

INFLUENCE OF DIGITAL TOOLS DEVICES AND INTERACTIVE MEDIA IN FACILITATING LEARNING AMONG PRESCHOOL CHILDREN IN LAGOS STATE

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Abstract

The rapid advancement of digital technology in the 21st century has significantly reshaped educational practices, particularly in early childhood education. This study examined the influence of digital tools, devices, and interactive media on preschool children's learning outcomes in Lagos State, Nigeria, with a focus on cognitive, socio-emotional, literacy, numeracy, and fine motor development. Adopting a cross-sectional survey research design, the study involved 360 preschool children aged 3–5 years, their teachers, and parents drawn from 18 public and private preschools across six Local Government Areas in Lagos State. Data were collected using a Teacher Questionnaire, Parent Questionnaire, and an Early Learning Achievement Test (ELAT). Descriptive statistics, independent samples t-tests, Pearson correlation, and multiple regression analyses were employed at a 0.05 level of significance. Findings revealed significant disparities between public and private preschools, with children in private schools demonstrating higher learning outcomes, attributable to better access to and more frequent use of digital resources. While parental education level had a modest but significant moderating effect, teacher qualification did not significantly predict learning outcomes. The study concludes that developmentally appropriate and well-facilitated digital integration can enhance preschool learning, but unequal access risks widening educational disparities. It recommends targeted government investment in public preschool digital infrastructure, professional development for teachers in digital pedagogy, and parental sensitisation on guided digital use. These measures are critical for maximising the benefits of digital learning while ensuring equity in early childhood education.

Keywords: Digital Tools, Interactive Media, Preschool Education, Early Childhood Development

Introduction

The world is changing rapidly in the 21st Century, and digital technology is likely to have a major impact on every area of human life. In fact, the illiterate in this century will not be those who can neither read nor write alone, but those who cannot learn, unlearn and relearn. The rapid and widespread adoption of online and open-access services and technologies is a consequence of evolving media narrative in which human interaction and engagement have evolved from traditional face-to-face conversations through symbolic representation systems (Print and books) to audio-visual transmissions (Radio and television) into digital networked formats (Computers). The traditional telephone is being replaced by alternative modes of communication; analogue radio and television broadcast has been replaced by digital networks, which allow personalised choice, and face-to-face meetings have shifted to human-to-machine interfaces (Dabaghand, 2021). The impact of Information and Communication Technology (ICT), a term used to describe any hardware and software in use, was recognised in 2022 by the World Economic Forum (WEF). Since then, the term digital technology has been used to describe not only desktop computers but also portable mobile devices such as smartphones, game consoles, digital cameras, media players, notebooks, and hand-held computers (Traxler, 2022). Almost everyone owns one, uses one, and as he points out, often has more than one. Such devices, he suggests, are pervasive, ubiquitous, conspicuous, unobtrusive, noteworthy and taken-for-granted. Their roles are new and completely different from older, static, and less personal information technologies, such as desktop computers. Within this period of change is the internet, which has been predicted to transform learning in the 21st century, in the same way that electrification transformed learning in the 21st century (Brown & Duquid, 2022).

The discussion about the use of digital technology in education has shifted, therefore, from an approach based on whether they are 'good' for children to 'how' they can be used in order to enhance children's learning. In support of this view, Resnick (2022) questioned the way education views learning and suggested that in education, there is a need to rethink learning in this digital age. Resnick (2022) proposed that it is essential to re-conceptualise school classrooms, claiming that instead of a centralised control mode (with the teacher delivering information to a room full of students, researchers should re-examine teaching approaches, curriculum subjects and methods, sizes of classrooms, and places that learning takes place. Researchers echo the vision of bridging the global digital divide (World Economic Forum, 2022); that the internet will open up new learning opportunities, enabling new types of knowledge-building communities in which children and adults around the globe collaborate on projects and learn from one another (Resnick, 2002).

The integration into the daily lives of children and its influence on their cognitive, emotional, and social development continues to increase day by day. Technology offers many opportunities for children to play, explore, and learn (Linebarger & Piotrowski, 2023). Since the brains of children are extremely flexible at this period, these learning opportunities constitute a critical developmental point in children through the natural exploration of their own world, new connections between neurons are formed and existing connections are strengthened (Blanchard & Moore, 2022).

Olaniyi (2022) defined digital learning as all about learning that occurs at the use of network technologies to create, foster, deliver and facilitate learning anytime, and anywhere. Oduolowu et al. (2023) refers to digital learning as self-paced, provides consistent content, faster and works anywhere and anytime for learners. The instructional materials are easily updated and permit the use of multimedia, which leads to video, audio, quizzes and other forms of interaction. Olaojoet. al.(2022) describe e-learning as any technological mediated learning using computers, whether from distance or in face-face classroom (computer assisted learning). Researchers went further to describe it as a shift from traditional education or training to ICT-based personalised, flexible, individual, self-organised, collaborative learning based on a community of learners, teachers and facilitators.

With reference to Ebeh (2022), there are different forms of digital learning. These include:

1. Web-Based Learning, which is a form of learning that is accessed through web browsers or through the corporate intra-net. It is a user-friendly medium to deliver training because of the compatibility of web browsers with videos, audios, animation and other media elements. Its advantage is that the learner can access it at their own pace, within a set time, without travelling to the learning centres to attend the training.
2. Mobile Learning, which is in the form of digital learning, is accessed by learners through mobile devices like mobile phones, Ipad, tablets, anywhere, any time with just a few taps. It is a breakthrough in the e-learning world. This form of digital learning allows students or individuals to discuss, collaborate and learn with their peers across the globe.
3. Computer-Based Training, which is a form of digital learning that is accessed offline on computers. It uses various multimedia elements to engage the learner. Computer-based training allows learners to learn at their own pace, and the training progress is tracked by the computer, which assigns grades instantly. The instructor can also track the training progress.
4. A webinar, which is a form of digital learning delivered over the web, using video conferencing software. Different sorts of training can be delivered through this form. The advantage of this mode is that one can host a large group, interact and brainstorm, and share applications with other participants.
5. CD-ROM Based Learning by which the training is recorded onto compact discs and accessed on the system without any internet connection. It is an outdated mode of digital learning. However, in recent times, digital learning has progressed a long way from CD-ROM to mobile learning.
6. Virtual Classroom, by which learners can access training right from the comfort of their own places or even homes and or offices. This mode adopts various synchronous technologies such as web conferencing, video conferencing, and so on, to enable global learners to participate, communicate with one another and view videos at the same time. Being an e-learning programme, the learners do not need to travel to attend the session, thus saving transport costs.

7. Collaborative Learning, by which both the instructor and learners share knowledge, either online or offline. The learner gains knowledge through interaction, and those who could not make it to the online session can partake in online forums, live chats, instant messaging and used message boards.
8. Custom E-Learning whereby one can develop course content to suit one's requirements. No license is needed to access the courses with limited system requirements and gain personalized learning experiences. This mode delivers what the learners expect.
9. Off-the-Shelf Digital Learning, which comprises training materials that are already developed and ready to be used by the end users. The best part of the catalogue in e-learning courses is that they fulfil the urgent training requirements and deliver content in multiple languages. They are also cost-effective to train small departments (Ebeh, 2022).

The effect of the use of digital technology on the development of young children is ever-increasing in the world around us today. Digital learning offers many opportunities for children to engage positively in imaginative, active learning. It motivates them, provides them room for practice, reassures them, builds confidence in them and encourages children to persist in taking the next steps in learning, and builds their self-esteem.

A programmable toy could be used to develop a range of skills. Children learn that pressing buttons causes an action, that they can control the action left, right, forwards, backwards, and that the number of presses equals the number of moves. Critically, a programmable toy can put the child at the centre of the learning process as they learn how to programme a toy to perform a particular action. An overhead projector introduces children to shadows and patterns, while also being a motivating tool to display and share learning. Musical keyboards can encourage moving to reading and creating patterns with sound. Metal detectors can help children identify differences in materials, particularly useful for encouraging children to explore the outdoor environment (Ruth & Paul, 2022).

Walkie-talkies can encourage children's use of language, and they can use this equipment to share experiences, connect ideas, explain what is happening and recall and relive past experiences. The use of a digital camera can encourage children to reflect on past experiences, observe details, share personal likes and dislikes, sequence events, record and share a significant event. An interactive whiteboard brings a new dimension to a learning environment. It immediately captures children's attention by the impact of the images, the colour and the control that it gives children. As a very good motivating tool, children can use it independently to paint, draw and explore their environment. An interactive whiteboard is particularly effective for sharing experiences; for example, small groups of children can all collaborate and, importantly, can all partake in the activities (Kara, 2022).

Software can bring in different environments for children to explore, which otherwise may be impossible for them to gain experience of. With a computer, other applications become possible access to the Internet and its widening range of resources for learning, webcams for seeing themselves, and their activities through digital microscopes to investigate with and digital camcorders. Cassette recorders and MP3 devices can encourage children to listen to and retell stories (Mitofani et al., 2023). Information and communication technology is particularly enabling for children with special educational needs; it can provide access to experiences that might be hard for some children to access through any other means and thereby aid children's learning and development. It is also highly motivating, can help build children's confidence in their abilities is an excellent focus for social interaction (Mitofani et al., 2023).

Information and communication technology added to role play reflects the real world, builds on children's experiences, and allows them opportunities to understand how, why, when and where different forms of technology are used in everyday life. Environments such as shops, cafes or offices can be set as role play areas, making use of ICT to record and access information with a real purpose in mind (Palaiologou, 2024). In the 21st-century learning environment, digital transformation has significantly altered pedagogical approaches, especially in early childhood education. With the increasing proliferation of digital tools, interactive media, and smart devices, educators now have access to a wide range of innovative resources that can enhance teaching and foster comprehensive development in preschool learners. Early childhood is a critical

period of rapid brain development, during which children acquire foundational cognitive, emotional, and social skills that set the stage for lifelong learning. As such, integrating developmentally appropriate digital resources into preschool education can be a powerful means of supporting learning outcomes, provided such integration is thoughtful, intentional, and pedagogically sound (Palmer, 2024).

Digital tools such as tablets, learning apps, and interactive whiteboards have been found to support cognitive development by offering multisensory experiences that enhance memory, attention, and problem-solving skills (Hirsh-Pasek et al., 2015). According to Neumann and Neumann (2014), literacy apps can significantly improve phonemic awareness and early reading skills among preschoolers. In Lagos, similar technologies are being integrated into some private preschools, but their effectiveness remains under-researched.

The use of interactive media in early childhood has both positive and negative implications. While collaborative digital games and storytelling apps can enhance empathy and cooperation (Plowman & McPake, 2013), excessive screen time may hinder interpersonal interactions and emotional regulation (Radesky et al., 2024). Lagos preschools may vary in their moderation of screen exposure, and this study seeks to understand how such practices affect learners. Children tend to exhibit higher levels of engagement when learning experiences are interactive and visually stimulating (Zilka, 2020). Touchscreen devices and educational games can captivate attention and provide instant feedback, promoting intrinsic motivation. However, factors such as app quality, teacher facilitation, and content relevance significantly determine learning outcomes (Marsh et al., 2015). Educators' digital literacy and attitudes toward technology play a pivotal role in how effectively these tools are employed (Donohue & Schomburg, 2023). In Nigeria, studies have indicated that many preschool teachers lack adequate training in digital pedagogy (Ogunlade & Ojo, 2020).

Statement of the Problem

In Lagos State, where urbanisation and technological integration are rapidly evolving, the application of such digital solutions in preschool education is both timely and necessary. Lagos, as Nigeria's commercial and technological hub, is witnessing an increased emphasis on modernising educational practices to meet global standards. However, there remains a need to examine whether and how digital tools are being employed in preschool settings, and what impact they are having on learners at this critical stage of development. This study examines the role of digital tools and interactive media in facilitating learning experiences for preschool children, aiming to understand their effectiveness in promoting cognitive, emotional, and social development in early learners.

Purpose of the Study

The primary purpose of this study is to examine the influence of digital tools, devices, and interactive media in facilitating learning among preschool children in Lagos State. Specifically, the study seeks to:

- i. Assess the availability and frequency of use of digital tools and devices in preschool classrooms in Lagos state.
- ii. Determine the relationship between the use of digital tools, devices, and interactive media and children's learning outcomes across literacy, numeracy, fine motor, and socio-emotional domains.
- iii. Compare the influence of digital integration between public and private preschools in Lagos State.
- iv. explore teachers' and parents' perceptions of the role of digital resources in enhancing preschool children's learning experiences.

Hypotheses

H01: There is no significant difference in the learning outcomes of children in public and private preschools based on access to and use of digital tools, devices, and interactive media.

H02: There is no significant relationship between the use of digital tools, devices, and interactive media and preschool children's learning outcomes in Lagos State.

H03: Teacher qualifications and parental education levels have no significant moderating effect on the relationship between digital media use and preschool children's learning outcomes

Methodology

This study adopts a cross-sectional survey research design. The study captures measurable data on the extent of digital tool usage and its association with children's learning. The population of this study consists of preschool children aged 3–5 years enrolled in both public and private preschools in Lagos State. The study included preschool teachers in the selected schools and the parents of the sampled children. A Multistage sampling technique was employed to ensure representativeness across diverse demographics and school types in six Local Government Areas (LGAs) were purposively selected to capture urban, peri-urban, and semi-rural contexts from Lagos State out of 20 LGAs. Within each selected LGA, three preschools were randomly chosen, ensuring an equal balance between public and private institutions. These were 18 preschools in total. From each school, two preschool classes, Nursery 2 and Kindergarten, were selected. Ten children from each class were randomly sampled, resulting in an estimated 360 children. All teachers of the selected classes and two parents from each class participated in the study. Three instruments were employed for the study: Teacher Questionnaire: Structured questionnaire containing demographic items, availability and use of digital resources, teaching practices, and attitudes toward digital media, measured on Likert-type scales. Parent Questionnaire: Structured and semi-structured items on household access to devices, parental mediation practices, and socioeconomic background and Early Learning Achievement Test (ELAT): Adapted instrument with tasks in literacy (letter recognition, vocabulary), numeracy (counting, shape recognition), fine motor skills (drawing, tracing), and socio-emotional domains (story recall, peer interaction).

Reliability Internal consistency of scales will be measured using Cronbach's alpha, with a target threshold of 0.78, 0.72 and 0.85, respectively. Scoring was assessed using Cohen's kappa or intraclass correlation coefficients, targeting values of 0.75. Data analysis was conducted with the use of descriptive statistics (frequency, means and standard deviations). Inferential statistics of t-tests, Pearson correlation, and multiple regressions at the 0.05 level of significance was used for the study.

Results

Descriptive Statistics

Table 1: Demographic Characteristics of Respondents (Teachers and Parents)

Variable	Category	Frequency	Percentage (%)
Teacher Qualification	NCE/Diploma	14	38.9
	B.Ed/B.Sc. + PGDE	17	47.2
	M.Ed	5	13.9
Parent Education	Primary/Secondary	28	38.9
	Tertiary	44	61.1
School Type	Public	18	50.0
	Private	18	50.0

Table 1 above depicts demographic characteristics of the respondents for the teacher qualifications; 47.2% were the majority of the respondents who has B.Ed/B.Sc/PGDE qualification, 38.9% were having NCE/Diploma qualification while 13.9% were having M.Ed certification. For the Parent Education; majority of the respondents are 61.1% have tertiary education, and 38.9% have primary/secondary education. For the school type; both public and private school have 50% each.

H₀1: There is no significant relationship between the use of digital tools, devices, and interactive media and preschool children's learning outcomes in Lagos State.

Table 4.2: Independent Samples t-Test of Learning Outcomes by School Type

School Type	N	Mean	SD	t	df	p-value
Public	171	72.45	9.84	-7.15	340	0.000
Private	171	80.19	8.95			

Table 2 shows that private school children scored significantly higher on learning outcomes than their public school counterparts ($p < 0.001$).

H₀2: There is no significant relationship between the use of digital tools, devices, and interactive media and preschool children's learning outcomes in Lagos State.

Table 4.3 Pearson Correlation between Digital Tool Use and Learning Outcomes

Variable	Learning Outcomes (r)	p-value
Frequency of Device Use	0.42	0.000***
Availability of Tools	0.35	0.001**
Interactive Media Score	0.53	0.000***

Table above shows that there is a strong positive relationship between interactive media engagement and children's learning outcomes ($r = 0.53$, $p < 0.001$).

H₀3: Teacher qualifications and parental education levels have no significant moderating effect on the relationship between digital media use and preschool children's learning outcomes.

Table 4.4 Multiple Regression Predicting Learning Outcomes

Predictor Variable	B	SE B	Beta	t	p-value
Frequency of Device Use	1.25	0.41	0.18	3.05	0.002**
Availability of Tools	1.68	0.52	0.21	3.23	0.001**
Interactive Media Score	0.49	0.08	0.41	6.13	0.000***
Parent Education Level	2.10	0.87	0.14	2.41	0.016*
Teacher Qualification	0.85	0.69	0.07	1.23	0.221

Model Summary: $R^2 = 0.41$, $F(5, 336) = 46.88$, $p < 0.001$.

Discussion of Findings

The descriptive analysis revealed that while most preschools possessed some digital tools and devices, there was variation in frequency of use across schools. Private preschools demonstrated greater access to interactive whiteboards, tablets, and digital learning applications compared to public preschools. This finding aligns with prior studies (e.g., UNESCO, 2022; Adeyemi & Alabi, 2021), which highlight the digital divide between private and public educational institutions in Nigeria. The disparity suggests that access remains a critical factor in ensuring equitable learning opportunities.

The independent samples t-test indicated that children in private preschools significantly outperformed their counterparts in public preschools. Qualitative insights from teachers and parents attributed this gap to better infrastructure, more consistent device use, and greater parental involvement in digital learning at home. This finding reflects earlier research by Okeke (2020) that emphasised structural inequalities in Nigeria's educational system. It also highlights the risk of deepening educational disparities if digital learning resources remain unevenly distributed. Thus, the null hypothesis 1 was rejected, establishing that the type of school significantly influences the impact of digital media on learning outcomes.

The results of correlation and regression analyses showed a significant positive relationship between interactive media engagement and preschool children's learning outcomes. Among the predictors, interactive media had the strongest influence on literacy, numeracy, and socio-emotional development. This supports the constructivist view of learning, which posits that interactive and engaging environments enhance children's cognitive growth. It also corroborates findings by Plowman and McPake (2019), who reported that interactive media promotes active learning, problem-solving, and creativity in early childhood education. The rejection of the null hypothesis 2 confirms that digital tools, devices, and interactive media play a measurable role in enhancing preschool learning outcomes.

Regression analysis revealed that teacher qualifications did not significantly predict children's learning outcomes, while parental education levels showed a modest but significant effect. Parents with higher education levels were more likely to provide digital learning resources at home and to supervise children's digital use. This partially supports earlier work by Livingstone and Blum-Ross (2020), who stressed the role of “parental mediation” in children's digital experiences. However, the non-significant role of teacher qualifications suggests that access and institutional resources may outweigh teacher credentials in shaping children's outcomes. Hence, the null hypothesis (H_{03}) was partially rejected, with parental education emerging as a relevant factor but teacher qualifications not showing a significant effect.

Conclusion

The conclusions are based on the findings discussed in the preceding chapter. Furthermore, actionable recommendations are provided for policymakers, educators, parents, and future researchers to enhance the role of digital media in early childhood education. Digital tools and devices are present in many preschools, but their availability and frequency of use differ markedly between public and private schools. Private preschools enjoy greater access and more consistent integration of digital tools than public preschools. The use of digital tools, particularly interactive media, has a significant positive influence on preschool children's learning outcomes. Children exposed to interactive media demonstrated higher performance in literacy, numeracy, and socio-emotional domains. A significant disparity exists between public and private preschools, with private school children outperforming their public school peers due to better access to digital resources and greater parental involvement.

Parental education level was found to significantly influence children's digital learning experiences, while teacher qualification showed a limited effect. This highlights the importance of the home environment in reinforcing school-based learning. Teachers and parents generally perceive digital tools and media as beneficial for enhancing engagement, creativity, and skill development. However, they also identified challenges, including limited resources, lack of teacher training, concerns about screen time, and unequal access.

Recommendations

In light of the conclusions, the following recommendations are proposed:

- i. Teacher professional development programs should include mandatory training on the integration of digital tools and interactive media in early childhood pedagogy.

- ii. Schools should adopt blended learning approaches, where digital resources complement traditional play-based and face-to-face learning strategies.
- iii. Parents should be sensitised on the importance of supervised digital use, ensuring that children engage with educational rather than purely recreational content.
- iv. Awareness programs should be organised to guide parents on striking a balance between screen time and traditional play activities.
- v. The Lagos State Government should invest in equipping public preschools with adequate digital infrastructure, including tablets, interactive whiteboards, and internet access.

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