



Digital Technological Tools for Science Classrooms: Availability and Use for Teaching Effectiveness in Senior Secondary Schools

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Abstract

This research work assessed the availability and use of digital technology on teaching effectiveness of secondary school science teachers in Lagos State. It adopted a descriptive survey approach where multistage sampling techniques were used to purposively select 200 science teachers. One hypothesis was tested and answered accordingly and was rejected. The scope of the study was within the confinement of the six (6) educational districts of Lagos State. A researcher-designed questionnaire that intended to reflect the impact of digital technology on science teachers teaching effectiveness based on gender was used as the research instrument. The reliability coefficient of 0.78 was obtained. A descriptive analysis was used to explain the demographic data and the use of means was considered to answer research questions while inferential statistics of T-test was used to test the hypothesis at 0.05 significant levels. The results revealed that there was a significant difference in the use of digital technology by science teachers in Lagos State secondary schools based on science teachers' gender. These findings recommended among others that the government should engage science teachers in rigorous trainings in order to be adept with digital technology and science teachers should allow students to become more motivated, more active and independent as they choose to be very intentional in using digital technology to teach them their science classes.

Keywords: Digital Technological; Tools; Science; Classrooms; Availability; Use; Teaching Effectiveness; Senior Secondary Schools

INTRODUCTION

Teachers are the main agents of educational change, helping students adopt a modified way of living to make them relevant to themselves, their communities, and the wider world. As a result, they must encourage successful innovation and adjust to new teaching methods that the students can follow for efficient learning. To make learning engaging and academically relevant in the twenty-first century, teachers must integrate traditional teaching strategies with digital technologies. The emergence of innovations

and technological advancements cannot be ignored by the educational system in this era of knowledge explosion. According to Glenda (2006), instructors that incorporate technology into the classroom not only inspire their kids to learn, but also aid them in developing important skills.

According to Sanni (2019), our educational system should never be taken lightly because it acts as a catalyst for several developments and improvements that are necessary to meet the goals established for Nigeria's prosperity. Intentional integration and advancement of science and technology at all educational levels, from basic school through tertiary institutions, must be one of the goals of the educational system. This will enrich and improve the quality of life for the populace.

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He further maintained that it will surely be a great beginning when Nigeria's learning environments are well equipped with technology resources like smart boards, functional computer laboratories and internet access – this will by all means help the students in their academic, vocational, and personal goals in life endeavours.

Every country develops its own system of education which undergoes transformation to meet the challenges of the changing times. For instance, Nigeria uses 6-3-3-4 educational system with a constant crusade that teaching methodology should be student centred for training where students learn for themselves and actively engaged in hands-on-learning. Out of all the educational levels, secondary school education serves as a link between the primary school and higher education for an individual. New teaching and learning environments and instructional modalities have been developed for the educational community as a result of the disruption caused by digital technology to traditional approaches to teaching and learning. Teachers' attitudes and teaching paradigms must shift in order for new technology to be successfully incorporated into the teaching and learning processes. They will be forced by these changes to adjust to new managerial practices, instructional conceptions, and methodological approaches—all of which must be implemented in contexts where technology is prevalent. The transmission of skills and knowledge made possible by computers and networks is fundamentally what these digital technologies are (Selamat, 2015). As a result, teachers must incorporate technology into the way they instruct pupils on a daily basis.

The term "technology adoption" describes how new technology is embraced, integrated, and used in society. Technology adoption was described by Carr (1999), quoted by Sharma and Mishra (2014), as the phase of choosing a technology for use by a person or a company.

Web-based learning, computer-based learning, virtual classroom opportunities, and digital collaboration are all examples of digital classroom applications and procedures. Content is provided via the internet, intranet or extranet, audio or video tape, satellite TV, and CD-ROM. It comprises media in the form of text, image, animation, streaming video, and audio and can be taken at one's own pace or under an instructor's guidance. Science fosters

inquisitiveness, a critical mindset, and provides students with the tools they need to better understand their surroundings.

It sheds light on how people and nature interact and serves as a reminder that natural resources are limited and extremely valuable. All areas of our environment are covered by science. Its products are all around us, from audio players to digital instruments to computers, and we unquestionably need a scientific culture to survive in this rapidly expanding environment (Eurydice European Unit, 2006). Anandan and Gopal (2011) conducted research on the effects of ICT in classroom instruction and found that good instructors who employ creativity in their teaching approach by incorporating technology in the classroom instruction to provide the best for the students are crucial to the quality of education.

Senior secondary schools are not exempt from the impact of technology on academic activities such as teaching, learning, research, and extension activities in universities, colleges, and other institutions. Our daily lives involve the usage of machines, cell phones, televisions, computers, and the internet. We are becoming more and more reliant on technology for everything from entertainment to instruction, communication, and transportation. The COVID-19 pandemic that is currently sweeping the globe forced Nigeria to close all academic institutions and businesses in March 2020 is a case in point of this trend. Osborne and Dillion (2008) noted that effective teachers with current knowledge and skills are the cornerstone of any system of formal science education. They also noted that any teaching and learning experience is a synthesis of three components: a curriculum that specifies the objectives and the experiences by which they will be met; a pedagogy that enacts the curriculum; and an assessment system. Early in the school year, decisions are made about scientific classes, frequently before the effects are clear. These choices could have a big impact on future jobs (Munro & Elsom 2000). They continued by stating some additional benefits of science, such as the following: the economy requires a constant supply of highly educated scientific and technological talent, including teachers; everyone must have a basic understanding of the technological devices and processes that surround us at home, at work, and elsewhere;

many employers seek out candidates with science-related skills such as data handling, analysis, problem-solving, and IT.

During this pandemic's existence, the entire world has made greater use of technology innovation, allowing institutions with the necessary infrastructure to conduct teaching and learning over the internet. Due to the government's lockdown order, the government of Nigeria has moved educational activities to radio and television stations. As a result, many organizations have switched to a new model of working from home. People use digital technologies like the Zoom application, Telegram, Google Classroom, Loom, Free Conference Call app, House party, podcast, YouTube, Facebook Live, and WhatsApp. Because students constantly seek out new knowledge to satisfy their level of interest, our educational system is forced to use a variety of technological instruments in all sectors, including academic, administrative, and research. In order to satisfy contemporary students who may otherwise have difficulties adjusting to the requirements of the new information age, teachers must inevitably adapt their teaching methods to follow those that involve the transfer of pedagogy from the traditional approach to electronic (completely online) or computer assisted classrooms (courses supported in any way by computer technology) (Guvén & Sulun, 2012). Data from WAEC in 2017 indicated that problems with students' subpar academic performance in science are still present. Due to teachers' inability to incorporate information and communication technology (ICT) and multimedia learning materials into their teaching-learning process, student performance in biology, physics, and chemistry has been falling over time (Balogun, 2019)

Despite the availability of various digital technology platforms, instructional media have been underutilized as a result of teachers' attitudes regarding their utilization. For science teachers to be ready to meet the

difficulties of these advancements, they must keep up with the explosion of knowledge and the rapidly changing role of ICT. So, the purpose of this study is to examine the digital tools that science instructors in secondary schools in Lagos State can use.

PURPOSE OF THE STUDY

The purpose of this study was to assess the available digital technology usage on the teaching effectiveness of secondary school science teachers in Lagos State. The specific objectives of the study were to determine:

1. The available digital technology platforms and the most frequently used by secondary schools' science teachers in Lagos state.
2. How long science instructors spend per week using digital technology for instruction.
3. The effects of digital technology on teaching effectiveness of science teachers in the secondary school.
4. The effect of digital technology on the teaching effectiveness of secondary school science teachers based on gender.

RESEARCH QUESTIONS

The following research questions were raised for the study:

1. What are the available digital technology platforms and the most frequently used by secondary schools' science teachers in Lagos state?
2. How long do science instructors spend per week using digital technology for instruction?
3. What are the effects of digital technology on teaching effectiveness of secondary school science teachers?
4. What are the effects of digital technology on the teaching effectiveness of secondary school science teachers based on gender?

RESEARCH HYPOTHESES

H₁: There is no significant effect of digital technology on the teaching effectiveness of secondary school science teachers based on gender.

RESEARCH METHODOLOGY

The study uses a survey-style descriptive methodology. An event or concept is described, discovered, and interpreted using a descriptive method without the use of outside manipulation. The survey method was used for this study because it enables the researcher to get a lot of data regarding secondary school science instructors in Lagos State's secondary schools' attitudes about, and usage of, digital technology. The researcher might use the survey to examine how digital technology has affected the effectiveness of science teachers in Lagos State secondary schools. All of the scientific teachers in the six educational districts of Lagos State (Agege, Maryland, Lagos Island, Mainland, FESTAC, and Ikeja) comprised the study's target group. Teachers of the three pure sciences—physics, chemistry, and biology—make up the population. For this investigation, a multi-stage sampling technique was adopted. The study's six educational districts were all specifically

chosen. Senior secondary schools were chosen at random from public secondary schools in the districts. For the study, 200 science teachers in total were chosen at random. The data for this study were gathered using a researcher-designed questionnaire titled "availability and usage of digital technology on teaching efficacy of scientific teachers." Sections A and B make up the instrument. The "respondents' bio-data information" is required for Section A. Articles addressing the effects of digital technology on science instructors' ability to teach in senior secondary schools in Lagos State were found under Section B. Experts verified the instrument to make sure it was relevant to the study and that the language was clear. Their comments and ideas were recorded and incorporated into the instrument's final draft.

By giving the survey to science teachers who weren't involved in the study, the reliability of the questionnaire utilized in this study was increased. Cronbach Alpha was used to calculate the instrument's dependability coefficient, which came out to be 0.78. Figure 1 reveals that 093 (58.13%) of the respondents are female, while 067 (41.87%) of the respondents are male.

DATA ANALYSIS AND RESULT

Respondents Demographic Data

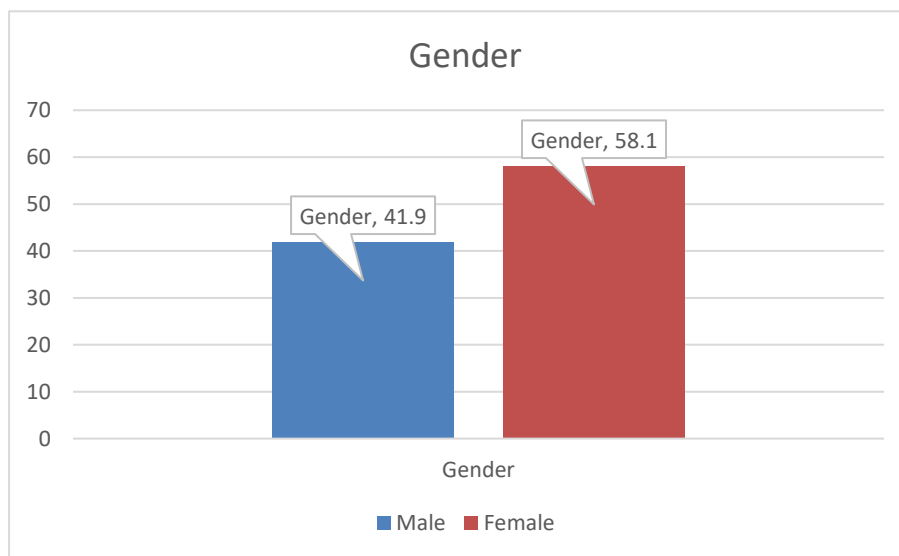


Figure 1. Percentage Distribution of Respondents by Gender.

1. Which of the available digital technology platforms are frequently used by science teachers in Lagos state secondary schools?

infrequent use, and 19.4%, 68.1% for frequent use, Zoom and Facebook are respectively. With percentages of 71.9%, 83.8%, and 75.6%, telegraph, WhatsApp, and free conference calls came in second and third, respectively. Research demonstrates that science professors in Lagos State secondary schools use WhatsApp the most.

According to Table 1a, the percentages of teachers using Google Meet and Google Classroom, respectively, are 46.9%, 52.8% for rarely used and 46.0%, 34.4% for commonly used. With percentages of 71.3%, 31.9% for

Table 1a. Digital technology platforms used by science teachers.

S/N	Available Platform	Never been Used (%)	Occasionally Used (%)	Seldom Used (%)	Frequently Used (%)
1	Google Meet	0.0	7.2	46.9	46.0
2	Google Classroom	4.4	8.8	52.8	34.4
3	Zoom	4.4	85.0	71.3	19.4
4	Facebook Live or Facebook Page	0.0	0.0	31.9	68.1
5	Telegram	0.0	0.0	28.1	71.9
6	WhatsApp	0.0	0.0	16.3	83.8
7	Free Conference Call	0.0	0.0	24.4	75.6

Table 1b. Digital technology usage among the respondents in hours.

Hours	Frequency	Percent
0-5hrs	8	5.0
6-10hrs	16	10.0
11-15hrs	28	17.5
16-20hrs	108	67.5
Total	160	100.0

Table 1b shows that 8 (5.0%) of the respondents use digital technology for 0–5 hours, 16 (10.0%), 28 (17.5%), and 6–10 hours, 6–11 hours, and 16–20 hours, respectively, whereas 108 (67.5%) of the respondents use digital technology for 16–20 hours. This means

that science instructors spend close to 16 hours each week using digital technology.

2. What is the effect of using digital technology by science teachers in Lagos state secondary schools?

Table 2. Effect of using digital technology on teacher’s effectiveness.

No	Items	Mean	SD
1	ICT allows me to be more creative and imaginative in my teaching profession.	3.14	0.92
2	The use of ICT helps me to find related knowledge and information for learning.	3.18	0.91
3	I believe that the use of ICT helps to broaden students’ knowledge capacities.	3.56	0.98
4	The use of ICT promotes active and engaging lesson for a better teaching experience.	2.89	0.82
5	The usage of digital technology helps my teaching effectiveness.	3.26	0.44
Average mean		3.21	

Table 2 demonstrates that the use of ICT allows science instructors to be more creative and imaginative in their teaching profession, which increases their effectiveness. 3.14: They can find relevant knowledge and information for learning thanks to the use of ICT. 3.18 ICT use broadens students' knowledge capacity. 3.56 For a better teaching experience, ICT utilization encourages dynamic and engaging lessons. 2.89. The median score is 3.21 on average,

which is higher than the benchmark of 2.50. i.e., that ICT use makes science teachers effective because it enables them to be more inventive and creative in their teaching.

3. Is there any difference between the effects of digital technology on teaching effectiveness of science teachers in Lagos State secondary schools based on gender?

Table 3.

No	Items	Male (Mean)	Female (Mean)
1	ICT allows me to be more creative and imaginative in my teaching profession.	3.21	3.13
2	The use of ICT helps me to find related knowledge and information for learning.	3.12	2.97
3	I believe that the use of ICT helps to broaden students' knowledge capacities.	2.96	3.08
4	The use of ICT promotes active and engaging lesson for a better teaching experience.	3.09	3.14
5	The usage of digital technology helps my teaching effectiveness.	3.78	2.99
Average mean		3.23	3.06

The gender-based mean responses for items 1 through 5 were shown in Table 3. The mean score for ICT is 3.21 for men and 3.13 for women, which indicates that ICT enables me to be more creative and imaginative in my teaching career. I believe that the use of ICT helps to extend students' knowledge capacities with a mean rating of 2.96 for males and 3.08 for females. The use of ICT helps me find relevant knowledge and information for learning with a mean rating of 3.12 for males and 2.97 for females. Also, ICT use encourages dynamic and interesting lessons for a better learning

experience, as indicated by mean ratings of 3.09 and 3.14, and ICT use enhances my ability to teach effectively, as indicated by mean ratings of 3.78 for men and 2.99 for women. This demonstrates that there was gender-based differences in how digital technology affected science teachers' ability to teach.

H0₁: There is no significant difference between the effects of digital technology on the teaching effectiveness of secondary school science teachers based on gender.

Table 4. Effect of digital technology on science teachers based on gender.

Gender	No	\bar{X}	SD	df	T	Sig,
Male	67	17.61	0.98	158	5.62	0.00
Female	93	14.81	3.83			

According to Table 4, $t(158) = 5.62$, and $p = 0.00$. That is the outcome of a 5.62 t-value that has a 0.00 significance value less than a 0.05 alpha level. This implies that the null hypothesis—that there is no appreciable

difference in the impact of digital technology on the effectiveness of science teachers' instruction in Lagos State secondary schools—was rejected.

SUMMARY OF FINDINGS

The findings of this study are therefore summarized as follows:

1. Based on the findings of the study, WhatsApp is the most frequently used platform by science teachers in Lagos state secondary schools.
2. science teacher's uses digital technology close to 16 hours.
3. the use of digital technology makes science teachers effective as ICT allows them to be more creative and imaginative in their teaching profession.
4. the effect of digital technology on the teaching effectiveness of science teachers is gender positive towards the male science teachers
5. There is no significant difference in the effect of digital technology on the teaching effectiveness of science teachers in Lagos State secondary schools based on gender was rejected.

CONCLUSION

So, it can be said that scientific teachers have easy access to and make excellent use of digital technological tools. WhatsApp is also the digital technology tool that science professors in Lagos State use the most frequently. The use of digital tools by science instructors, however, reveals that male science instructors use digital tools more frequently than female science instructors.

RECOMMENDATIONS

Based on the finding of this study the following recommendations are suggested:

- a. Digital technology resources should be accessible to the students, it must not only be provided only to gather dust where they are kept and unused.
- b. Science teachers should allow students to become more motivated, more active, and independent, and more attentive in their learning process by engaging them with digital technology teachings in the field of science.
- c. The school authority should devise a means to motivate science teachers to effectively use digital technology in their teaching endeavors.

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