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Gender Disparities in The Utilization of Digital Technology Among Science Teachers in Lagos State Secondary Schools

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Abstract

This research explored the differences in digital technology usage among science teachers in secondary schools in Lagos State, focusing on gender disparities. A descriptive survey method was employed, utilizing a multistage sampling technique to purposively select 200 science teachers from the six educational districts of Lagos State. A questionnaire designed by the researcher was used as the primary tool to investigate gender disparities in digital technology utilization among science teachers. The reliability coefficient of the instrument was 0.78. Descriptive statistics were used to present demographic data, and mean values were applied to address the research questions. The hypotheses were tested using a T-test at a 0.05 significance level. The results indicated a significant difference in the use of digital technology among science teachers based on gender. Furthermore, the findings highlighted that digital technology enhances the effectiveness of science teachers by fostering creativity and innovation in their teaching practices. However, science teachers also encountered challenges when utilizing digital technology. The study underscored the importance of gender-specific attitudes and perceptions in influencing teachers' decisions on technology integration. It was recommended that policies and guidelines should be developed to promote gender equity in the use of technology in schools, which, in turn, could lead to greater student motivation and independence.

Key Terms: *Gender, Digital Technology; Science Teachers; Secondary Schools,Utilization*

Introduction

Digital technology has revolutionized traditional teaching and learning methods, creating new environments and instructional modalities for the educational community. Successful integration of these technologies into teaching and learning requires teachers to adapt their attitudes and teaching paradigms. This transition compels educators to embrace new methodologies, educational concepts, and management approaches within technology-rich environments. According to Kaminskienė, et. al., (2022), digital technologies refer to the computer and network-enabled transfer of skills and knowledge. Consequently, there is an increasing need for teachers to incorporate technology into their everyday teaching practices.

Technology adoption refers to the acceptance, integration, and usage of new technologies by individuals or organizations. Carr (in Selwyn, 2021), defined technology adoption as the process by which a technology is selected for use. This process begins when individuals become aware of the technology and ends with its full acceptance and usage. Qazi, et. al., (2022) emphasized that technology adoption is inherently social and complex, influenced by unique perceptions and requiring attention to cognitive, emotional, and contextual factors. The Technology Adoption Model (TAM) developed by Davis (1989) focuses on two primary constructs—perceived usefulness and perceived ease of use—as key predictors of technology adoption at the individual level (Selwyn, (2021)

In the realm of education, digital technology encompasses a range of tools such as web-based learning, computer-based learning, virtual classrooms, and digital collaboration platforms. These technologies can be delivered in a self-paced manner or through instructor-led formats and utilize various media, including text, images, animations, video, and audio. Particularly in science education, the integration of these digital advancements fosters curiosity, critical thinking, and a deeper understanding of the natural world (Nguyen et al., 2020). The Eurydice European Unit (2021) highlights that science education is vital for navigating an increasingly digital landscape, helping students grasp the intricate relationship between humanity and nature while recognizing the finite nature of our natural resources.

Research indicates that incorporating digital tools into science education cultivates dynamic learning environments that encourage active student participation (Mouli & Saroja, 2023). Furthermore, studies show that technology-infused classrooms can lead to improvements in academic achievement, attendance, and behavior among students (Mridha, 2019). Technology

enables students to engage in complex problem-solving and advanced reasoning tasks (Balalle, 2024). However, due to the disparities present within Nigeria's educational system, a thorough investigation is required to ascertain whether these positive outcomes are replicable in this context. While there is a prevailing belief that technology use in classrooms enhances learning, its effectiveness is contingent upon its application, the individuals utilizing it, and the objectives pursued. Teacher adoption of technology varies significantly, with some educators incorporating it extensively while others may seldom use it. Motivations for adopting technology among teachers include the desire to organize lessons more effectively, enhance student engagement, save time, and navigate physical challenges such as writing on whiteboards (Ertmer & Ottenbreit-Leftwich, 2013). Despite these motivations, the overarching expectation is that technology will improve learning outcomes by engaging students and facilitating more effective information absorption.

However, several sociocultural factors can impede digital technology adoption and effective use, including age, gender, social class, mobility, geographical location, language, and literacy (Xiao, et. al., 2024). Culturally responsive approaches are essential in integrating ICT, as local cultures and traditions significantly influence knowledge creation and interpretation (Oppenneer, 2021). In many African contexts, individuals often prefer peer consultation for information over utilizing libraries or online resources.

Of particular concern is the impact of gender on technology adoption in education. Research indicates persistent gender disparities in access to and utilization of digital technology, reflecting broader societal inequities (Sunley, 2020). Hilbert, (2020) argued that ICT has exacerbated the digital divide, particularly between males and females, a view supported by more recent findings that indicate similar trends (Osborn, 2021). In Nigeria, these disparities are further intensified by linguistic factors, socioeconomic conditions, and urban biases in internet access (Osborn, 2021). Understanding these gender-based differences in technology utilization is crucial for fostering equitable educational environments.

Given the significance of gender dynamics in technology adoption, it is imperative to investigate the extent of gender disparities in the integration of digital technology among science teachers in Lagos State secondary schools. This research aims to explore these disparities, examining the factors influencing technology adoption and its impact on teaching effectiveness. By identifying barriers and promoting equitable access to technology, educators can leverage digital tools to enhance science education and foster gender equity in technology utilization.

Research Objectives

1. To evaluate the impact of digital technology utilization on teaching effectiveness in science education among secondary school teachers in Lagos State.
2. To examine gender-based differences in the utilization of digital technology among science teachers in Lagos State secondary schools.
3. To identify the challenges faced by science teachers in Lagos State secondary schools when utilizing digital technology for teaching.

Research Questions

1. How does the utilization of digital technology impact teaching effectiveness in science education among secondary school teachers in Lagos State?
2. What gender-based differences exist in the utilization of digital technology among science teachers in Lagos State secondary schools?
3. What challenges do science teachers encounter in Lagos State secondary schools when utilizing digital technology for teaching?

$H0_1$: There is no significant difference in the utilization of digital technology between male and female science teachers in Lagos State secondary schools.

Methodology

This study examined gender disparities in the use of digital technology among science teachers in secondary schools across Lagos State. The research employed a descriptive survey design, which is effective for describing, exploring, and interpreting events or ideas as they occur without manipulation. A survey method was chosen for this study because it allows for the collection of substantial data on the beliefs, values, and activities related to digital technology use and its impact on the teaching effectiveness of science teachers in secondary schools in Lagos State. The target population comprised all science teachers in Lagos State's six educational districts: Agege, Maryland, Lagos Island, Mainland, Festac, and Ikeja. The focus was on teachers of core science subjects such as physics, chemistry, and biology. A multistage sampling technique was applied,

with all six educational districts purposively selected. From each district, public senior secondary schools were randomly chosen. Within these schools, science teachers were randomly selected to participate.

A total of 200 science teachers were selected for the study, and 160 completed and returned the questionnaire, which was considered valid for analysis. The research instrument was a questionnaire developed by the researcher titled "Gender Disparities in the Utilization of Digital Technology Among Science Teachers in Lagos State Secondary Schools." The questionnaire consisted of two sections: Section A gathered demographic information, while Section B contained items relating to gender disparities in digital technology usage among science teachers. Responses were measured using a Likert scale ranging from Strongly Agree (SA) = 4 to Strongly Disagree (SD) = 1. Respondents participated voluntarily, and their responses were kept confidential. Statistical methods employed included descriptive analysis (percentage and mean) to address the research questions and inferential analysis (t-test) to test the null hypotheses based on gender. Additionally, graphical representations were used to visualize the distribution of respondents.

Respondents Demographic Data

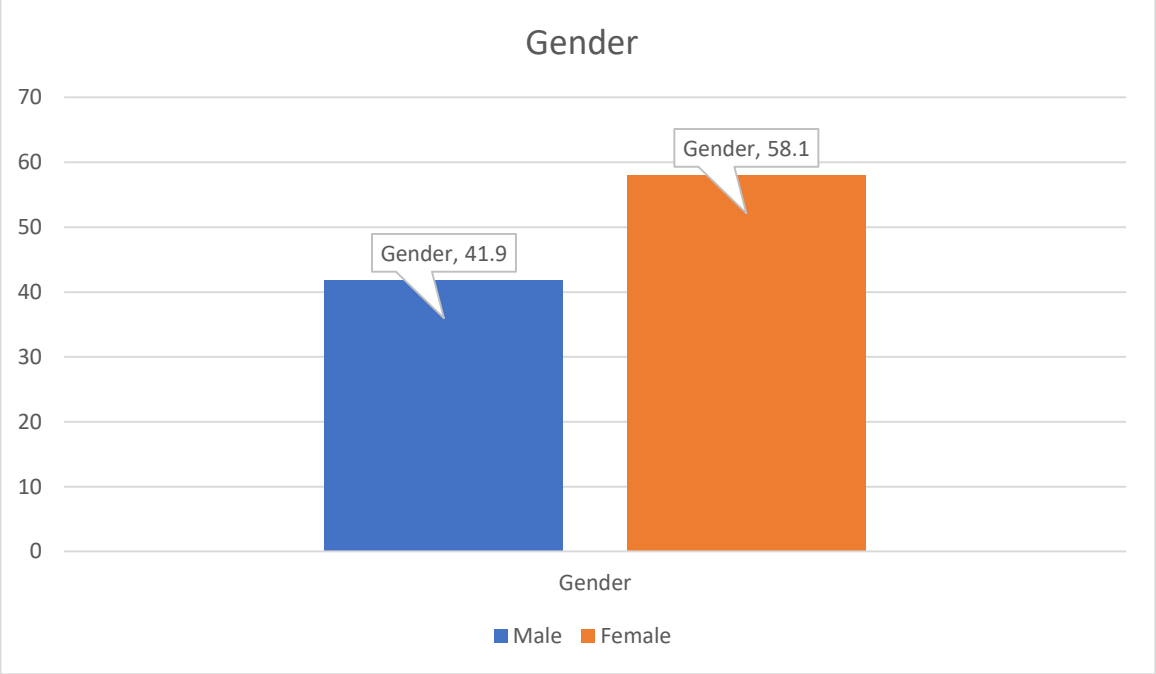

Figure 1: Percentage Distribution of Respondents by Gender

Figure 1 reveals that 093 (58.13%) of the respondents are female, while 067 (41.87%) of the respondents are male.

Results

Research Question 1: How does the utilization of digital technology impact teaching effectiveness in science education among secondary school teachers in Lagos State?

Table 1: Effect of Using Digital Technology on Teachers' Effectiveness

No	Items	Mean	SD	Decision
1.	ICT enables me to enhance creativity and innovation in my teaching practices.	3.14	0.92	Acceptable
2.	Utilizing ICT facilitates access to relevant knowledge and information for instructional purposes	3.18	0.91	Acceptable
3.	I believe that incorporating ICT expands students' learning potential.	3.56	0.98	Acceptable
4.	The integration of ICT fosters interactive and engaging lessons, improving the overall teaching experience.	2.89	0.82	Not Acceptable
5.	The application of digital technology significantly enhances my teaching efficiency.	3.26	0.44	Acceptable
	Average mean	3.21		Acceptable

Table 1 presents the findings on the effect of using digital technology on teachers' effectiveness, reflecting the perceptions of science teachers regarding the impact of information and communication technology (ICT) in their teaching practices. The responses reveal a generally positive outlook among teachers, indicating that digital technology plays a significant role in enhancing their effectiveness. The first item, which states that ICT enables teachers to enhance creativity and innovation in their teaching practices, received a mean score of 3.14. This suggests that teachers believe ICT contributes positively to their ability to be creative and innovative in their approach to teaching.

The second item focuses on the facilitation of access to relevant knowledge and information for instructional purposes through the use of ICT, garnering a mean rating of 3.18. This positive score reflects the teachers' perception that digital technology aids them in locating and utilizing relevant information to support their teaching. In terms of student learning potential, the third item received the highest mean score of 3.56, indicating a strong consensus among teachers that incorporating ICT significantly expands students' learning opportunities. Conversely, the fourth item, which examines whether the integration of ICT fosters interactive and engaging lessons, scored the lowest with a mean of 2.89. This suggests that teachers may perceive a lesser impact of ICT on lesson interactivity and engagement compared to other aspects. Lastly, the fifth item addresses the impact of digital technology on teaching efficiency, receiving a mean score of 3.26. This indicates that teachers generally believe that applying digital technology significantly enhances their efficiency in teaching.

Overall, the average mean score of 3.21 across all items suggests that science teachers in Lagos State hold a predominantly positive view of the role of digital technology in enhancing their teaching effectiveness. This score, being above the midpoint of 2.50, reinforces the notion that teachers believe ICT is beneficial in their teaching practices. However, the findings also highlight areas, such as lesson interactivity, where improvements may be needed to fully realise the potential of digital technology in the classroom.

Research Question 2: What gender-based differences exist in the utilization of digital technology among science teachers in Lagos State secondary schools?

Table 2: Gender-Based Differences in The Utilization of Digital Technology

No	Items	Male (Mean)	Female (Mean)
1	ICT enables me to enhance creativity and innovation in my teaching practices.	3.21	3.13
2	Utilizing ICT facilitates access to relevant knowledge and information for instructional purposes.	3.12	2.97
3	I believe that incorporating ICT expands students' learning potential.	2.96	3.08
4	The integration of ICT fosters interactive and engaging lessons, improving the overall teaching experience.	3.09	3.14

5	The application of digital technology significantly enhances my teaching efficiency.	3.78	2.99
	Average mean	3.23	3.06

The table presents the mean responses from male and female science teachers regarding their perceptions of the impact of digital technology on their teaching practices. For the first item, which addresses the enhancement of creativity and innovation through ICT, male teachers reported a mean score of 3.21, slightly higher than the 3.13 mean reported by female teachers. This suggests that male teachers feel more positively about the creative benefits of ICT in their teaching. In terms of accessing relevant knowledge and information, male teachers scored 3.12, while female teachers had a lower mean of 2.97. This indicates that male teachers perceive ICT as more effective for instructional resource access compared to their female counterparts. Interestingly, when considering the expansion of students' learning potential, female teachers had a mean score of 3.08, surpassing the male score of 2.96. This suggests that female teachers believe more strongly in the potential of ICT to enhance student learning.

Regarding the integration of ICT to foster interactive and engaging lessons, male teachers scored 3.09, while female teachers reported a mean of 3.14. This shows that female teachers perceive ICT as slightly more effective in promoting engagement in the classroom. Finally, for the item concerning teaching efficiency, male teachers rated the application of digital technology significantly higher, with a mean score of 3.78 compared to 2.99 for female teachers. This suggests that male teachers feel much more strongly that digital technology enhances their overall teaching efficiency. The average mean scores indicate that male teachers scored 3.23 while female teachers scored 3.06, reflecting a generally positive perception of ICT among both genders, with some variations in specific areas of application.

Research Question 3: What challenges do science teachers encounter in Lagos State secondary schools when utilizing digital technology for teaching?

Table 3: Challenges Faced When Using Digital Technology

No	Items	Mean	SD
1	There is no digital technology provision in this school.	3.31	0.46

2	The government organises special training sessions for the use of technology	3.27	0.40
3	I don't have adequate skills in the usage of digital technology.	3.52	0.50
4	Lack of electricity could not allow my phone and system to charge as expected.	3.04	0.21
5	Mobile data subscriptions all the time is my main issue when I need access to digital technology.	3.26	0.44
6	I lack interest in the usage of digital technology.	1.74	0.42
7	I may not have the time to cater for students' needs if ICT is used in teaching.	3.10	0.30
8	I think the use of ICT in teaching is a waste of time.	1.59	0.49
9	here are no training sessions, workshops, or seminars on how to use instructional media	3.63	0.32
	Average Mean	2.94	

Table 3 presents the challenges faced by respondents when using digital technology, as indicated by their mean scores. The data shows that a notable issue is the lack of adequate skills in using digital technology, which received the highest mean score of 3.52. Additionally, respondents expressed concerns about the absence of digital technology provision in their schools and the lack of training opportunities, with mean scores of 3.31 and 3.63, respectively. Other challenges include reliance on mobile data subscriptions and inadequate electricity supply, which scored 3.26 and 3.04, respectively. Interestingly, the lack of interest in using digital technology and the perception that ICT in teaching is a waste of time received the lowest scores, at 1.74 and 1.59, respectively. Overall, the average mean score of 2.94 suggests that while there are significant challenges in using digital technology, issues like skill deficiencies and inadequate resources are more pressing concerns.

$H0_1$: There is no significant difference in the utilisation of digital technology between male and female science teachers in Lagos State secondary schools.

Table 4: Utilisation of Digital Technology by Science Teachers According to Gender.

Gender	No	$\overline{X}$	SD	Df	Z	Sig

Male	67	17.61	0.98				
						6.75	0.00
				158			
Female	93	14.81	3.83				

Table 4 presents the utilization of digital technology among science teachers, differentiated by gender. The data indicates that male science teachers have a mean score of 17.61 with a standard deviation of 0.98, while female teachers have a mean score of 14.81 with a standard deviation of 3.83. The degrees of freedom (df) for this analysis are 158, with a z-value of 6.75 and a significance level (Sig) of 0.00. This suggests a statistically significant difference in the utilisation of digital technology between male and female science teachers, with males demonstrating higher usage.

Discussion of Findings

The findings of this study provide valuable insights into the utilization of digital technology among science teachers in Lagos State secondary schools, with a specific focus on gender disparities. The research revealed a significant difference in the use of digital technology based on the gender of science teachers (Smith et al., 2020), highlighting the importance of considering gender dynamics when examining technology integration practices among educators. In today's digital age, possessing adequate digital literacy competence is essential for effectively processing information into knowledge and applying it in both professional and everyday contexts (Ertmer et. al., 2013). Interestingly, the study found that male and female science teachers exhibited varying levels of digital literacy competence and utilization. While some gender differences may stem from societal norms and expectations, it is evident that addressing these disparities is crucial for ensuring equitable access to digital resources and enhancing teaching effectiveness in science education.

Moreover, attitudes towards computers in education were found to significantly influence teachers' technologically innovative methods and classroom use of computers (Inan & Lowther, 2010). Gender-specific attitudes and perceptions towards technology may contribute to differences in technology integration practices among science teachers. For example, male teachers may be more

inclined to adopt and experiment with new technologies, while female teachers may approach technology integration more cautiously. Individual preferences, attitudes, and perceptions also played a crucial role in shaping teachers' choices regarding technology utilization, highlighting the need for targeted interventions to address gender-specific barriers and challenges (Taherdoost, 2023). Understanding these gender dynamics is essential for developing inclusive strategies to promote equitable access to digital resources and support effective technology integration practices among science teachers. In summary, the findings underscore the importance of considering gender disparities in technology utilization among science teachers in Lagos State secondary schools. "Addressing these disparities and providing tailored support and training can help bridge the gender gap in digital technology integration and enhance teaching effectiveness in science education."

Conclusions

In conclusion, this study highlights the significant gender disparities in the utilization of digital technology among science teachers in Lagos State secondary schools. The findings underscore the need to address these disparities to ensure equitable access to digital resources and enhance teaching effectiveness in science education. Gender-specific attitudes and perceptions towards technology play a crucial role in shaping teachers' choices regarding technology integration. Understanding and addressing these barriers are essential for promoting inclusive practices and improving student learning outcomes. Moving forward, targeted interventions and tailored support are needed to bridge the gender gap in digital technology integration among science teachers. By fostering a supportive environment for technology adoption, educators can create a more equitable learning environment for all students in the Lagos State secondary schools.

Recommendations

Based on the findings of this study, several recommendations can be proposed to tackle gender disparities in the use of digital technology among science teachers in secondary schools across Lagos State:

1. Implement training programs that are tailored to address the specific needs and preferences of male and female science teachers regarding digital technology integration.
2. Develop policies and guidelines that promote gender equity in technology utilization within schools.
3. Provide ongoing professional development opportunities that focus on enhancing technology integration skills and strategies for science teachers.
4. Create opportunities for male and female science teachers to collaborate and share their experiences with digital technology integration.
5. Incorporate digital technologies in ways that appeal to both male and female students and highlight the relevance of technology in science education.

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