ICT Assisted Gadgets and Students' Academic Performance in Biology in Abak Local Government Area of Akwa Ibom State, Nigeria

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Abstract

This study examined the effect of digital projector and desktop computer on students' academic performance in Biology in Abak Local Government Area of Akwa Ibom State. To achieve the purpose of the study, two research questions and two hypotheses were formulated to guide the study. Quasi-experimental design was adopted for this study and the study was carried out in Abak Local Government Area of Akwa Ibom State. The population for the study includes all 3,428 senior secondary two (SS2) Biology students in the eleven public secondary schools during 2024/2025 academic session in Abak Local Government Area of Akwa Ibom State, Nigeria. The choice of co-educational schools is because gender as a variable under study. Simple random sampling technique was used to select three schools for the study. Students from the six schools were used in their intact classes. A sample size for the study consists of 200 SS2 Biology students drawn from six selected co-educational public secondary schools for the study but in their intact classes, 194 Biology students agreed to participate for the study. The instrument used for data collection is the Biology performance test (BPT). The instrument was duly validated and subjected to reliability analysis and was deemed appropriate for the study. Mean and standard deviation was used in answering the research questions while analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 alpha level. From the results of the analyses carried out, the findings showed that there is a significant difference in academic performance of students' in Biology based on digital projector, desktop computer and those taught without the ICT-assisted gadgets. The result showed also that there is a significant difference of male and female students' performance in Biology based on digital projector, desktop computer and those taught without the gadgets. From the findings, it was concluded that students' taught using instructional materials based on digital projector, desktop computer lead to better academic performance on the part of the students than their control counterparts. Based on the findings, recommendation among others made was that educational authorities should integrate ICT tools like digital projectors and desktop computers into the Biology curriculum to enhance teaching and learning processes.

Keywords: ICT Assisted Gadgets, Academic Performance

Introduction

Education is the totality of life's experiences which enables people to be relevant, responsible, productive and useful to the society. A good educational system is a strong base for science and technological development which equips people with sound knowledge and skills for designing methods and process that will enable them to make maximum use of their natural resources for the advancement of the society (Aremu, 2015, Awodun & Oyeniyi, 2018). The growth and development of a nation depends largely on the type and quality of science and technology education individuals acquire. Science and technology therefore forms an integral part of the human society and its impact is expected to be felt in every sphere of life. Developed nations of the world, by applying science and technology education principles have been able to maintain sovereignty which has provided them with functional and meaningful roles in wealth creation, improvement of the quality of life, real economic growth and educational advancement. (Shodeinde, 2015). The National Policy on Education, Federal Republic of Nigeria (FRN, 2014) prescribed the following for science, technical and vocational education: provision of knowledge and skills necessary for economic development; providing people who can apply scientific knowledge to the improvement and solution of environmental problems for the use and convenience of man among others. One of the ways in which the above objectives can be fully achieved is through Biology.

Biology is a branch of natural science concerned with the study of life and living organisms, including their structures, functioning, growth, evolution, distribution, identification and taxonomy (Duru, Uko, & Utibe, 2024). Biology also enable students apply scientific knowledge to everyday life, in matters of personal, community health and agriculture among others (Federal Ministry of Education, 2019). The non-utilization of

available resources by teachers has been shown to be true and also to cause reduced performance and interest in mathematics and other science related subjects such as Biology (Ado, Abasi & Nwankwo, 2017). Resources are very vital tools in education (Abasi, 2018). They aid teaching and learning and includes everything that provides information to the teacher as well as the learner (Abasi, 2018). According to Ado *et al*, (2017), Abasi and Umoinyang (2020), the teaching and learning of mathematics and related sciences requires the intensive application of resources that would appeal to all the sense of perception to improve the effectiveness of instruction as well as learning. This is the reason why selecting resources, for a particular concept for classroom delivery is an important routine that a resourceful teacher should undertake while preparing his lesson (Abasi, Okri & Adie, 2022; Abasi, 2018).

Information and Communication Technologies (ICT), according to Okigbo and Okeke (2011) have become within a very short time, one of the basic resource in terms of the building blocks of modern society. He further stated that many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the essence of education, together with reading writing and numeracy. Accordingly, Ado *et al,* (2017) posited that technology today has a great role to play in the teaching and learning process. Its role is rapidly becoming one of the most important and widely discussed issues in contemporary education policy. According to Ochoyi and Ukwumonu (2008), the fields of education are of the opinion that technology especially ICT holds a great promise to improve teaching and learning in addition to shaping workforce opportunities. The use of new technological devices as Computer Assisted Instruction (CAI), Computer Based Instruction (CBI), Computer Based Learning (CBL) for curriculum delivery have been found to be very effective in science, technology and mathematics curriculum delivery and also useful to learners in solving of learning tasks in education (Ado *et al*, 2017).

Information and Communication Technology (ICT) in Biology education is making major differences in learning and teaching approaches Udofia, Akpan & Sambo (2024). It is crystal clear that the modern-day classroom needs are very different from the traditional classroom needs (Uko & Uko, 2020). Interactivity, flexibility and convenience have become the order of the day in ICT supported environment. ICT opens up opportunities for learning because it enables learners to access, extend, transform and share ideas and information in multi-modal communication style and format (Akpan, Udofia & Nkoyo, 2016). The rapid development of computer and communication technology has contributed to teachers' use of ICT for classroom instructions (Udofia, Akpan, Babayemi & Jonah, 2024; Salini & Reeves, 2017) hence, the use of ICT assisted gadgets integration in the classroom is vital.

ICT assisted gadgets such as under study are the Digital Projector and Desktop Computer. Digital Projector is one of the innovational approaches of teaching and learning in which students view lessons during teaching and learning activities in classroom (Nikolopoulou & Gialamas, 2015). The projected classroom made use of Projector as ICT assisted gadget, innovational classroom approach for teaching and learning practices, the teacher can prepare lessons which are projected, and students can view and list them in the class while they learn. Desktop Computer in the other hand is one of the ICT assisted instructional gadget subsumed into visual materials. In this format, Biology students learn only through the visual sensory modality through the use of computer (Nikou & Economides, 2016). The computer ICT assisted gadget in this study shall limit its application of visual medium to mode of lesson presentation such as graphs, drawing, diagrams, sketches, textbooks. However, some variables such as gender may influence students' mode of learning as well as their academic performance.

Academic performance is vital in Education. It is usually counter-productive for learners to undergo a course of learning over specific time frame without recording a high degree of academic achievement. Uko and Uko (2024) consider academic achievement as the most critical aspect of an instructional encounter. Learners must show mastery and internalize what they have been taught. For learners to excel, they have to be exposed to teaching and learning approaches that will enhance optimal performance and retention. One of such approaches is the utilization of information and communication technology (ICT) assisted gadgets during instruction in Biology.

The West African Examination Council Chief Examiners' report of 2023 revealed that students' performance in Biology examination is not encouraging. An examination of the performance of Biology students mirrored a decline in the percentage of Biology candidates obtaining credit grades. In spite of the importance of Biology, students' performance at senior secondary school level remains low (WAEC, 2019). Statistics show that not up to 60% pass at credit level has been recorded in May/June Senior Secondary Certificate Examination (SSCE) in the subject (WAEC, 2023). Students' poor performance as generally observed by Hakan and Azize (2015), Udofia and Sambo (2021) has been attributed to teachers' failure to utilized information and communication technology assisted aids for effective teaching and learning, such as the use of computers, and projectors during the teaching and learning process in Biology.

Statement of the Problem

The effectiveness of Information and Communication Technology (ICT) tools in enhancing students learning is a subject of ongoing debate. While projectors and desktop computers offer potential benefits in Biology education through visual aids and interactive learning experiences, their impact on students academic performance remains unclear. Many Biology concepts are complex and require effective visualization, mental scaffold and engagement to facilitate understanding. This study seeks to investigate the extent to which the use of projectors and desktop computers as ICT-assisted gadgets influences student academic performance in Biology. Specifically, the study addresses the lack of empirical evidence regarding the effectiveness of these specific technologies in improving student learning outcomes in a Biology context. The problem is further compounded by the potential of unequal access to these technologies, leading to disparities in learning opportunities among students.

Based on the above hindrances, coupled with the fact that students may not understand what they are taught without effective integration of ICT assisted gadgets, this study is poised to establish whether the use of Projector and desktop computer ICT gadgets in the teaching of Biology by teachers in senior secondary classes could have any facilitative effect on students' academic performance in Biology in Abak Local Government Area of Akwa State, Nigeria.

Purpose of the Study

The main purpose of this study is to examine the effect of projector and desktop computer on students' academic performance in Biology in Abak Local Government Area of Akwa Ibom State. Specifically, the objectives of the study seek to:

1. Determine the mean performance scores of Biology students' taught the concept of respiratory system using projector, desktop computer and those taught without ICT gadgets.
2. Compare the mean performance scores of male and female Biology students taught the concept of respiratory system using projector, desktop computer and those taught without ICT gadgets.

Hypotheses

1. There is no significant difference in the mean performance scores of Biology students taught the concept of respiratory system using projector, desktop computer and those taught without ICT gadgets.
2. There is no significant difference in the mean performance scores of male and female Biology students taught the concept of respiratory system using projector, desktop computer and those taught without ICT gadgets.

Methods

The study adopted a quasi-experimental design. Specifically, the study employed a non-randomized pretest, posttest design. The design was considered appropriate for the study because intact classes were used to avoid disruption of normal class lessons. The researcher chooses Abak Local Government Area for the study because of students' poor performance in Biology and to introduce innovative materials using ICT assisted aids for instruction that can help to improve the academic performance of students in Abak. Population for the study includes all 3,428 senior secondary two (SS2) Biology students in the eleven public secondary schools during 2024/2025 academic session in Abak Local Government Area of Akwa Ibom State, Nigeria. The choice of co-educational schools is because gender is the variables under study. A sample size for the study was 200 SS2 Biology students drawn from six selected co-educational public secondary schools for the study. But 194 Biology students agreed to participate for the study. The instrument used for data collection was tagged: Biology performance test (BPT). The instrument was duly validated and subjected to reliability analysis with a coefficient of 0.78 obtained and was deemed appropriate for the study. Analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 alpha level.

Results

Hypothesis one: There is no significant difference in the mean performance scores of Biology students' taught the concept of respiratory system using digital projector, desktop computer and those taught without ICT gadgets.

Table 1: Summary of analysis of covariance of mean performance scores of Biology students' taught the concept of respiratory system using digital projector, desktop computer and those taught without ICT gadgets

Sources of variance	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14309.410[a]	3	4769.803	80.181	.000
Intercept	17261.907	1	17261.907	290.176	.000
Pretest	479.823	1	479.823	8.066	.005
Materials	10131.332	2	5065.666	85.155*	.000
Error	11302.652	190	59.488		
Total	227610.000	194			
Corrected Total	25612.062	193			

*Significant at $p < .05$, $n = 194$

The result in Table 1 indicates that the F-value of 85.155 with 2 and 194 degrees of freedom at .05 alpha level is significant since the p-value of .000 is lower than the alpha value of .05. The null hypothesis is rejected, which means that there is significant difference in the mean performance scores of Biology students'

taught the concept of respiratory system using digital projector, desktop computer and those taught with those taught without ICT gadgets.

Hypothesis two: There is no significant difference in the mean performance scores of male and female Biology students taught the concept of respiratory system using digital projector, desktop computer and those taught without ICT gadgets.

Table 2: Summary of analysis of covariance of mean performance scores of male and female Biology students taught the concept of respiratory system using digital projector, desktop computer and those taught without ICT gadgets

Sources of variance	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	17700.817[a]	6	2950.136	69.733	.000
Intercept	15589.600	1	15589.600	368.495	.000
Pretest	580.080	1	580.080	13.711	.000
Gender	546.068	1	546.068	12.908	.000
Materials * Gender	2290.501	2	1145.250	27.071*	.000
Error	7911.245	187	42.306		
Total	227610.000	194			
Corrected Total	25612.062	193			

*Significant at $p < .05$, $n = 194$

The result in Table 9 indicates that the F-value of 27.071 with 2 and 194 degrees of freedom at .05 alpha level is significant since the p-value of .000 is lower than the alpha value of .05. The null hypothesis is rejected, which means that there is significant difference in the mean performance scores of male and female Biology students taught the concept of respiratory system using digital projector, desktop computer and those taught without ICT gadgets.

Discussion of Findings

The result of hypothesis one indicated that digital projector, desktop computer significantly influence students' academic performance than those taught the concept of respiratory system in Biology without ICT assisted gadget. The integration of digital projectors and desktop computers as ICT-assisted gadgets has been shown to enhance student learning and academic performance in Biology. This study is in agreement with the works of Bhatti,Chuadhry and Liaqut (2022), that there is a significant impact of electronic gadgets on the academic performance of secondary school students. Moreover, it was also depicted from the result that, modern gadgets greatly improve the performance of educational standards. This is attributed to the visual representation of information, which caters to various learning styles, particularly visual learners.

Furthermore, desktop computers facilitate access to a wealth of online resources, simulations, and interactive Biology programs that can deepen students' engagement and comprehension. This study is in consonance with the works of Tolorunleke, Haruna, Aliyu and Danladi (2022), who investigated the impact of Information and Communication Technology (ICT) tools on students' academic performance in Nigerian educational system. There study showed a significant influence on the use of ICT tools such as Google Classroom, desktop computer can creates room for individualized learning and makes learning more interesting and meaningful within and outside the school settings. Thus, the hypothesis that ICT-assisted gadgets positively influence students' performance in Biology is supported by empirical evidence.

The result of analysis two indicated that male and female students' in the experimental groups taught the concept of respiratory system based on digital projector, desktop computer significantly influence students' academic performance than those taught without instructional materials in the concept of respiratory system in Biology. Gender differences in academic performance have been a subject of research particularly in STEM fields, including Biology. This study is in support with the works of Duru, Uko and Utibe (2024), who investigated the impacts of instructional material in teaching and learning Biology and its gender dimension in senior secondary school. The study showed a notable difference in the performance of male students taught with information and communication technology-related facilities and female students taught with ICT-related facilities.

Moreover, the influence of gender on performance may also be shaped by classroom dynamics and teacher perceptions, where girls may receive more encouragement and support in science subjects (Ogunlowo, Ozbey & Ogunlowo, 2024).The significant impact of gender on academic performance in Biology aligns with the hypothesis that gender differences play a crucial role in students' academic outcomes.

Conclusion

From the findings, it can be concluded that students' taught using instructional materials based on digital projector, desktop computer lead to better academic performance on the part of the students than their control counterparts. Also, the interaction effect of treatments and gender; treatments and school location; gender, school location and treatment have a significant effect on students' academic performance in Biology when taught the concept of respiratory system.

Recommendations

1. Educational authorities should integrate ICT tools like digital projectors and desktop computers into the Biology curriculum to enhance teaching and learning processes.
2. Institutions should provide ongoing professional development and training for teachers to effectively utilize ICT tools in their classrooms, ensuring they are well prepared to implement technology enhanced teaching resources.
3. Schools should encourage parental involvement in students' learning, particularly in technology use, to foster a supportive home environment that reinforces classroom learning.

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