

Effect of Digital Learning Aids on Secondary School Physics Students Learning Outcomes in Benue State, Nigeria

Mojeed Olaoluwa Akinwumi & Sunday Onoja Clement

Department of Physics, Federal College of Education, Odugbo

Corresponding author: amojee009@gmail.com

Abstract

The study explored effect of digital learning aids on Physics students' learning outcomes in secondary school in Benue State. The study population included all the 13,324 Senior Secondary Schools Two (SSSII) Physics students as at August 2024. The sample consisted of 39 SSS II students chosen using a multi-stage sampling technique. Physics Achievement Test (PAT) and Physics Students' Attitude Questionnaire (PSAQ) were used as instrument for data collection and were validated and the reliability of PAT and PSAQ were 0.87 and 0.86, using Pearson Product Moment Correlation (PPMC) and Cronbach's Alpha respectively. The findings revealed that, students who were taught using the Teacher Expository Approach performed considerably lower than those who were taught using digital learning aids ($t = 9.013$, Sig. = .000 at $p < 0.05$). Also, in comparison to students taught using the Teacher Expository, those taught utilizing the digital learning aids exhibited a significant improvement in attitude. The study concluded that digital learning aids boost academic achievement and attitude. The study recommended that Physics teachers should adopt and incorporate digital learning technologies into their classroom instruction.

Key Words: Digital Learning Aids, Learning Outcomes, Physics, Attitude, Academic Achievement

Introduction

Preparing students for future challenges through technical, methodological, social, and personal competencies is the aim of education in the twenty-first century and beyond. Therefore, the child's education should be geared toward equipping them with the skills they will need as future workers to use digital tools and keep up with the quickly evolving technology. Generally speaking, social media platforms, mobile devices, and computers as parts of digital learning aids all play important roles in education. Given that digital learning technologies are facilitating more active student participation, this will help to lessen the difficulties associated with the traditional classroom approach, which tends to restrict the amount of communication between teachers and students.

Practitioners are also concerned with how instructors who are digital migrants and students who are digital natives adjust to fundamental digital skills and technology, which will ultimately facilitate learning

for students and enable teachers to teach more effectively. If instructors and students don't adjust to the possibilities of digital learning tools, the constant calls for innovation and reform aimed at enhancing scientific education in Nigeria through the use of digital tools may be a fantasy (Odhiambo, 2018; Dancsa, 2023).

A child's education has evolved to include a variety of disciplines with unique curricular material in the arts, humanities, social sciences, and, more recently, vocational subjects. Numerous factors pertaining to students, teachers, the school environment, and government legislation have had a negative impact on how these materials are delivered. The teaching of sciences at secondary school includes the learning of Biology, Chemistry, and Physics, which provide a basis of scientific knowledge for addressing a variety of human, material, and environmental issues. It can also be viewed as consisting of two main complementary modes: gathering scientific knowledge about the natural world through exploration and discovery endeavours, and applying that knowledge for human and material

development in order to solve the problems that arise as man interacts with society.

Physics is crucial among secondary school students and the society as the student benefits by gaining critical thinking and problem-solving through the procedural and process skill methods that are adopted in sciences. Physics is also expected to increase the students' innovation and creativity by fostering curiosity and experimentation that are expected to make the students live a functional life within the society.

Since Physics improves technical developments, teaching and understanding about it will also benefit the society as a whole. This may be the case since Physics propels technological advancements and raises the standard of living. By fostering the expansion of sectors like energy, transportation, and communication, Physics also significantly contributes to the economic development of society, which in turn increases job prospects for the general public.

Studies have repeatedly demonstrated that senior secondary school students perform poorly in Physics (Nzewi, 2010). The deficiency of proficiency in Mathematics, which has been shown to significantly predict performance in Physics, is one of the variables contributing to this poor performance (Ayoola & Akinwumi, 2019; Nzekwe, 2020). Additional difficulties include the dearth of resources that impede efficient learning and the insufficiency of the teaching strategies used by the instructors, as traditional teaching approaches have crept into Benue State's Physics classrooms.

Odhiambo (2018) found that the majority of science teachers in Nigerian secondary schools continue to use the traditional teaching methods, which is the primary reason why students perform poorly in science classes at the secondary school level. This trend seems to have been going on for a while with no end in sight. The effect of digital learning instructional strategies on learning effectiveness, capacity to foster maximum achievement, learning satisfaction, and the formation of a positive attitude toward the study of Physics are all significant factors to take into account when teaching and learning Physics content. According to Guzel (2024), a negative attitude toward a subject may be thought to hinder learning. Accordingly, students are more likely to succeed when they approach a subject with positivity and renewed interest. Therefore, efforts must be focused on identifying the teaching method that would encourage the development of a favourable attitude toward Physics.

In today's digital age, modern instructional materials such as mobile application, virtual and augmented reality are critical and widely used. A modern educational system employs technology to transmit knowledge. It will go a long way at complementing the traditional teaching approaches that have been found to be predominant among science teachers in Nigeria and Benue State in particular. Incidentally, digital tools have been found with capacity to generate information that can be delivered in a variety of ways (Kaklamanou, et al., 2012).

Instead of actively involving students in hands-on activities, traditional classroom instruction/teacher expository approaches seem to only appeal to the senses of hearing and seeing, which does not seem to provide an instant learning environment, faster assessment, or enhanced engagement (Martin & Herro 2012; Sandor & Guban, 2022). Online digital tools, according to Alordiah et al. (2023), are internet-accessible software, programs, technologies, plug-ins, add-ons, or websites that support in-depth study, help learners understand the material, improve learning, increase linguistic awareness, and promote peer collaboration. Online platforms were employed by educational institutions for daily operations, assessment, resource sharing, and instruction. The use of these platforms was proactive, nevertheless.

In a related study by Dancsa, et al., (2023) had used computers, tablets, and digital tools to empowers students in Chemistry to take an active role in their education leading to improved performance. This showed that teachers have a key role in ensuring optimal learning outcomes as learners can easily access digital materials and add their own content. In a different study, Udvaros, et al. (2019) found that the web allows students to produce content, work together, assess one another's work, and encourage co-learning. This may be because research has shown that using technology in scientific classes improves learning outcomes and fosters a positive attitude among students toward physics (Wang, et al., 2023).

Additionally, Sandor and Guban (2022) pointed out that students' acquired qualities and abilities determine their academic achievement. As a result, utilizing digital technologies and educational resources can improve the classroom environment and raise student participation. They also make it possible for educational establishments to adapt their curricula to each student's unique needs.

Attitude is another concept related to students' learning results. It is one of the affective domains of

learning outcomes that has been found to be connected to students' performance. According to Akinbobola (2019), an attitude is a general sentiment or opinion about anything. Human behaviour and emotion management during the learning process are greatly influenced by an individual's preparedness to perform in a particular manner. As such, it is one of the key concepts that has a significant impact on pupils' academic achievement (Areo, 2022). Understanding the link between Physics and students' attitude has been the subject of a large body of work (Bedemo, 2020). Finding a workable strategy to improve students' performance and confidence in Physics requires a bottomless understanding of their attitudes toward the subject. Nonetheless, earlier research has evaluated pertinent indicators of Physics students' attitude. Such studies include; Kapucu (2017) where it was found that students' attitudes about Physics were influenced by their level of comprehension which is largely dependent of the learning strategy. Agu & Iyamu (2020) linked a more positive attitude toward Physics with a metacognitive scaffolding teaching approach such as the use digital learning tools in the classroom. On the other hand, Mukhametshin et al. (2020) assert that although digital learning tools offer numerous benefits, they should only be used in conjunction with conventional teaching methods.

Also, the effectiveness digital learning tools in a large class as the case of Nigeria and Benue State in particular is still not clear. There is therefore the need to launch a study that will investigate the effectiveness of digital learning tools in improving Physics students learning outcomes in Benue State. As such, this study seeks to investigate the effects of digital tools on students' academic achievement and attitude in Secondary School Physics in Benue State.

Research Questions

The following research questions were raised to guide this study:

1. What is the difference in the academic achievement of students in secondary school Physics when taught using digital tools instructional strategy and teacher expository approach?
2. What is the difference in the attitude of secondary school students to Physics when taught using digital learning tools instructional strategy?

Research Hypotheses

The following hypotheses were generated to guide the study:

1. There is no significant difference in the performance of students in secondary school Physics in experimental and control group using digital tools.
2. There is no significant difference in the academic achievement scores of male and female students in secondary school Physics when taught using digital tools instructional strategy.

Methodology

A survey, a quasi-experimental control group, and non-equivalent pre-test and post-test research designs were all components of the mixed method research design employed in this work. For the purposes of this study, all 13,324 Benue State Senior Secondary School II (SSSII) Physics students were enrolled. All 13,324 Senior Secondary School II (SSSII) Physics students in Benue State were included in the study's demographic. 39 pupils from two secondary schools in Benue State's Apa Local Government Area made up the sample, which was selected using a multi-stage sampling process. Zone C was chosen at random from among Benue State's three senatorial zones A, B, and C.

Using the random sample method, a local government was also chosen from zone C. Purposive sampling was also used to choose two schools from the chosen LGA. Purposively, the three chosen schools were split into two experimental groups: A (DLA) and B (TEA), which served as the control group. Purposive selection was based on the availability of a school with an averagely equipped physics lab and physics teacher for group B, and an averagely equipped and functional computer facility with at least 20 computers, power supply, and internet facilities for group A. Using a random sampling technique, a class of intact Physics students was chosen from among the schools that have multiple Physics classes.

Using a random sampling technique, a class of intact Physics students was chosen from among the schools that have multiple Physics classes. The Physics Students Attitude Questionnaire (PSAQ) and the Physics Achievement Test (PAT) were the two research tools used to collect data. The researcher created the Physics Students' Attitude Questionnaire (PSAQ), which was separated into sections A and B. Section B had 20 items on students' attitudes that were scored on a 4-point Likert scale, whereas Section A asked for the

students' biographical information. For this study, two educational programs were used. The DLT instructional bundle included a video and well-presented lesson on optics basics. The lesson plan had been stored on the computers under supervision before the classes began.

The reliability of PAT and PSAQ was assessed using the Pearson Product Moment Correlation (PPMC) and Cronbach's Alpha, respectively, yielding coefficients of 0.79 and 0.86. This study was conducted in three phases: the pre-test administration phase, the

intervention phase, and the post-test phase. To determine the equivalency of characteristics at the beginning of the experiment, the PAT and PSAQ were given to experimental group A and control group B during the pre-test phase. During the intervention phase, group A students received instruction utilizing the DLT Strategy, while group B students received instruction from their teacher using the teacher expository approach. Each group received treatment for two lessons per week for a total of 6 weeks.

Results

Based on the following research questions and hypotheses, the data analysis results of the study were presented:

Table 1

Mean and standard deviation of pre and post-test mean scores of students from experimental and control groups

	Descriptive Statistics				
	N	Minimum	Maximum	Mean	Std. Deviation
GROUP A PRE-TEST	20	10.00	18.00	14.7500	2.14905
GROUP A POST-TEST	20	20.00	54.00	35.5000	7.54983
GROUP B PRE-TEST	19	6.00	11.00	9.0526	1.54466
GROUP B POST-TEST	19	6.00	17.00	9.6842	2.80976

Table 1 results showed that the experimental group A's post-test mean score for secondary school physics students ($\bar{x} = 35.5000$, S.D = 7.54983) was higher than the control group A's pre-test mean score (\bar{x}

= 14.7500, S.D = 2.14905). This suggests that the digital learning resources were successful in raising the academic performance of Physics students.

Table 2

Mean and standard deviation of pre and post-test attitudinal scores of Physics students from experimental and control groups

	N	Mean	Std. Deviation
GROUP A PRE-TEST	20	35.5000	7.54983
GROUP A POST-TEST	20	70.5000	6.77845
GROUP B PRE-TEST	19	36.3842	6.08869
GROUP B POST-TEST	19	35.5000	7.54983

According to table 2 results, Physics students in experimental group A had a higher post-test mean attitudinal score ($\bar{x} = 70.5000$, S.D. = 7.77845) than they had before the intervention ($\bar{x} = 35.5000$, S.D. =

7.54983). This demonstrated how students' attitudes about physics are improved by digital learning resources.

Table 3

Paired t-test analysis for the academic achievement of students taught using Digital learning tools and Teacher Expository Approach

	Teaching Strategies	N	Mean	Std. Deviation	T	Df	Sig. (2-tailed)
Academic Achievement	Post-test DLT	20	35.50	7.55	8.848	22	.000
	Post-test TEA	19	9.68	2.81			

P<0.005

Table 3 clearly indicates that there is a substantial impact of the therapy on the academic achievement of students in Physics when taught using digital learning tools ($t = 8.848$, Sig. =.000 at $p < 0.05$).

Therefore, the hypothesis that there is no discernible difference between the experimental and control groups of secondary school Physics students in Benue State who use digital learning resources is rejected.

Table 4

Paired t-test analysis for the students' attitude when taught using DLT and TEA

	Attitude	N	Mean	Std. Deviation	t	Df	Sig. (2-tailed)
Students' Attitude	Post-Attitude DLT	20	7.50	8.78	8.946	22	.000
	Post-Attitude TEA	19	35.50	4.55			

P<0.005

Table 4 demonstrates that the treatment had a substantial impact on the students' attitude toward Physics when taught using DLT and TEA ($t = 8.946$, Sig. =.000 at $p < 0.05$). This effectively rejects the claim that there is no discernible difference in the attitudinal scores of secondary school Physics students when the subject is taught utilizing digital resources and teacher expository tactics.

Discussion

The results of this study, which aimed to ascertain whether employing digital learning tools as an instructional strategy would affect students' achievement in Physics, showed that students in the experimental group outperformed the control group in terms of mean scores. The hypothesis that there is no significant difference in the achievement of students in Physics from the experimental group when taught using digital tools instructional technique was put forth and evaluated in order to ascertain the relevance of the difference in group means. The findings demonstrated a considerable improvement in the mean scores of the experimental group. The results of the study corroborated those of Martin and Herrero (2012), who found a substantial correlation between academic

accomplishment and learning mode; however, the impact of learning.

Digital learning tools are not gender biased, according to the results of this study, which sought to ascertain whether there is a difference in the achievement scores of male and female students in Physics when taught using these tools as an instructional strategy. The results support those of Kaklamanou, et al., (2012), who found that different learners could continue engaging in different tasks in the same classroom thanks to digital learning. A teacher can use software to give challenging homework to groups of students, giving them more time to work one-on-one with other students. The results are also consistent with studies by Nzewi (2010), Nzekwe (2018) that looked at the gender effects and comparative study of male students' academic performance in Physics.

Digital learning tools boost students' attitudes about chemistry, according to the results of this study, which aimed to determine whether there would be any difference in students' attitudes toward Physics when taught utilizing a digital tools instructional style. The results showed a significant difference in the attitudes of students in both experimental groups, confirming the

research hypothesis that there is no significant difference in students' attitudes toward Physics when taught using digital tools instructional strategy. This suggested that using digital technology to teach Physics helped the experimental group's pupils acquire a positive attitude toward the subject. The results of this study, which aimed to determine whether students' perceptions of Physics would change in any way.

Conclusion

It is reasonable to conclude from the data analysis and interpretation of this study that digital learning resources help to improve the academic performance and attitude of Benue State secondary school Physics students.

The following suggestions are offered in light of the study's findings and conclusions:

1. To improve academic performance and attitudes, Benue State secondary school Physics teachers should embrace and integrate digital learning tools into their lessons.
2. To enhance student performance and attitude toward Physics, the Benue State government ought to develop digital learning resources.
3. To assist their kids learn Physics more efficiently, parents may want to buy digital learning resources.

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