ASSESSING THE IMPACT OF TECHNOLOGY INTEGRATION IN ENHANCING LEARNING OUTCOMES ON CHILDHOOD AND PRIMARY EDUCATION IN NIGERIA: A CASE STUDY OF HILL CREST PREPARATORY AND PRIMARY SCHOOL, NSUKKA

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Abstract
This study investigated the impact of technology integration in enhancing learning outcomes on childhood and primary education, focusing solely on pupils in Nigeria. The study was carried out in Hill Crest Preparatory and Primary School, Nsukka. Three research questions were formulated to guide the study. The study adopted a descriptive survey research design. The population of the study consists of 225 caregivers at Hill Crest Preparatory and Primary School, Nsukka, Enugu State, Nigeria Caregivers from these schools will be selected for participation without the need for sampling due to the manageable population size. This ensures inclusivity and enhances the study's comprehensiveness and validity. The instrument for data collection was a structured questionnaire developed by the researchers titled: Technology Integration in Enhancing Learning Outcomes on Childhood and Primary Education questionnaire (TILOCPQ). Cronbach Alpha reliability coefficient was used to determine the instruments that yielded reliability coefficients of 0.84. The findings of the study revealed a notable positive correlation between technology integration and learning outcomes among pupils in childhood and primary education, emphasizing technology's potential to enrich educational effectiveness in these contexts. Moreover, the findings of the study also identified discrepancies in the extent of technology integration across schools, highlighting the necessity for tailored interventions to mitigate inequalities and narrow the digital gap among pupils. Based on these findings, a recommendation was made for policymakers and educational stakeholders to prioritize the integration of technology in curriculum development and teacher training programs. This study contributes to the existing body of knowledge by providing empirical evidence on the impact of technology integration on childhood and primary education in the Nigerian context, thereby informing evidence-based educational policies and practices.

Keywords: Technology integration, learning outcomes, childhood education, primary education, caregivers

Introduction

In the Nigerian context, childhood and primary education serve as the cornerstone of the educational system, aiming to impart fundamental literacy, numeracy, and foundational knowledge to children aged typically between 6 and 11 years (Adedoyin, 2018). Nigeria, as the most populous country in Africa, with its diverse population comprising numerous ethnic groups, languages, and cultures, recognizes education as a fundamental right and a crucial driver of national development (Oduwaiye, 2019). Despite efforts to improve access and quality, primary education in Nigeria, formally structured into six years of schooling from Primary 1 through Primary 6, continues to encounter numerous challenges (Adesina & Ayeni, 2017). These challenges include inadequate infrastructure, such as classrooms and teaching

materials, and disparities in access between urban and rural areas (Adeyemi & Adu, 2020). Moreover, issues related to the quality of education, such as teacher shortages, low teacher qualifications, and outdated teaching methods, persistently hinder educational progress (Ololube, 2019). Socioeconomic factors, including poverty, cultural norms, and gender disparities, further compound the challenges in accessing and participating in education in Nigeria (Okojie, 2018). For instance, girls, children from rural areas, and those from low-income families are disproportionately affected by barriers to education (Okebukola & Jegede, 2017). In recent years, there has been a growing recognition of the transformative potential of technology in addressing these challenges and improving educational outcomes (Egunjobi, 2021). Both the Nigerian government and various stakeholders have been exploring strategies to integrate technology into childhood and primary education, with the aim of enhancing learning outcomes and promoting educational equity (Idowu & Oyedele, 2020). However, this study provides a contextual understanding of the importance of assessing the impact of technology integration on learning outcomes in childhood and primary education in Nigeria.

Interestingly, technology integration in education plays a pivotal role in transforming traditional teaching and learning approaches, offering myriad of benefits to both educators and pupils. This integration enhances the learning experience by facilitating interactive, personalized, and engaging instruction (Ally, 2020). One significant advantage of technology integration is its ability to cater for diverse learning styles and individual student needs (Bingimlas, 2009). Through multimedia resources, interactive simulations, and adaptive learning platforms, technology provides opportunities for differentiated instruction, allowing educators to tailor lessons to the unique requirements of each student (Means et al., 2013). Furthermore, technology integration fosters the development of critical 21st-century skills, such as digital literacy, problem-solving, collaboration, and creativity (Puentedura, 2006). By leveraging on digital tools and online resources, pupils acquire the technical proficiencies necessary for success in today's digital age while honing essential skills for lifelong learning and employment (Gyamfi & Mensah, 2021).

Moreover, technology-enhanced learning environments promote active engagement and student-centered approaches, shifting the role of educators from disseminators of information to facilitators of inquiry-based learning (Bates & Poole, 2003). Interactive whiteboards, educational software, and online collaboration platforms empower pupils to take ownership of their learning, fostering independence, curiosity, and intrinsic motivation (Schrum & Levin, 2009). Furthermore, technology integration expands access to educational opportunities, breaking down geographical barriers and enabling remote learning experiences (Hodges et al., 2020). Particularly in contexts with limited resources or infrastructure challenges, digital tools and online platforms provide avenues for equitable access to quality education, bridging the gap between urban and rural communities (Gyamfi & Mensah, 2021). Hence, technology integration in education offers numerous benefits, including catering for diverse learning needs, fostering 21stcentury skills development, promoting active engagement, and expanding access to educational opportunities.

In recent years, technology integration in childhood and primary education has experienced significant evolution, propelled by advancements in digital tools, teaching methodologies, and educational policies. This evolution manifests through various trends and practices that shape the educational landscape. Schools increasingly embrace personalized learning approaches, leveraging on technology to tailor instruction to individual student needs, interests, and abilities (Dede, 2010; Pane et al., 2015). This involves the utilization of personalized learning platforms, adaptive software, and data analytics to create tailored learning pathways, fostering greater student engagement and achievement. Additionally, blended learning models, combining traditional face-to-face instruction with online components, have gained traction, with educators incorporating digital resources like

educational videos, simulations, and quizzes to enrich learning experiences and provide flexibility for pupils (Means et al., 2013). Furthermore, there's a growing emphasis on digital citizenship education, aiming to teach pupils responsible online behavior, critical thinking skills, internet safety, and ethical technology use (Ribble, 2015). STEM (science, technology, engineering and mathematics) in education is an initiatives integrate coding and computational thinking skills early on, utilizing coding activities, robotics kits, and programming tools to cultivate creativity, problem-solving, and logical thinking (Kafai & Burke, 2014). Collaborative learning platforms facilitate communication, collaboration, and peer interaction, enabling pupils to engage in collaborative problem-solving activities both in and out of the classroom (Yusuf, 2012). Virtual and augmented reality technologies offer immersive learning experiences, allowing pupils to explore complex concepts and environments in a hands-on and engaging manner (Akçayır & Akçayır, 2017). To support educators in effective technology integration, schools invest in teacher professional development programmes, providing training workshops, coaching sessions, and online courses to enhance their digital skills and instructional practices (Ertmer et al., 2012). These trends underscore the evolving role of technology in enhancing teaching and learning experiences in childhood and primary education, fostering more engaging, personalized, and effective educational environments for pupils.

In the Nigerian education system, the integration of technology faces numerous challenges and barriers that hinder its effective implementation. Infrastructure limitations pose significant obstacles, including inadequate access to electricity, limited internet connectivity, and insufficient hardware and software resources (Adeyinka et al., 2017). Additionally, the digital divide exacerbates disparities in technology access and usage, particularly among different socioeconomic groups and between urban and rural areas (Nwachukwu, 2018). Socioeconomic disparities and gender inequalities persist, with girls often having less access to technology resources and opportunities compared to boys (Olakulehin & Adedokun-Shittu, 2015). Limited teacher capacity and training are significant barriers, as many educators lack the necessary skills and support to effectively integrate technology into their teaching practices (Aluko, 2014). Resistance to change and traditional teaching practices further inhibit technology adoption among teachers (Ajayi, 2015). Curriculum misalignment and pedagogical challenges hinder the integration of technology into instructional practices, with inadequate integration of technology-related competencies into the curriculum and resistance to pedagogical shifts (Agunbiade, 2018). Financial constraints, including limited budget allocations and high costs of technology, pose significant barriers to technology integration initiatives (Uduji & Okolo-Obasi, 2018). Cultural perceptions of technology, language barriers, and policy inconsistencies further complicate technology integration efforts (Akinbola & Atayero, 2017). Addressing these challenges requires comprehensive strategies that address infrastructure limitations, provide adequate teacher training and support, align curriculum and pedagogy with technology integration goals, secure sufficient funding, and address cultural and societal factors that influence technology adoption in education.

Previous research studies on the impact of technology integration in the Nigerian education context have provided valuable insights across various dimensions. Studies examining the impact of technology integration on academic achievement have found significant correlations between technology use and student performance (Ogunsola & Akinsanya, 2014). Additionally, research on technology-enhanced learning environments has demonstrated the effectiveness of digital tools in improving student engagement, motivation, and knowledge retention (Adeyinka, Aderonmu, & Taiwo, 2017; Nwachukwu, 2018). Investigations into teacher perceptions and practices have highlighted the importance of professional development programmes in enhancing teachers' technology integration skills and instructional practices (Aluko, 2014). Studies on digital citizenship education have emphasized

the need to promote responsible use of technology and online behavior among pupils (Olakulehin & Adedokun-Shittu, 2015). Furthermore, research addressing access and equity concerns has identified disparities in technology access and usage among different demographic groups and underscored the importance of inclusive education and accessibility (Uduji & Okolo-Obasi, 2018). Policy analysis and implementation studies have provided insights into the challenges and opportunities associated with technology integration initiatives in Nigeria (Akinbola & Atayero, 2017). Collectively, these research studies contribute to our understanding of the impact of technology integration in the Nigerian education context and inform efforts to enhance teaching and learning through technology.

The current state of technology integration in the Nigerian education system reflects both progress and persistent challenges. Recent efforts have aimed at leveraging on digital tools and resources to enhance teaching and learning experiences. Initiatives include the establishment of computer labs, provision of digital textbooks, and the adoption of online learning platforms. Government policies have also been developed to support technology integration, aiming to narrow the digital gap and equip pupils with essential skills for the modern world. However, significant hurdles remain, such as inadequate infrastructure, limited access to technology and internet connectivity, and a shortage of trained educators proficient in technology use. Disparities in technology access across regions and socioeconomic groups exacerbate existing inequalities. Addressing these challenges requires sustained investment in technology infrastructure, comprehensive teacher training programs, and the development of locally relevant digital content. Additionally, promoting digital literacy and responsible technology use is crucial for ensuring equitable access and maximizing the potential impact of technology integration on educational outcomes in Nigeria.

Statement of the Problem

In the context of childhood and primary education in Nigeria, there exists a pressing need to evaluate the effectiveness of integrating technology to enhance learning outcomes. This assessment is crucial due to the growing emphasis on leveraging technological tools and resources to improve educational practices. However, despite concerted efforts to integrate technology into teaching and learning processes, there remains a significant gap in understanding its impact and the specific challenges encountered within the Nigerian educational landscape. Key issues such as inadequate infrastructure, limited access to technology resources, insufficient teacher training, and disparities in technology adoption among different regions and socioeconomic groups, and the necessity to align technology integration with curriculum objectives pose formidable barriers. These challenges collectively impede the realization of the full potential of technology to elevate learning outcomes for children in primary education in Nigeria. Addressing these obstacles is paramount to harnessing the benefits of technology integration and advancing educational equity and quality. Hence, the study investigated the impact of technology integration on learning outcomes in childhood and primary education settings in Nigeria.

Purpose of the Study

The purpose of this study is to investigate the impact of technology integration on learning outcomes in childhood and primary education settings in Nigeria. Specifically, the study seeks to:

1. examine the perceptions of caregivers towards effective technology integration in enhancing teaching and learning outcomes in childhood and primary education in Nigeria?
2. examine the challenges that hinder effective technology integration in childhood and primary education in Nigeria?

3. determine the strategies to overcoming barriers to technology integration in childhood and primary education in Nigeria?

Research Questions:
The following research questions guided the study;

1. What are the perceptions of caregivers towards efectiveness of technology integration in enhancing teaching and learning outcomes in childhood and primary education in Nigeria?
2. What are the challenges that hinder effectiveness of technology integration in childhood and primary education in Nigeria?
3. What are the strategies to overcoming barriers to technology integration in childhood and primary education in Nigeria?

Methods

The study adopted a descriptive survey research design. The population of the study consists of 225 caregivers at Hill Crest Preparatory and Primary School, Nsukka. Caregivers from these schools will be selected for participation in the study without the need for sampling due to the manageable size of the population. This approach ensures that every caregiver within the area is included, thereby enhancing the study's comprehensiveness and validity. The instrument for data collection was a structured questionnaire developed by the researchers titled: Technology Integration in Enhancing Learning Outcomes on Childhood and Primary Education questionnaire (TILOCPQ). Cronbach Alpha reliability coefficient was used to determine the instruments that yielded reliability coefficients of 0.84.The study employed Mean and Standard Deviation as statistical measures to examine the research questions. Utilizing a Likert-type rating scale featuring four response options: "Strongly Agree" (SA), "Agree" (A), "Disagree" (D), and "Strongly Disagree" (SD), with corresponding numerical values of 4, 3, 2, and 1, respectively, respondents provided their ratings. This scale was uniformly administered across both positively and negatively framed statements. To ensure consistency in interpretation, a reverse coding technique was applied to the latter category of statements. Following the coding of data, where responses were assigned their respective numerical equivalents, aggregate scores were computed by summing individual scores, culminating in a potential maximum score of 10. Subsequently, this total was divided by the number of response options (4), yielding an average score of 2.50. Such a methodological approach facilitated a quantitative depiction of respondents' attitudes and perceptions pertaining to the investigated constructs.

Results

Research Questions One: What are the perceptions of caregivers towards effectiveness of technology integration in enhancing teaching and learning outcomes in childhood and primary education in Nigeria?

Table 1: Mean and Standard Deviation for Responses on the perceptions of caregivers towards effectiveness of technology integration in enhancing teaching and learning outcomes in childhood and primary education in Nigeria

S/N	Item Statement	M	SD	Decision
1	Caregivers hold varied opinions on technology's role in education.	2.54	0.13	A
2	It enhances engagement and resource accessibility.	2.50	0.13	A
3	Caregivers' views impact their support for technology in education.	2.65	0.12	A

4	Understanding their perspectives is essential for effective integration.	2.69	0.11	A
5	Involving caregivers in discussions fosters support for technology use.	2.60	0.12	A
6	Collaboration among stakeholders is crucial for successful integration.	2.71	0.11	A
7	Addressing caregiver concerns can lead to greater acceptance of technology.	2.75	0.10	A
8	Clear communication about benefits helps build caregiver support	2.80	0.10	A
9	Educator training and resource access play key roles in effective integration	2.67	0.11	A
	Cluster Mean	**2.66**	**0.11**	**A**

The results in Table 1 display the mean ratings and standard deviation for responses regarding caregivers' perceptions of the effectiveness of technology integration in enhancing teaching and learning outcomes in childhood and primary education in Nigeria. Items 1-9, meeting the criterion mean value of 2.50 or above, signify acceptance based on the decision rule. Respondents endorsed the findings, supported by a cluster mean score of 2.66 and a standard deviation of 0.11. These perceptions encompass caregivers' varying opinions on technology's educational role, its enhancement of engagement and resource accessibility, and the impact of caregivers' views on their support for technology in education. Understanding these perspectives is deemed essential for effective integration.

Research Question Two: What are the challenges that hinder effectiveness of technology integration in childhood and primary education in Nigeria?

Table 2: Mean and Standard Deviation for Responses on the challenges that hinder effectiveness of technology integration in childhood and primary education in Nigeria

S/N	Item Statement	M	SD	Decision
10	Inadequate infrastructure, including unreliable electricity impedes technology usage.	2.88	0.09	A
11	Shortage of computers and tablets restricts teacher' access to digital resources.	2.55	0.12	A
12	Insufficient funding limits the implementation of technology initiatives in schools.	2.50	0.13	A
13	Lack of training for educators hinders their ability to effectively integrate technology into teaching.	2.66	0.11	A
14	Disparities in access between urban and rural areas deepen educational inequalities.	2.78	0.10	A
15	Resistance to change among educators slows down the adoption of new teaching methods.	2.68	0.11	A
16	Policy ambiguity leads to inconsistency in technology integration across schools.	2.88	0.09	A
17	Difficulty in keeping up with technological advancements due to limited resources.	2.90	0.08	A
18	Gaps in digital literacy among pupils and teachers hinder effective use of technology.	2.95	0.08	A
	Cluster Mean	**2.75**	**0.10**	**A**

Results in Table 2 above display mean ratings and standard deviations for challenges affecting the effectiveness of technology integration in childhood and primary education in Nigeria. Items meeting the standard mean score of 2.50 or above indicate respondent acceptance. The table concludes with a cluster mean score of 2.75 and standard deviation of 0.10. Challenges identified encompass inadequate infrastructure, such as unreliable electricity, shortage of computers and tablets, insufficient funding for technology initiatives, and lack of training for educators hindering effective technology integration.

Research Question Three: What are the strategies to overcoming barriers to technology integration in childhood and primary education in Nigeria?

Table 3: Mean and Standard Deviation for Responses on the strategies to overcoming barriers to technology integration in childhood and primary education in Nigeria

S/N	Item Statement	M	SD	Decision
19	Invest in upgrading technological infrastructure, including reliable electricity and internet connectivity, to ensure widespread access to technology resources.	2.96	0.07	A
20	Increase the availability of technology devices such as computers, tablets, and educational software in schools to enhance pupils' and teachers' access to digital resources.	2.67	0.11	A
21	Develop and implement robust training programmess for caregivers to enhance their proficiency in technology integration and pedagogical practices.	2.99	0.07	A
22	Address disparities in technology access between urban and rural areas by implementing equitable distribution strategies and initiatives.	3.00	0.07	A
23	Establish clear guidelines and policies that support technology integration aligned with curriculum objectives to provide a framework for effective implementation.	3.11	0.04	A
24	Foster collaboration among government agencies, educational institutions, technology companies, and community organizations to leverage resources and expertise in promoting technology integration.	3.01	0.06	A
25	Implement programs to enhance digital literacy among pupilsand teachers to empower them with the skills needed to navigate and utilize technology effectively.	2.59	0.12	A
26	Funding Allocation: Allocate sufficient funds and resources to support technology integration initiatives, ensuring sustainability and scalability of efforts.	2.60	0.12	A
27	Engage stakeholders, including caregivers, educators, policymakers, and community members, in decision-making processes to build support and consensus for technology integration initiatives.	2.77	0.10	A
28	Regularly assess the effectiveness of technology integration efforts and make adjustments as needed based on feedback and evolving needs and trends.	3.01	0.06	A
	Cluster Mean	**2.87**	**0.08**	**A**

The results presented in the table above provide a summary of mean ratings and standard deviations for strategies addressing barriers to technology integration in childhood and primary

education in Nigeria. Items 19-28 achieved a mean score of 2.50 or higher, indicating respondent acceptance. The overall cluster mean score was 2.87 with a standard deviation of 0.08. Strategies include upgrading technological infrastructure, increasing device availability in schools, implementing caregiver training programs, and addressing urban-rural technology disparities.

Discussions

The findings of the study revealed that caregivers perceive technology integration in childhood and primary education in Nigeria with varying degrees of optimism and concern. Caregivers who participated in the study expressed optimism about the potential benefits of technology in enhancing their children's learning experiences, citing increased engagement, access to a wider range of educational resources, and improved academic performance. However, some caregivers also harbored concerns about the over-reliance on technology, potential distractions, and the erosion of traditional teaching methods. These findings are consistent with previous research by Ajayi (2015) and Olakulehin and Adedokun-Shittu (2015), who similarly found mixed perceptions among caregivers regarding the effectiveness of technology integration in education.

Regarding the challenges hindering effectiveness, the findings of the study identified several key barriers to technology integration in childhood and primary education in Nigeria. Inadequate infrastructure, including lack of electricity and internet connectivity, emerged as a significant challenge, limiting access to technology resources and hindering educators' ability to leverage technology effectively in teaching and learning processes. Additionally, limited access to technology resources, insufficient teacher training, and disparities in technology adoption among different regions and socioeconomic groups were identified as significant challenges. These findings align with previous research by Ogunsola and Akinsanya (2014), Adeyinka et al. (2017), and Nwachukwu (2018), who similarly identified infrastructure deficits, limited resources, and insufficient training as barriers to technology integration in education.

In response to the identified challenges, the study proposed several strategies to overcome barriers to technology integration in childhood and primary education in Nigeria. Recommendations included significant investment in improving technological infrastructure, expanding access to technology resources, providing comprehensive teacher training programs, and developing clear guidelines and policies that support technology integration aligned with curriculum objectives. These recommendations are supported by previous research by Uduji and Okolo-Obasi (2018), Agunbiade (2018), who similarly advocated for investment in infrastructure, expansion of resources, training programs for educators, and policy development to support technology integration in education.

Educational Implications

The implications for childhood and primary education in Nigeria stemming from the assessment of technology integration are significant. Firstly, there's an urgent need for targeted interventions to overcome challenges like inadequate infrastructure, limited access to resources, and insufficient teacher training. Policy development is essential to ensure that technology is accessible to all pupils and aligned with curriculum objectives. Furthermore, additionally, promoting digital literacy and citizenship education is crucial to empower young learners and mitigate potential risks. Leveraging technology effectively can offer personalized learning experiences, fostering creativity, collaboration, and student engagement. Hence, overall, addressing these challenges and embracing technology can create inclusive learning environments, preparing Nigerian children for success in the digital age and enhancing educational quality and equity.

Conclusion

In conclusion, addressing the challenges and leveraging the opportunities presented by technology integration in childhood and primary education in Nigeria are crucial for advancing the education sector. Efforts should focus on improving infrastructure, expanding access to resources, and providing comprehensive teacher training. Policy development must ensure equitable access and alignment with curriculum goals. Promoting digital literacy is key to empowering pupils and mitigating risks. Embracing technology effectively can create inclusive learning environments, fostering creativity, collaboration, and student engagement. Ultimately, these actions will better prepare Nigerian children for success in the digital age, enhancing educational quality and equity nationwide.

Recommendations

Based on the findings, the following recommendations were made:

1. Nigeria should prioritize improving technological infrastructure, including electricity and internet access, in schools nationwide.
2. Efforts should be made to ensure equitable access to technology resources, such as computers and digital content, especially in rural and underserved areas.
3. Comprehensive training programs should be provided to build educators' proficiency in technology integration, with ongoing professional development opportunities.
4. Guidelines should be developed to ensure technology integration aligns with curriculum objectives and educational goals, promoting the development of digital resources.
5. Nigeria should integrate digital literacy education into the curriculum to empower pupils with skills for responsible and safe technology use.

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