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Impact of Digital Technology in Teaching of Science and Mathematics in Secondary Schools for Sustainable National Development

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Abstract
The purpose of this study was to examine the ***impact of digital technology in science and mathematics teaching and learning for sustainable national development at senior secondary school in Oshimili North local government area of Delta State.*** *Two research questions and two hypotheses were raised for the study. The design adopted for the study was descriptive survey. The target population was all the senior secondary schools in Oshimili North* ***local government area of Delta State*** *with a sample size of 160 students which is made up of twenty students each were randomly drawn from each of the nine schools selected for the study.. The instrument used for data collection was a questionnaire. Mean and standard deviation were used to analyze the research questions, while t-test statistics was used in testing the hypotheses. The findings from the study amongst others indicated that: The use of digital technology has drastically improved science and mathematics teaching and learning in educational sector. The study therefore recommended among others that: Digital technology should be used in teaching Mathematics and in the professional development of teachers' training and retraining programme; Government should provide the necessary funds to schools for the purchase of digital technology facilities like computer hardware for effective education delivery; The teacher should use digital resources like apps, social media etc to keep the class informed about activities and upcoming assignments.*

Keywords: *Digital Technology, science, Mathematics, Sustainable National Development*

Introduction

Science and mathematics teaching and learning is greatly being influenced by new technologies which in turn influence school curriculum and practices. As science and mathematics teachers we witness these developing technologies and often wonder whether we are keeping pace with the emerging technologies in teaching and learning. The need for the science and mathematics teacher to ensure quality lesson delivery cannot be overemphasized. One of the fundamental components of the hat.

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United Nations sustainable development goals is quality education.. The experience of the recent COVID-19 pandemic brought to the fore the need for a paradigm shift in our old classroom practices. As we realized during the schools lockdown some schools could conveniently go on while some remained locked down without much activities. The schools that keyed into online lessons were schools that were equipped for that. With that experience digital transformation becomes a global imperative in today's world. The science and mathematics teachers need to understand these technologies as a means of enhancing his lessons and resources and at the same time engage in practices that will provide his students with tools and opportunities to place them in the global map.

The globalization of the world makes it imperative for the science and mathematics teachers and the students to acquire knowledge and skills that will impart on the society and the nation for sustainable development and global competitiveness. There is a strong consensus that digital technology can improve teaching and learning by motivating students with engaging, interactive and fun learning environment. According to Taylor, Fudje Mirriahi, and De Latt, (2021), digital technology offers new avenues of meaningful communication and collaboration between teachers and students. Digital technology in education has to do with introduction of new technology-assisted learning tools such as mobile devices, interactive white boards, smart boards, tablets, laptops, simulations, dynamic visualization and virtual laboratories. Traditional classroom instructions fall short of providing an immediate learning environment, faster evaluations, and more engagement. In contrast, digital learning tools and technology fill this void. With smart phones and other wireless technology devices becoming popular among the general public, it only makes sense that schools and educational institutions make efficient use of them by putting technology in the classroom. According to Haleem, Javaid, Qadri and Suman (2022), integrating technology into education provides students with an engaging learning experience, allowing them to remain more interested in the subject without being distracted. During the pandemic, digital classrooms became the order of the day in order to sustain the education system. Digital classrooms are defined by using electronic devices or platforms such as social media, multimedia and mobile phones to teach students.

With digital technology in education, today's educational landscape has altered for the better. Digital learning is a learning strategy that employs technology to fulfill the entire curriculum and allows students to learn quickly and rapidly. The digital classroom entirely focuses on teaching via the use of technology. Students use technological or internet-connected gadgets like laptops, tablets, chrome books etc. Instead of taking notes on what the teacher has taught, most of the curriculum is

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delivered to students online through an engaging and interactive platform. Digital technology in the classroom refers to various software and gadgets meant to help students with particular accessibility needs. Digital technology means that devices can be more compact, faster, lighter and more versatile. Huge amounts of knowledge can be stored locally or remotely and moved around virtually immediately. Digital learning is any type of learning that uses technology. Digital learning is defined as any instructional practice that effectively uses technology to strengthen students learning experience and encompasses a wide spectrum of tools and practices. Examples of digital media include softwares, digital images, digital video, video games, web pages and websites, social media, digital data and data bases, MP3, electronic documents and electronic books.

Digital Technology is universal in society. There are new demands on educational systems in order to prepare students for further professions (Guo, 2015). The use of digital technology in the mathematics classroom has long been a topic for consideration by mathematics lecturers. Digital technology tools in mathematics include: portable, graphic calculator and computerized graphics, specialized software, programmable toys or floor robots, spreadsheets and databases. Access to technology via personal devices will increase, with the consequence that technology integration into mathematics education, within and outside the classroom, can be easily realized. Students will also have personal technology such as a tablet, a smart watch, a mobile phone or similar with which they are familiar to use mathematical focused applications. These tools are allowing pupils to collect data, and manipulate it using spreadsheets and databases for work in numeracy (Moseley, 2009). The use of digital tools in mathematics speeds up the graphing process, freeing people to analyze and reflect on the relationships between data (Hennessy, 2010). Mathematical specialists software such as Computer Algebra System (CAS), Dynamic Geometry System (DGS), Matrix Laboratory (Mat Lab), Statistical Package for the Social Sciences (SPSS) and so on. With the advent of such technology, the question arises as to what the impact on education and teaching practices should be in order to prepare the next generation of students for future careers (Clark-Wilson, 2015). Digital technology has the ability to assist teachers in improving the study and teaching of mathematics elsewhere. Students' mathematical performance has transformed due to their increased mathematical exposure (Cahyono & Ludwig, 2018). Teachers' greater use of digital materials will create a fresh experience for students learning mathematics, such as guaranteeing students are not bored (Wijaya, Zhou,, Houghton, Weinhandl, Lavicza & Yusop., 2022).

The purchase of new digital technology infrastructures slowed down in pace which made learning atmosphere to be non-conducive for effective learning. Digital technology has the ability to assist teachers in improving the study and teaching of

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science and mathematics elsewhere. Students' mathematical performance has transformed due to their increased mathematical exposure (Cahyono & Ludwig, 2018). Teachers' greater use of digital materials will create a fresh experience for students learning mathematics, such as guaranteeing students are not bored (Wijaya et al., 2022).

Statement of the Problem

The national politics determines the quality of education policies, programmes and processes and eventually the products (results or outcomes). Government's underfunding and commoditization of education is likely to worsen the crisis in digital technology in education. Teachers encounter some challenges in the use of digital technology in science and mathematics teaching and learning. While some of the barriers are extrinsic that is external to the teacher some of the barriers are intrinsic arising from the teacher's attitude, beliefs and knowledge. The external barriers arise mainly from institutional challenges in the acquisition of digital technology equipment. If the school does not provide adequate computers and other digital resources, and lacks fast internet connection it becomes difficult to implement. Challenges internal to the teacher include challenges of inadequate training. Teachers need the skills and knowledge to be able to use technology in teaching, without which they lack the confidence in using it. These had negative effects on teachers and students. Therefore, concerned with this phenomenon, the study was conducted to examine the impact *of digital technology in science and mathematics teaching and learning for sustainable national development at senior secondary school in Oshimili South local government area of Delta State*

Purpose of the Study

The purpose of this study was to examine the impact of *digital technology in science and mathematics teaching and learning for sustainable national development at senior secondary school in Oshimili North local government area of Delta Stat***e.** Specifically the study sought to:

1. Find out the use of digital technologies by science and mathematics teachers *for sustainable national development*.
2. Find out the Challenges encountered in the use of digital technology in science and Mathematics teaching and Learningfor sustainable national development.

Research Questions

The following research questions guided the study;

1. What digital technologies are used by science and mathematics teacher *for sustainable national development?*

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2. What are the challenges of digital technology in science and mathematics teaching and learning *for sustainable national development?*

Hypothesis

The following null and alternative hypotheses were formulated and tested at 0.05 level of significance.

HO1: There is no significant difference between the mean responses scores of male and female teachers on the use of digital technologies by science and mathematics teachersand the challenges encountered by teachers as a result *the use of digital technology in science and mathematics teaching and Learning for sustainable national development.*

HO2: There is significant difference between the mean responses scores of male and female teachers on the use of digital technologies by science and mathematics teachersand the challenges encountered by teachers as a result *the use of digital technology in science and mathematics teaching and learning for sustainable national development.*

Methodology

The study adopted a descriptive survey design, since the opinion of the respondents was collected from the field. The target population was all the all the senior secondary schools in Oshimili North educational zone of Delta State. The sampling technique used for the study comprises of a sample size 160 respondents which is made up of twenty students each were randomly selected from each of the eight schools for the study.The instrument used for data collection was a questionnaire. The respondents were requested to express their opinions on a 4-point modified Likert response scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) with their weight ranging from 4-1 for positively skewed items and vice-versa for negatively skewed items. The instrument was validated by two experts who certified them fit for the study with a reliability coefficient of 0.74. Data collected were analyzed using mean and standard deviations and t-test statistics to test the hypothesis. The results of the study were obtained from the research questions answered through data collected analyzed. Any item with a mean score of 2.50 and above was adjudged to agree, while item with a mean score below 2.50 is adjudged to disagree.

Results

Research Question 1: What digital technologies are used by science and Mathematics teachers for **sustainable national development**?

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Table 1: *Mean and Standard Deviation Results on the Use of Digital Technologies by Science and Mathematics Teachers* ***for Sustainable National Development.***

S/N	ITEM	Mean	SD	Decision
1.	Smart Mobil devices ensure quality lesson delivery	3.60	0.55	Agree
2.	The use of laptops help students in classroom instruction	3.45	0.63	Agree
3.	The use of interactive white boards improve students' learning abilities	3.36	0.72	Agree
4.	Smart board devices provide students with an engaging learning experiences	3.00	0.97	Agree
5.	Dynamic visualization and virtual laboratories are used to improve students' learning abilities	3.20	1.03	Agree
6.	Digital technology tool such as stimulation is used for faster evaluation and engagement	3.15	1.07	Agree
	Grand Mean and Standard Deviation	**3.22**	**0.85**	**Agree**

The results obtained from Table 1 shows that all items were agreed with a grand mean and standard deviation scores of 3.22 and 0.85 respectively. This implies that the use of digital technologies by science and mathematics teachers **for sustainable national development help** to access computer hardware for effective education delivery and Smart board devices provide students with an engaging learning experiences among others in Osimili North Local Government Area of Delta States of Nigeria

Research Question 2: What are the challenges of digital technology in science and mathematics teaching and learning **for sustainable national development**?

Table 2: *Mean and standard Deviation Results on the Challenges Encountered by Teachers* ***in the Use of Digital Technology in Science and Mathematics Teaching and Learning for Sustainable National Development.***

S/N	Item	Mean	SD	Decision
1.	Lacks fast internet connection	3.63	0.57	Agree
2.	Inadequate computers and other digital resources,	3.56	0.78	Agree
3.	Inadequate training of Teachers in the use of technology	3.36	0.80	Agree
4.	Inadequate staff training through workshops and conferences	3.19	0.91	Agree
5.	Inadequate grant to schools for effective digital technology equipment	3.32	0.94	Agree
6.	Lack of experience in the use digital technologies	3.32	1.06	Agree
7.	Digital technology may be distracting to students	2.80	1.07	Agree
	Grand Mean and Standard Deviation	**3.31**	**0.88**	

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The results obtained from Table 2 shows that the grand mean and standard deviation for the respondents were 3.31 and 0.88 respectively. The table also shows that all items were agreed with mean scores ranging from 2.80 to 3.58. This implies that the items posed challenges to teachers as a result of lack of digital technology tools in science and mathematics teaching and learning *for sustainable national development.*

HO1: There is no significant difference between the mean responses scores of male and female teachers on the use of digital technologies by science and mathematics teachers and the challenges encountered by teachers as a result ***the use of digital technology in science and mathematics teaching and Learning for sustainable national development***

Table 3: *Independent Sample t-Test Analysis on the Mean Responses of Male and Female Teachers on the* ***Impact of Digital Technology in Science and Mathematics Teaching and Learning for Sustainable National Development.***

Gender	(N)	Mean	STD	Df	tcal	tcri	A	Significance
Female	80	3.22	0.85					
				15	0.864	1.98	0.05	Accept H1
Male	80	3.31	0.88					

Table 3 reveals the mean responses of the male and female teachers on the ***impact of digital technology in science and mathematics teaching and learning for sustainable national development***. The result shows that $t_{ca\ l}$score of 0.864 which is less than t_{cri} score of 1.98 means the null hypothesis (H_0) should be rejected. Hence, the alternative hypothesis should be accepted.

Therefore, it is clear from the result that there is significant difference between the mean responses scores of male and female teachers on the use of digital technologies by science and mathematics teachers and the challenges encountered by teachers as a result ***the use of digital technology in science and mathematics teaching and learning for sustainable national developmen*t.**

Discussion

The findings of the study as presented in Table 1 indicates that the use of digital technology has drastically improved science and mathematics teaching and learning in education sector which were strongly agreed by the teachers as a result of accessibility to the computer hardware for effective education delivery and smart board devices provide students with an engaging learning experiences among others. This is in agreement with (Wijayaet al 2022) that Teachers' greater use of digital materials will create a fresh experience for students learning mathematics, such as guaranteeing students are not bored. They reported that digital technology nd

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offers new avenues of meaningful communication and collaboration between teachers and students and lack of funds for the purchase of new technology-assisted learning tools such as mobile devices, interactive white boards, smart boards, tablets, laptops, simulations, dynamic visualization and virtual laboratories hardware stands out as the number one problem confronting the teaching and learning of core subjects

The result of the analysis in Table 2 shows the challenges of digital technology in science and mathematics teaching and learning ***for sustainable national development***. This finding is in agreement with Haleem et al (2022) that integrating technology into education provides students with an engaging learning experience, allowing them to remain more interested in the subject without being distracted.. They express that many teachers lack of knowledge about ways to integrate digital technology to enhance the curriculum and to integrate and use different digital tools in a single class session. These conditions bring about divided attention and poor concentration on the teaching job thereby reducing their output. Some become unnecessarily harsh to students and would not take time to give proper explanation on any concept taught using digital technology, as students' lose interest in class activities thereby affecting the impartation of such knowledge.

The result of the analysis in Table 3 reveals the mean responses of the male and female teachers on the ***impact of digital technology in science and mathematics teaching and learning for sustainable national development*** In addition, higher number of respondent agreed that the alternative hypothesis should be accepted. Therefore, it is clear from the result that there is significant difference between the mean responses scores of male and female teachers on use of digital technologies by science and mathematics teachers and the challenges encountered by teachers as a result of ***the use of digital technology in science and mathematics teaching and learning for sustainable national development.***

Conclusion

Sustainable development goals emphasize quality education as one of the global goals. Digital technology is a gateway to the world for today's student and when applied in science teaching and learning will equip students with skills and knowledge relevant in today's world. Digital technology is needed to promote learning and position our students to be globally competitive. The digital transformation needed in today's world became more evident during the COVID-19 pandemic which accelerated the need to rapidly adopt digital solution.

Recommendations

Based on the above, the following recommendations were made:

1. Digital technology should be used in teacher education and in the professional development of teachers' training and retraining programme.

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2. Government should provide the necessary funds to schools for the purchase of digital technology facilities like computer hardware for effective education delivery.
3. The teacher should use digital resources like apps, social media etc to keep the class informed about activities and upcoming assignments
4. There is need for adequate provision of equipment and infrastructures by the government for teachers to perform their duties diligently.

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