Digital Technology: Effectiveness and Implications on Students Academic Achievement

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Abstract:- **Considering the importance of digital technology in the 21st century and its importance in educational development and advancement, thisstudy investigated the effectiveness of digital technology in the teaching and learning on students' academic achievement and retention in secondary schools, using Ethiope East Local Government Area, Delta State as a case study. To guide the study four (4) research questions and four hypotheses were formulated. The study employed descriptive survey as research design and enrolled one hundred and twenty-seven (120) randomly selected voluntary respondents across five secondary schools in the study area. Well-structured and validated questionnaire was used as an instrument for data collection with reliability coefficient of 0.77 using Cronbach alpha. Analysis of data was carried out using Microsoft Office Excel Version 2016 to analyze for sample mean and standard deviationand student's t-test was used to test for the hypotheses at 0.05 level of significance. The result of the study showed that students taught using digital technology performs when better compared to those taught without digital technology. The study also showed that students with internet connection from a home computer and personal cell phones performed better than those with nointernet connections from home computers and personal cell phones. Furthermore, the results showed that students taught with traditional based lessons performed less compared to their counterpart taught using digital technology. The study however recommended that government should provide relevant and up to date digital facilities for teaching and learning in secondary school; teachers should be trained and retrained on the utilization of digital tools to facilitates teaching and learning processes in secondary schools; and curriculum planners should restructure secondary school curriculum to suit digital teaching and learning approach.**

Keywords:- *Achievement, effectiveness, digital technology, learning, retention, teaching.*

I. INTRODUCTION

Technology has renovated the ways of instruction, where and how learning occurs and the roles it play on students and educators at large (Costley, 2014). This rapid development of ICT advancement in the educational field has brought new techniques for teaching and learning. ICT helps to make difficult things simple to comprehend by teachers and students by simulations (Das, 2019). Ashley (2016) stressed that technology has helps educators in preparing students for the real world setting. Hence, technology acts as a facilitator of dynamic for effective teaching and learning in digital format.

Digital technology has had a major impact on the lives of high school students and people through the use of computers, wearable devices, the internet and mobile phones to share information around the world (Yao Ting *et al.,* 2016) and effectively transformed the learning and teaching process, giving teachers and students access to materials (Ghavifekr and Rosdy, 2015). The integration of digital technology into education and learning via the internet and social media is an expanding and rapidly growing toolkit. These tools support student learning in everyday social activities (Johnson *et al.,* 2016). Digital technology allows both teachers and students to spend more time, their interactions become more flexible, and continue beyond classroom barriers in the process of engagement, content sharing, connectivity and communication (Pinto and Leite, 2020). Students learned faster and better using digital resources than textbooks. Devices such as PCs (desktops and laptops), mobile phones, tablets, e-readers, mobile applications, video conferences, channels (YouTube, Facebook) are considered excellent digital technology tools in educational and learning environments (Aresta*et al.,* 2015).

Common knowledge amongst schools is that digital technology engages students more. Programmes associated with digital resources are more stimulating for the students because they engage students and are interactive than just using pencil and a paper (Friedman andHeafner, 2008). Engagement is one of the main jobs of a teacher,when a student is well engaged and committedthere is every tendency that of learning and retaining such information. When using digital technology as a tool for learning students are more engaged and shows better performance compared to using hard copies resource materials. Students also collaborate and interact more when using technology based lessons (SchipperandYocum, 2016).Students tend to follow up on current topics and trending events using technology (Guertin*et al.*, 2012; Lumpkin *et al.,* 2015). Students are intrigued with the idea and concept of technologies which help them learn and enjoy learning process. Digital resources and technology such as PowerPoint presentation slides, weblogs, classroom response systems are important tools for students engagement. These technologies over the years, has been reported to improve academic activities, performance and student's active engagement (Lumpkin *et al.,* 2015).

A. Literature Review

Series of studies has proven that digital technology improves students' performance.Chang*et al.* (2015) found that students who used Online Discussion Forums performed better on the final exam than students who did not. Math classes have found that students who use digital lessons instead of standard lessons increase achievement and retention (Ozerbasand Erdogan, 2016). When digital curriculum is used it is more attractive visually for students and engagement is higher. A reason for the achievement could be the familiarity students had with the computers. Eyyam and Yaratan (2014) found that students were able to increase math scores by using a digital math curriculum compared to a standard curriculum.Wilder and Berry (2016) found that student academic achievement was the same when comparing technology based lessons in a math classroom. They further revealed that students' score where better when used digital curriculum than those do not. When comparing textbook lessons to digital lessons students prefer the digital lessons more than the textbook lessons (YildirimandDemir, 2013). Students claim that the digital lesson and digital assessments are "stress-free" compared to when they had to learn using a textbook. Learning was more positive when using a digital lesson compared to a textbook lesson.

The study of Chantorn*et al*. (2011) revealed that there is increase in the satisfaction and motivation of students in online learning environments mainly associated with mobile technologies.Chaiprasurt and Esichaikul(2013) also stated from their study that learners often use mobile digital technology if they feel it can improve and enhance their performance. Sai (2019) conduct a study on effect of digital-learning on student's and reported no difference on male and female students' achievement. However, the study observed that digital technology motivate and improve students' performance.Dan (2018) conducted a study on impact of technology on student performance andreported that student's taught with digital technology as well as those taught without digital technology showed no difference in performance. Ensa*et al* (2014) studied the effect of the technological devices on students' success using factors such as cell phones ownership, cell phones internet connection availability, and ownership of computers with internet connection. Result obtained from their study shows that students who have computers and have connection to internet at home have been found more successful than those do not.

B. Statement of the Problem

An effective teaching and learning environment leads to student success and prevents major failures. Students in Delta still have very poor academic performance. This ugly situation has plagued educators, advocates, parents, and society. Although many factors can lead to these poor academic performances of students. Many researchers claim that student failure was caused by traditional methods of education and learning. The question researchers are trying to answer is, can modern methods of education and learning improve student performance? Therefore, this study is an attempt to investigate the effectiveness of digital technology in education and learning regarding academic performance of student in secondary schools in the Ethiope East, Delta State.

C. Research Questions

This research questions guide the study.
- Is there any difference in achievement of students taught using digital technology and those taught without digital technology?
- Is there any difference in achievement of students that have internet access in their home computers and with those with no internet access in their home computers?
- Is there any difference in achievement scores of students' who have phone with internet network and those who have phones with no internet network?
- Is there any difference between teaching using the notebook and chalkboard approach and digital technology approach onstudents' achievement.

D. Research Hypotheses

H_{01}: No difference exist in the achievement of students who were taught with digital technology and those who were not taught with digital technology.

H_{02}: No difference exist in the achievement of students that have internet access in their home computers and with those with no internet access in their home computers.

H_{03}: No difference exist in the achievement of students' who have phone with internet network and those who have phones with no internet network.

H_{04}: No difference exist between teaching using the notebook and chalkboard approach and digital technology approach onstudents' achievement.

II. MATERIALS AND METHODS

A. Design of the Study

This study used a descriptive survey method which aimed at investigating the effectiveness of digital technology in the teaching and learning and its effectiveness on students' achievement in Ethiope East Local Government Area of Delta State.

B. Population and Sample Size

The subjects included all high school students in the Ethiope East of Delta State. A sample size of 127 students randomly selected from five schools was used in the survey based on availability. The schools were selected using simple random sampling.

C. Research Instrument

A well-structure and validated questionnaire was used for data collection. This questionnaire were designed to get factual information and it comprised of two sections A and B. Section A contains student's personal data, while section B contains research items. The questionnaires followed the Four Likert Scale of Strongly Agree (SA-4), Agree (A-3), Strongly Disagree (SD-2) and Disagree (D-1).

D. Validity and Reliability

The questionnaires that make up the created tool were checked by researchers and other experts in the field of science education for testing and measurement to confirm the effectiveness of the tool. The device was built on the basis of research questions. However, it was criticized and modified accordingly. The reliability of the survey equipment was established by exposing the equipment to smaller units of respondents extracted from different sampling areas. The response was analyzed using Cronbach's alpha with a coefficient of 0.77. This shows that the tool is reliable for research.

E. Method of Data Collection

Researchers made various contacts with schools to collect information related to the survey, using sample sizes extracted from the five schools selected for the survey. Using the questionnaire, instructions on the purpose of the survey, the type of questionnaire, and how to respond to the equipment were provided by the surveyor prior to the start of data collection. 127 copies of questionnaires were distributed to students selected for the survey and given time to complete them. All items in the questionnaire were completely answered and immediately retrieved by the research team.

F. Data Analysis

The data collected from the respondents were computed using Microsoft Office Excel Version 2016. Analysis of data were further carried out using Microsoft Office Exce statistical tools for mean and standard deviation. Student t-test was used to test the hypotheses at 0.05 level of significance.

III. RESULTS AND DISCUSSION

This section gives the results obtained from the different research question raised and hypotheses stated to guide the study. The importance and effectiveness of digital technology and its implication on academic achievement among secondary school students' within Ethiope East Local Government Area of Delta State are stated.

Research Question 1: Is there any difference in achievement of students taught using digital technology and those taught without digital technology?

From Table 4.1, the mean and standard deviation values are 13.20 ± 7.72 for students taught using digital technology and 11.10 ± 8.49 for students taught without digital technology. The mean difference is 2,10. The difference in average means that there is a difference in performance between students who are taught with digital technology and those who are taught without digital technology.

Hypothesis H_{01}: No difference exist in the achievement of students who were taught with digital technology and those who were not taught with digital technology.

From Table 4.2, the calculated t-value shows 5.11, but the tabular value is 2.30, and 0.05 degrees of freedom is important. However, the higher the calculated value, the more the basis for rejecting the null hypothesis is formed. This means that there is a significant difference in academic performance between students taught using digital technology and those taught without digital technology. This shows that digital tools help teachers integrate literacy practices, provide students with diverse literacy practices, and improve their learning. It shows that,in addition, digital tools have a positive impact on the education and learning process by creating opportunities to share and collaborate on ideas. Students also use and create multimodal hybrid texts using digital tools. It also helps improve your skills in using digital tools.

Variables Students	N	Mean	SD	Mean Difference
Student taught using Digital Technology	64	13.20	7.72	
Student taught without Digital Technology	63	11.10	8.49	2.10

Table 4.1: Mean and Standard Deviation difference in achievement of students taught using digital technology and those taught without digital technology

Variables Students	N	Mean	SD	Df	T -cal	T -crit	Alpha Level	Decision
Student taught using Digital Technology	64	13.20	7.72	125	5.11	2.30	0.05	Rejected
Student taught without Digital Technology	56	11.10	8.49					

Table 4.2: t-test Analysis of students taught using digital technology and those taught without digital technology

Research Question 2: Is there any difference in achievement of students that have internet access in their home computers and with those with no internet access in their home computers?

From Table 4.3, the mean and standard deviation scores of students with access to internet connection was 16.32 ± 9.11 while those with no access to internet connection was 10.22 ± 3.43. The study revealed a mean difference of 7.21. This mean difference signifies that there was differences in the achievement scores of students'who had access to internet connection at their homes compared to those had no access to internet connections at home.

Hypothesis H₀₂: No difference exist in the achievement of students that have internet access in their home computers and with those with no internet access in their home computers.

From Table 4.4, the calculated t-value of 3.32 was obtained while the table-value observed in the distribution table was 2.30 with degree of freedom at 0.05 level of significant. A higher calculated value of t is compared to the critical value, rejects the null hypothesis which indicates from the results that there is a significant difference in achievement scores of students' with access to internet facilities from home computer compared to those with no interned connection from home computer.However, it is expected that students with internet connection at home interact with teachers and online materials to learn and study more which results to excellence performance. Hence, the result obtained from this their study showed that students who have computers and have connection to internet at home have been found more successful than those who do not.

Variables (Students)	N	Mean	SD	Mean Difference
Student's with Internet Connection at Home	70	16.32	10.22	
Student's without Internet Connection at Home	50	9.11	3.43	7.21

Table 4.3: Mean and Standard deviation difference in achievement of scores of students' with access to internet connection from a home computer and those without access

Variables (Students)	N	Mean	SD	Df	t-cal	t-crit	Alpha Level	Decision
Student's with Internet Connection at Home	70	16.32	10.22	125	3.32	2.30	0.05	Rejected
Student's without Internet Connection at Home	50	9.11	3.43					

Table 4.4: t-test Analysis in achievement of scores of students' with access to internet connection from a home computer and those without access

Research Question 3: Is there any difference in achievement scores of students' who have phone with internet network and those who have phones with no internet network?

From Table 4.5, it was revealed that the mean and standard deviation scores of student's with internet accessfrom personal cell phones was 15.42±5.32 while those with no cell phone internet access was 6.32±2.12 with a mean difference of 8.68. Theobserved mean difference signifies that there is a difference in achievement of scores of students'with personal cell phone internet access when compared to those with no personal cell phone internet connections.

Hypothesis H₀₃: No difference exist in the achievement of students' who have phone with internet network and those who have phones with no internet network.

From Table 4.6, the t-value 5.66 for is calculated from the student's average score, the corresponding table value is 2.30 and the degrees of freedom are 0.05. If the calculated value of t is high compared to the critical value in tabular form, the presented null hypothesis is rejected. This shows that there is a significant difference in scores between students who have access to the internet through their personal mobile phones and those who do not have access to the internet through their personal mobile phones. The results obtained are consistent with the study by Chantorn*et al.* (2011) that the use of mobile phones / technologies in learning enhances student satisfaction, motivation and achievement. Chaiprasurt and Esichaikul (2013) also report that learners are more likely to use mobile digital technology if they feel they can improve and improve their performance.

Variables (Students)	N	Mean	SD	Mean Difference
Student's with Personal Cell Phone Internet Access	70	15.42	5.32	8.68
Student's without Personal Cell Phone Internet Access	57	6.32	2.12	

Table 4.5: Mean and Standard Deviation in achievement scores of students' with internet access from personal cell phone and those without

Variables (Students)	N	Mean	SD	Df	t-cal	t-crit	AlphaLevel	Decision
Student's with Personal Cell Phone Internet Access	90	20.12	8.91					
Student's without Personal Cell Phone Internet Access	30	10.11	4.52	125	5.66	2.30	0.05	Rejected

Table 4.6: t-test Analysis in achievement scores of students' with internet access from personal cell phone and those without

Research Question 4: Is there any difference between teaching using the notebook and chalkboard approach and digital technology approach onstudents' achievement.

From Table 4.7, it was revealed that the mean and standard deviation from student's response on traditional based lesson effectiveness was 30.45 ± 15.23 while student's response on digital technology based lesson was 50.32 ± 25.04 with a mean difference 19.87. The mean difference signifies that there is a difference on student's response to the effectiveness of traditional based lessons and digital technology based lessons on academic achievements.

Hypothesis H$_{04}$: No difference exist between teaching using the notebook and chalkboard approach and digital technology approach onstudents' achievement.

The t-values in Tables 4.8 of 8.21 have been calculated. Here, the value in the corresponding table is 2.30 and the degrees of freedom are 0.05. However, the null hypothesis was rejected because the calculated t-value was higher than the critical (tabular) value. The results show that there is a significant difference between traditional (textbook and chalkboard approach) and digital technology-based education in terms of student performance. The results are consistent with the study by Yildirim and Demir (2013). The study further found that when comparing textbook instruction to digital instruction, students prefer digital instruction to textbook instruction due to factors such as the stress-free nature of digital learning compared to using textbooks.

Variables (Students)	N	Mean	SD	Mean Difference
Traditional Based Lesson	120	30.45	15.23	19.87
Digital Based Lesson	120	50.32	25.04	

Table 4.7: Mean and Standard deviation in traditional based lessons and digital technology based lessons on academic achievement of students

Variables (Students)	N	Mean	SD	Df	t-cal	t-crit	Alpha Level	Decision
Traditional Based Lesson	127	30.45	15.23					
Digital Based Lesson	127	50.32	25.04	125	8.21	2.30	0.05	Rejected

Table 4.8: t-test Analysis of traditional based lessons and digital technology based lessons on academic achievement of students

IV. CONCLUSION AND RECOMMENDATIONS

Based on the findings of the study, the researcher concludes that

- Students that who were exposed to digital technology in their teaching and learning processes performed better compared to their counterparts who were taught without digital technology.
- Students with students with internet connection from a home computer performed better than those with nointernet connections from home computers.
- Students with internet access from personal mobiles phones to engage academic activities performed better than those with no internet access on personal mobile phones.
- Students taught with traditional based lessons performed less compared to their counterpart taught using digital technology.

Based on the findings, the study recommended that;

- Government should providerelevant and up to date digital facilities for teaching and learning in secondary school.
- Teachers should be trained and retrained in the use of digital tools to facilitate the process of education and learning in secondary school.
- Governments need to provide schools with the necessary digital equipment, such as laptops, projectors, internet equipment, and adequate power supplies, and provide them to students to enhance their learning.
- Curriculum planners need to restructure their secondary school curriculum to adapt it to a digital approach.

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