INFLUENCE OF MULTIMEDIA INSTRUCTION ON STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY IN SENIOR SECONDARY SCHOOLS IN IDO/OSI LOCAL GOVERNMENT AREA, EKITI STATE.

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Abstract

This study investigated the influence of multimedia instruction on students' academic performance in Biology in senior secondary schools in Ido/Osi local government area of Ekiti State. The study adopted quasi-experimental, pretest, posttest (one experimental group and one control group), and non-randomized control group design. To achieve the objectives of this study, four research questions and four null hypotheses were formulated to guide the study. The population of the study consisted of all the 1,378 biology students in public senior secondary schools in Ido/Osi Local Government Area, Ekiti State. The study was carried out in two mixed public senior secondary schools with a sample size of 50 students. The instrument used for this research study is a Biology Achievement Test (BAT) having 20 multiple-choice objective items with five options (A-E) each. The reliability of the instrument was determined using Kuder Richardson 21 after carrying out a pilot testing using test-re-test method and a reliability coefficient of 0.79 was found. The data from the pretest and post-test administered were analyzed using frequency count, bar and pie charts, mean and standard deviation. The research hypotheses were tested using t-test and Analysis of Covariance (ANCOVA) statistics at 0.05 level of significance. The study revealed that there is significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools' students. Also, there is no significant difference in the academic performance of male and female biology students after being exposed to multimedia instruction in senior secondary schools. Based on the findings, it was recommended among others, that Government and school owners should provide multimedia aid that could be used for biology instruction in secondary schools and that training on the usage of modern multimedia instructional aids should be organized for teachers by educational agencies and manufacturer of such products.

Keywords: Multimedia Instruction, Academic Performance, Gender, Biology

Introduction

Science is universally recognized as the foundation of today's cutting-edge technologies. Nigeria is one of several nations throughout the globe making rapid strides to modernize its economy through the application of cutting-edge technology and scientific research. This is due to the fact that our global culture is getting more "scientific" (Quarcoo-Nelson, Buabeng & Osafo, 2012).

According to Genber (2015), the social meanings that people ascribe to gender throughout their whole lives (from birth to death) influence how those meanings impact people's feelings, ideas, and actions, which in turn influences how those meanings may affect people's day-to-day lives. In the secondary school science curriculum, biology has a special place in studying living organisms in many forms. As a result, it's a prerequisite for other profitable and demanding careers like medicine, nursing, pharmacology, biochemistry, and agriculture, to name a few (Olayinka, 2022).

According to Gambari, Yaki, Gana, & Ughovwa (2014), biology is crucial not only for individual progress but also for the advancement of the social, economic, and political aims of nations throughout the globe. According to Umar (2011), biology is a natural discipline that investigates "how living things came to be and how they interact with one another and their environment," as well as "how the world is ordered, how it operates, and what these functions are."

According to Taiwo & Emeke (2014), students who study biology get insight into their own identities as well as their personal and global surroundings. It's possible that this is why it's being considered for use in Nigeria's Senior Secondary School (SSS) curricula. Among the goals of biology education in Nigeria's secondary school system are the development of students' laboratory and field skills in biology, as well as their understanding of the importance of science in fields like medicine, nutrition, and agriculture and their ability to apply what they learn in the classroom to (FME, 2013).

According to Steinberger (2019), a student's academic performance is not limited to a single event but spans their whole educational career, from elementary school through college and beyond, and reflects their holistic development as human beings and as individuals. An individual's academic success is measured by how well they are able to complete their assignments and make progress in their studies.

According to Taiwo & Emeke (2014), student performance is consistently low on both internal and external assessments. Biology performance in high school should be well-planned so that students get knowledge and skills that will help them succeed in life. This might be used to the teaching of biology in light of the UNESCO (2012) suggestion to improve the teaching of science via the diversity of topics and techniques, the promotion of experimentation, innovation, the dissemination, and sharing of knowledge.

The use of multimedia in the classroom is one of the most exciting developments in the field of blended learning (Lyndon et.al., 2013). It's a novel idea since it takes into account the benefits of both online and offline learning, which are made possible by information and communication technologies (Asparin & Tan, 2018). Students may gain or refine their practical abilities using this novel instructional approach. There is a strong need for a move to technology integration tactics as a new type of pedagogy in scientific classrooms since traditional approaches have failed to foster students' problem-solving abilities, curiosity, and critical and logical thinking (Shan & Khan, 2015). Information and communication technologies (ICT) have altered many facets of modern society (Olayinka 2019).

According to Malik & Agarwal (2012), a multimedia presentation is an exciting mix of computer hardware and software that enables integration of text resources, audio, animation, graphics, and video to create a successful presentation on a low-cost desktop computer. Multimedia may be a part of a live performance or it can be recorded and played, shown, interacted with, or accessed by information content processing equipment like computers and electronics. Content that employs many media types, such as text, audio, photos, animations, video, and interactivity, is considered multimedia. There are many applications of multimedia in teaching at all levels of education, from elementary school to university (Olayinka, 2019).

The use of multimedia as a supplementary teaching tool has been shown to be beneficial by studies such as those conducted by Mantei (2013) and Szaba and Husting (2010). It's worth noting that Keckley (2011) also found that using multimedia in the performance improved students' outcomes. Research-based approaches for minimizing distractions, prioritizing what's most important, and encouraging creative thinking are all part of what makes multimedia lessons so effective for students (Novak, 2019).

Shah & Khan (2015) used educational software to examine how using multimedia apps can affect students' performance in scientific classes and it was shown that students' knowledge and enthusiasm for science improved after using multimedia programs.

Due to a number of factors, the use of multimedia in classroom instruction is severely limited in Nigeria. These include high cost of multimedia gadgets and lack of computer literate teachers and technical staff. Therefore, this study investigates the influence of multimedia instruction on students' academic performance in biology in Ido/Osi local government area, Ekiti State.

Statement of the problem

Even though the advantages of multimedia presentations are well-known, they are not commonly utilized in secondary schools in Nigeria. In the majority of schools, the conventional approach of teaching, in which the instructor is the repository of knowledge, is still the norm, and this method is utilized to teach topics such as biology, which are naturally rich in abstract notions and phenomena. As a result, many students fails in both internal and external examinations, causing them to lose interest in it because they believe it is too difficult to comprehend. The West African Examination Council (WAEC) has often reported the poor biology performance of secondary school students.

According to WAEC Chief Examiners' report the performance of candidates in the West African Senior School Certificate Examinations indicates that more students fail biology due to the shortcomings that were noted annually but not rectified by schools or the government. Surveys have shown that the prevalent manner of teaching in Nigerian scientific classrooms is the primary reason of pupils' low performance in science (Ukoh & Adewale, 2014). The low performance of students in biology has been attributed to ineffective methods of instruction adopted by teachers (Ahmed & Abimbola, 2017; Kareem, 2016; Umar, 2018). The conventional teaching method (CTM) consists mostly of classroom-based lectures and teacher-directed training. As a result, several researchers (Ahmed & Abimbola, 2017 & Kareem, 2016) assert that CTM does not promote in–depth learning and long–term memory of some abstract biological notions. Using a technology-based educational system that encourages meaningful learning is one approach to resolving these issues.

Therefore, this study sought to investigate the influence of multimedia instruction on students' academic performance in biology in senior secondary schools in Ido/Osi Local Government Area, Ekiti State.

Research Questions

The following research questions were formulated to guide the conduct of the study:

vi. What is the effect of multimedia instruction on the academic performance of secondary school students in biology?

vii. What is the difference in the academic performance between male and female biology students after being exposed to multimedia instruction in senior secondary schools?

Research Hypothesis

The following null hypotheses were formulated to guide the study:

3) There is no significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools students.
4) There is no significant difference in the academic performance of male and female biology students after being exposed to multimedia instruction in senior secondary schools.

Methodology

The study is a quasi-experimental, pretest, posttest (one experimental group and one control group), non-randomized control group. The study was carried out in two mixed public senior secondary schools in Ido-Osi Local Government Area, Ekiti State, Nigeria.

The population of the study consisted of all the 1,378 biology students in public senior secondary schools in Ido/Osi Local Government Area, Ekiti State. The total population comprised of 17 public secondary schools in the local government area.

The sample for the study consisted of 50 senior secondary school biology students (SSS II) students from two randomly selected intact classes in the sampled schools. The experimental group was taught using multimedia instruction method/ strategy, while the control group was taught using conventional method/strategy.

The sample for Experimental Group was made up of 25 biology students while the Control Group was made up of 25 biology students. Both the experimental and the control groups consisted of 50 students. The treatment lasted for six weeks.

The instrument was a self-structured, critically examined and edited by the supervisor who made corrections where necessary to ensure both face and content validity of the instrument. The instrument was administered to 25 students that were not being included in the study. The instrument was administered to the same students after two weeks. The results of both administrations were analyzed using Pearson product moment correlation analysis to ensure the reliability of the items. The reliability of the instrument was determined using Kuder Richardson 21 after the pilot testing and found to have a reliability coefficient of 0.79. The data from the pretest and post-test administered were analyzed using frequency count, bar and pie charts, mean and standard deviation. The research hypotheses were tested using t-test and Analysis of Covariance (ANCOVA) statistics at 0.05 level of significance.

Results

Research Question One: What is the effect of multimedia instruction on the academic performance of secondary school students in biology?

In answering the question, the "pretest and posttest mean scores of students in Biology, being exposed to treatments were computed and compared. The result is presented in Table 1.

Table 1: Mean and standard deviation of pre-test and post-test scores of students in the experimental and control groups

Strategies	Test	N	Mean	S.D	Mean Diff.
Experimental	Pretest	25	6.000	1.258	**11.360**
	Posttest		17.360	1.630	
Control	Pretest	25	6.520	1.085	**6.310**
	Posttest		12.560	1.804	
Total		**50**			

Table 1 revealed the effect of multimedia instruction on the academic performance of secondary school students in biology. The performance mean difference of students in Biology between pre-test and post-test scores for experimental group is 11.360 while control group is 6.310.It appears that the use of multimedia instruction influences students' performance in Biology as the performance mean score of the experimental group is greater than the control group. The graphical representation below further shows the effect of multimedia instruction in the teaching and learning of Biology.

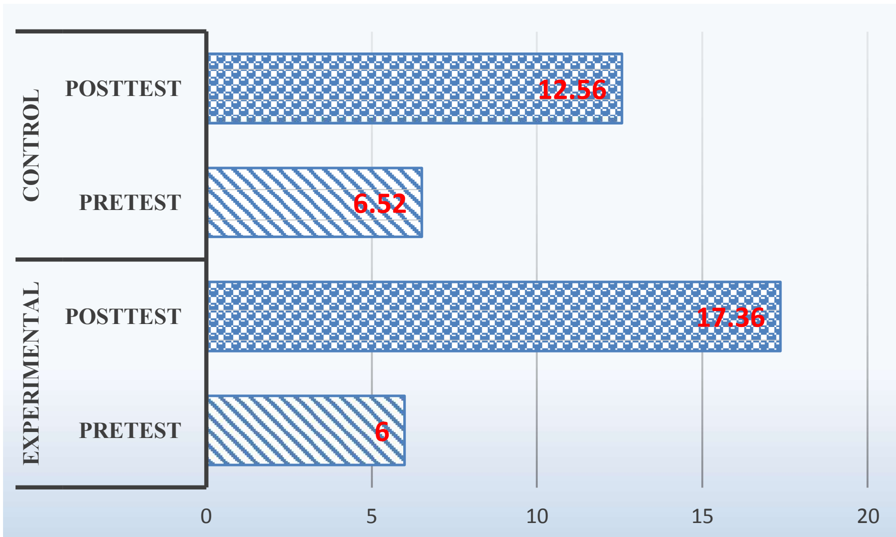

Figure 1: Bar chart showing Pre-test and Post-test mean scores of students in Biology in the experimental and control groups

Research Question Two: What is the difference in the academic performance between male and female biology students after being exposed to multimedia instruction in senior secondary schools?

Table 2: Mean and standard deviation of scores of male and female students in the experimental groups

Strategies	Gender	N	Mean	S.D	Mean Diff.
Experimental	Male	14	17.429	1.651	**0.156**
	Female	11	17.273	1.679	
Total		**25**			

Table 2 revealed the difference in the academic performance between male and female biology students after being exposed to multimedia instruction in senior secondary schools. The performance mean score of male and female students after being exposed to multimedia instruction is 17.429 and 17.273 with standard deviation of 1.651 and 1.679 respectively. The mean difference in the performance mean score of male and female students in Biology is 0.156. It appears that the effect of the use of multimedia instruction on students' performance in Biology is not gender biased. The graphical representation below further shows the gender difference in performance of students exposed to multimedia instruction in Biology.

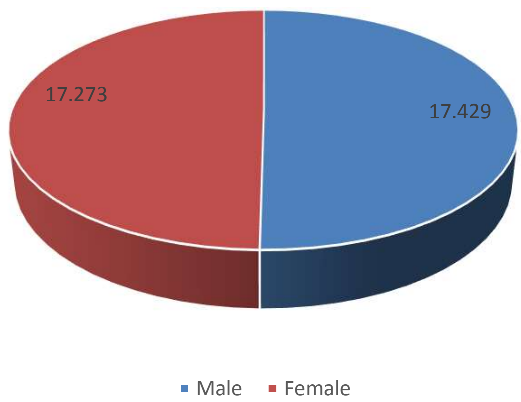

Figure 2: Pie chart showing Male and Female students' mean scores in Biology in the experimental group.

Testing of Null Hypotheses

Hypothesis 1: There is no significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools' students.

In order to test hypothesis three, performance of students in biology were collected from the pretest and posttest. ANCOVA was used to compute the effect of treatment onthe experimental and control group. The result is presented in Table 3.

Table 3: Analysis of Covariance for difference in the pre-test and post-test mean scores of students in science in the groups

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	289.035[a]	2	144.517	48.212	.000
Intercept	405.210	1	405.210	135.180	.000
PRETEST1_A	1.035	1	1.035	.345	.560
GROUP1_A	266.647	1	266.647	88.955	.000
Error	140.885	47	2.998		
Total	11620.000	50			
Corrected Total	429.920	49			

a. R Squared = .672 (Adjusted R Squared = .658)

The result presented in table 3 shows that there is a significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools' students as $F_{cal} = 88.955$, $P = 0.000 < 0.05$. This result led to the rejection of hypothesis 1. By implication, there is significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools' students. This is also an indication that the treatment brings about the improvement in the academic performance of students in biology.

Hypothesis 2: There is no significant difference in the academic performance of male and female biology students after being exposed to multimedia instruction in senior secondary schools.

To test hypothesis four, posttest scores of male and female students in biology in the experimental group were collected. T-test was used to compute difference in performance of male and female students after treatment for the experimental group. The result is presented in Table 4.

Table 4: t-test analysis for difference in the posttest mean scores of male and female students in biology exposed to multimedia instruction

Variations	N	Mean	SD	Df	t_{cal}	P
Male	14	17.429	1.651	23	0.233	0.818
Female	11	17.273	1.679			
$P > 0.05$	25					

Table 4 shows that male students exposed to multimedia instruction had posttest mean score of 17.429 and standard deviation of 1.651 while their female counterparts had posttest mean score of 17.273 and standard deviation of 1.679. The table revealed t-value at 0.05 significance level: (t = 0,233; df = 23; P =0.818). Hypothesis 2 is therefore not rejected. This shows that there is no significant difference in the academic performance of male and female biology students after being exposed to multimedia instruction in senior secondary schools.

Conclusion

In this study, significant effect of multimedia usage for biology instruction on the academic performance of senior secondary schools' students was found. The students exposed to multimedia instruction had higher performance mean scores than their counter parts who were not exposed to biology instruction with the aid of multimedia even with their level of homogeneity at the commencement of the experiment. This is also an indication that the treatment brings about the improvement in the academic performance of students in biology. This finding conforms to the finding of Shah and Khan (2015) that used educational software to examine how use of multimedia apps can affect students' performance in science classes and found that students' performance and enthusiasm for science improved after using multimedia programs.

Also, a significant difference in the academic performance of male and female biology students was found after being exposed to multimedia instruction in senior secondary schools. This is an indication that the effectiveness of the usage of multimedia for biology instruction is not peculiar to a particular gender which implies that the treatment is not gender biased. This could be due to the ability to motivate students to learning academic contents. This is in accordance to the findings of Yusuf and Afolabi (2010) who found non-existence of significant difference in the performance of male and female students exposed to computer assisted instruction in either individual" or cooperative settings.

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