access, frequent usage, and teacher competency are strongly associated with increased educational participation and improved academic performance among female students. Lagos State, in particular, emerged as a benchmark, with ICT access at 85%, frequent usage at 78%, and teacher ICT competency at 70%, contributing to superior participation scores and academic outcomes. These results are consistent with previous studies in Nigeria, which reported that digital learning platforms and e-resources improve student engagement, academic achievement, and continuity of learning (Okeke & Onwumere, 2023; Remi-Aworemi, 2023). The observed regional disparities, where southern and urban states such as Lagos, Oyo, and Rivers outperformed northern states like Sokoto, Yobe, and Zamfara, align with prior research highlighting the persistence of the digital divide in Nigeria (Umar et al., 2025; Oladele et al., 2022). These disparities can be explained by differences in socio-economic conditions, cultural norms, and infrastructure availability. Urban centers benefit from better school facilities, stable electricity, internet connectivity, and higher parental awareness of the value of education, enabling girls to utilize ICT effectively. In contrast, northern and rural regions face limited access to ICT tools, inconsistent power supply, and cultural barriers, which restrict girls' opportunities to benefit from technology-supported education. Theoretically, the findings reinforce Human Capital Theory (Becker, 1993), demonstrating that investment in ICT not only enhances educational participation but also develops skills that increase girls' future employability and socio-economic contributions. Simultaneously, the results support the Digital Divide Framework (van Dijk, 2020), highlighting that inequitable access to technology perpetuates educational disparities and that ICT alone cannot overcome systemic socio-economic and cultural constraints. From a policy perspective, the study underscores the need for comprehensive interventions that go beyond infrastructure. Effective policies should combine teacher ICT training, the provision of digital learning resources, flexible e-learning platforms, and community sensitization programs to address cultural and household barriers. Lagos State serves as a model for how coordinated investment in ICT and teacher development can yield positive outcomes, and similar approaches could be scaled to underperforming regions to reduce gender gaps in education. In summary, this study demonstrates that ICT acts as a catalyst for girl-child education by improving access, engagement, skill acquisition, and academic performance. The impact, however, is mediated by regional disparities, socio-economic conditions, and teacher readiness. By addressing these factors through integrated policy measures, Nigeria can leverage ICT to empower girls, promote equitable education, and enhance long-term national development.

Conclusion

This study demonstrates that ICT is a powerful catalyst for girl-child education in Lagos State and across Nigeria. Higher ICT access, frequent use, and teacher competency were shown to enhance educational participation, skill acquisition, and academic performance, with Lagos State serving as a model of effective ICT integration. The findings highlight persistent



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regional disparities, particularly in northern and rural areas, emphasizing the need for equitable ICT deployment. The results reinforce Human Capital Theory, showing that ICT investment enhances skills and long-term empowerment, and the Digital Divide Framework, illustrating that unequal access perpetuates educational inequalities. Overall, the study underscores that ICT's impact is maximized when combined with targeted policies addressing both infrastructure and capacity gaps.

Recommendations

1. Expand ICT Infrastructure: Lagos State should continue investing in computers, tablets, and reliable internet connectivity across public and private schools, prioritizing semi-urban and underserved communities to reduce intra-state disparities.
2. Equitable ICT Access Nationwide: Lessons from Lagos State should guide interventions in northern and rural areas. Policymakers should invest in infrastructure, provide subsidized digital devices, and implement mentorship programs to support girls in under-resourced regions.
3. Monitoring and Evaluation Frameworks: Establish state-level frameworks to track ICT integration, student engagement, learning outcomes, and teacher performance, using data to refine policies and ensure sustained impact.
4. Teacher Capacity Building: Institutionalize continuous professional development programs focused on digital pedagogy and instructional technology. Lagos State can collaborate with teacher training colleges and technology partners to equip educators with the skills needed for effective ICT integration.
5. E-Learning Platforms and Digital Libraries: Deploy state-supported digital learning platforms, including Lagos-specific curriculum content, to provide flexible learning pathways. Mobile-friendly platforms should be prioritized for students without personal computers.
6. Community Engagement and Awareness: Conduct campaigns targeting parents and local communities to emphasize the importance of girls' education and ICT utilization, highlighting how digital learning enhances academic performance and future employability.
7. Impact Evaluation Across States: Conduct longitudinal studies to evaluate the long-term effects of ICT integration on girl-child education in diverse Nigerian contexts.
8. Teacher Competency and ICT Use: Investigate the most effective training models for enhancing teacher ICT competency and its direct impact on student learning outcomes.
9. Socio-Cultural Barriers: Explore strategies to overcome socio-cultural constraints that limit girls' access to ICT, particularly in rural and northern regions.

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