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Media Devices and Students Academic Achievements in Biology among Co-educational Secondary Schools in Eket Local Government Area, Akwa Ibom State, Nigeria

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ABSTRACT

This study investigated the effect of media instructional packages on Biology students' academic achievement and retention of the concept of the circulatory system. The study adopted a Quasi-experimental research design. The population consisted of all the 1821 students of the 2022/2023 academic session in the nine co-educational Secondary Schools in Eket Local Government Area of Akwa Ibom State, Nigeria. The study sample comprised 150 students in the three intact classes of the SSII students selected using a purposive sampling technique. The researchers-made instrument titled 'Achievement Test on Circulatory System (ATCS)' was used for data collection. The reliability coefficient was determined using the Kuder-Richardson formula-21. The data obtained were analysed using mean, standard deviation, and Analysis of Covariance (ANCOVA). The result showed a significant difference in the mean achievement scores of Biology students taught the concept of the circulatory system using online and offline media instruction packages and that there was no significant effect of gender on academic performance on the circulatory system. There was no interactive effect of the use of media instructional packages and gender on Biology students' achievement scores when taught the concept of the Circulatory system. Hence, Biology teachers should effectively use media instructional packages to teach concepts in biology.

Keywords: *media devices, academic achievement biology*

INTRODUCTION

Education is the bedrock of a nation. The Federal Government of Nigeria adopts education as an instrument of excellence to address national issues in society (FRN, 2013). One of the goals of education in Nigeria is that it should be adopted to develop individuals into morally sound, patriotic, and effective citizens (National Policy on Education 2014). This can be achieved through educational activities that are learner-centered for maximum development and self-fulfillment. Gbamanja (2019) asserted that the success or failure of any educational system depends on the successful planning and execution of the education curriculum.

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Anwukah (2017) and Thomas (2017) opined that the survival of a nation or society depends on how to address contemporary issues such as crime, poverty, unemployment, terrorism, conflict, religious strife, drug abuse, and ethnicity. The inclusion of Biology in the school curriculum has become paramount because the acquired knowledge can help some contemporary issues.

Biology is a study that ranges from microscopic cellular molecules to the biosphere, encompassing the earth surface and all living organisms. It has become the central intellectual discipline, especially in biotechnology. It helps an individual to think more clearly about the values in this fast-changing world (Thieman and Polladina, 2018). Biological knowledge and practices have contributed immensely to various aspects of life, conservation of natural resources, food production, better health care and proper family life, crime detection through the use of fingerprints, disease control, development of vaccines and drugs, organ transplanting, plants and animals' hybridization, and development of pesticides.

Biology is a requirement for further learning in many science-related courses like medicine, anatomy, pharmacy, botany, cytology, embryology, and agricultural science. The human circulatory system is a concept in the Biology curriculum that deals with the movement of materials to the various parts of the body in higher animals (human beings). The circulatory system is also called the cardiovascular system. It is an organ system that permits blood to circulate and transport nutrients, hormones, and blood cells to where they are needed in the body, either from or to the body of cells. It has been that most students choose biology over other science subjects; this is because they find it very relevant as it deals with the study of living things around them. Despite popularity and numerous benefits of Biology to all areas of human endeavour, most Biology students' academic achievement in WASSCE in Nigeria has been consistently poor (WAEC Chief Examiner Report, 2022). This study aimed to investigate the causes of poor academic achievement.

Students' academic achievement is the total of academic performance in a particular subject. It is dependent on variables such as teaching methods, teachers' qualifications, students' parental background, and family size (Utibe and Onwiouokit, 2019). The desire to know and understand the causes of students' poor performance resulting from poor retention in Biology has attracted the attention of researchers in recent times and a considerable number of researchers have ascertained the causes in Biology (Akpan, 2015). Problems identified include the inadequate qualified biology teachers, poor infrastructures, and inadequate laboratory facilities, abstract of some biological concepts, and non-availability and utilization of instructional resources. The problems have brought about the conception that science subjects, especially Biology, are difficult to teach and learn. In this light, appropriate instructional strategies and resources in the classroom could help address the

complexity and abstract nature of the concept of the circulatory system. The circulation of blood takes place internally; hence, it is abstract to students. For the concept of the circulatory system to be taught effectively and well understood by students, there is a need to illustrate it in a visible form that resembles the actual process; hence, the choice of multimedia devices. Students' achievement on a course is a function of teaching strategies/resources adopted by the teachers. It, therefore, implies that for teaching and learning to be effective and successful, a teacher must carefully select the appropriate teaching methods in collaboration with appropriate teaching materials. The Biology curriculum advocates the teaching of Biology via instructional resources. The resources include media such as audio-visual, visual, audio, and graphic.

Media, as used in this study, is a multi-faceted approach. It is the application of a computer that allows the integration of multiple media elements such as audio, video, graphics, and animation into one synergetic and symbiotic whole that results in more benefits for the end user than media elements can provide individually. The media-based instruction is user-friendly; through it, information is delivered effectively. Teaching through media-based resources is an interactive learning process, which enables a teacher to use various elements of media like audio, video, graphics, text, and animation which provide a stimulating environment for learning as compared to the conventional method (Mayer, 2016). Media devices also enable a teacher to present information in various media via sound, text, animation, video, and images. Audio and video-based media instruction is concerned with the computer-controlled integration of text, graphics, drawings, still and moving images, animation, audio, and any other media where every type of information can be represented, stored, transmitted, and processed digitally (Ololube, 2019).

Conventional strategies with no audio and video-based media devices adopted by teachers at the secondary school level in Nigeria have been identified as one of the factors contributing to poor achievement of students in biology (Akpan, 2015). Atadoga and Lakpini (2013) found that the persistent low academic achievement in biology is attributed to instructional packages adopted by teachers. Instructional packages are decisions about organizing people, materials, and ideas to provide learning. They are both the teaching methods and the materials used in teaching. Instructional strategies are techniques teachers use to help students become independent and creative learners. There are so many aspects of biology that are difficult and yet must be learned by students; with the aids of multimedia all these are made available to students as if they are in real form. Hence, this study aims to examine the effect of audio-video-based devices on students' academic achievement and retention in Biology. Academic achievement refers to the extent to which a student has

accomplished his/her short or long-term goals. It is the success in bringing an effort to a desired end.

Academic achievement and retention do not generally depend on whether the student is male or female. The gender refers to socially ascribed attribute which differentiates male and female, and the hidden structures that govern relationships between them. According to Mberekpe (2013), gender is the social or cultural characteristics, roles, or behaviours which males and females are known for in society. Although there has been a general belief that males perform better than females in science, Olele (2014) reported that females did better than male students in conceptual understanding of force and motion. The inconsistent results on gender generated the need for further study. The study examined the effect of multimedia devices on students' academic achievement in Biology among public Secondary Schools in Eket Local Government Area.

The objectives of teaching and learning Biology in Secondary Schools emphasize the promotion of an understanding of Biology concepts to apply such knowledge in real-life problems. Online and offline media devices might play a tangible role in moving Biology concepts from abstraction to reality.

Since students prefer what they see and hear for better understanding. The study sought to answer the question, is there any difference in Biology students' academic achievement taught with the use of online and offline media packages?

The following hypotheses are formulated and tested at a 0.05 level of significance:

1. There is no significant difference in the mean achievement scores of Biology students taught the concept of the circulatory system using online and offline media packages.
2. There is no significant difference in the mean achievement scores of male and female Biology students taught the concept of the circulatory system.
3. There is no significant interactive effect of media instructional packages and gender on Biology students' achievement scores when taught the concept of the circulatory system.

The study would be important to biology teachers, school administrators, students, curriculum developers, and the government. It focuses on the effect of online and offline media packages on Biology students' academic achievement on the concept of the circulatory system, SS II students in co-educational public schools in Eket, Akwa Ibom State, Nigeria (2022/23 academic session).

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METHOD

This study adopted a quasi-experimental research design. The design was adopted because it would not be possible to have complete randomization of the subjects to avoid the disruption of school system (Kpolovie, 2018). Eket has nine public secondary schools.
The population for this study consists of 1821 Senior Secondary Two (SSII) biology students registered in the nine public secondary schools in Eket Local Government Area of Akwa Ibom State, Nigeria (LEC, Eket LGA, 2023). The sample size for this study consisted of 150 SSII Biology students drawn from three intact classes in two selected secondary schools. This study adopted purposive sampling technique, since schools sampled were required to satisfy certain conditions such as availability of electricity, availability of well-equipped and functional computer laboratory and technicians. Researchers made instrument titled: Achievement Test on Circulatory system (ATCS) was used for this study. The instrument had three distracters and one correct option lettered A-D. The researchers also prepared lessons plans and instructional packages that were used in teaching the students the concept of circulatory system with the different media instructional packages.

The instrument was face validated by two Secondary School Biology Teachers and one lecturer in Measurement and Evaluation in the Department of Science Education, Akwa Ibom State University. The content validity was done with the test blue print designed by Bloom Taxonomy. To ascertain the reliability of the instrument, copies of the ATCS were administered to a trial test group of 30 SSII students in the schools within the area, which were not part of the sample. Data were subjected to Kuder-Richardson's formula-21. The result showed reliability co-efficient of 0.79. Based on high reliability index, the instrument was deemed suitable for conducting the research.
The sampled students were pretested using ATCS before the teaching (treatments). The actual teaching was done for four weeks, while the posttest was administered immediately after complete teachings. The scores from the posttest test was recorded and used to provide information on students' academic achievement across treatment groups. Mean and Standard deviation were used to analyse data, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at a 0.05 alpha level of significance.

RESULTS AND DISCUSSION

Table 1: Mean and standard deviation of students' pre-test and post-test scores classified by treatment groups

Treatment Groups	n	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Online media package	52	22.38	.89	74.56	4.75	52.18
Offline media package	57	22.60	.92	61.12	3.23	38.52

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Table 1 shows the pre-test and post-test mean scores and standard deviation scores of the two groups of students taught with online and offline media packages. The post-test and pre-test mean scores of 74.56 and 22.38, for those in online media package group yielded the mean gain score of 52.18. While the post-test and pre-test mean scores of 61.12 and 22.60 for those in offline media package yielded the mean gain scores of 38.52. It shows that the online is higher than the offline media packages.

Table 2: Mean and standard deviation of students' pre-test and post-test scores classified by gender

Gender	n	Pre-test		Post-test		Mean Gain Score
		Mean	SD	Mean	SD	
Male	71	22.10	.79	75.70	4.22	53.60
Female	79	22.56	.91	73.84	4.99	51.28

The post-test and pre-test mean scores difference by gender displayed in Table 2 show that the male students had the mean gain score of 53.60, while the female had a mean gain score of 51.28. It shows a difference in the mean achievement scores of male and female Biology students taught the concept of circulatory in favour of male students.

Table 3: Analysis of Covariance (ANCOVA) of students' achievement scores classified by treatment groups and gender

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision at 0.05 alpha level
Corrected model	51072.685[a]	6	8512.114	684.972	.000	S
Intercept	912.141	1	912.141	73.400	.000	S
Pretest	12.468	1	12.468	1.003	.318	NS
Treatment groups	49031.166	2	24515.583	197.774	.000	S
Gender	9.471	1	9.471	.762	.384	
Treatment groups * gender	33.923	2	16.962	1.365	.259	
Error	1777.055	143	12.427			
Total	536445.000	150				
Corrected total	52849.740	149				

a. R Squared = .966 (Adjusted R Squared = .965), S= Significant at .05 alpha level, NS= Not significant at .05 alpha level

Table 3 shows that there is no interactive effect of media packages and gender on Biology students' achievement scores when taught the concept of Circulatory system. The result on Table 3 shows that an F-ratio $F(1,149) = 197.77$ ($p<0.05$) was obtained. Since the associated

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probability value of 0.000 is less than 0.05 set for the study, the null hypothesis that there is no significant difference in the mean achievement scores of Biology students taught the concept of circulatory system using online and offline media packages was rejected. There was a significant difference among mean achievement scores of Biology students in the circulatory system when taught using online and offline media packages. Table 3 further shows that an F-ratio $F(1,149) = 0.762$ ($p<0.05$) was obtained. Since the associated probability value of 0.384 is higher than 0.05 set for the study, the null hypothesis that there is no significant difference in the mean achievement scores of male and female Biology student taught the concept of circulatory system was accepted. There was a no significant difference among mean achievement scores of male and female Biology students in the circulatory system.

There is no significant interaction effect of media instructional packages and gender on Biology students' achievement scores when taught the concept of Circulatory system. Table 3 also shows that an f-ratio $F(1,149) = 1.365$ ($p<0.05$) was obtained. Since the associated probability value of 0.259 is greater than 0.05 set for the study, the null hypothesis that there is no significant interactive effect of media instructional packages and gender on Biology students' achievement scores when taught the concept of circulatory system was accepted.

The result of hypothesis one shows that there was a significant difference among mean achievement scores of Biology students in the concept of circulatory system when taught using online and offline media packages. This result could be attributed to the fact that students taught using online media tend to see and hear the concept. The students performed better when they see what they are learning than when they hear without seeing. The result of this finding is in line with the findings by Osemwinyen (2018) that students in the experimental group (those taught biology using e-learning (audio-video aids)) performed better than the control group (those taught same topic using the conventional lecture method) with respect to achievement. The finding also agreed with Gbamanja (2019), who reported that the achievement scores of students taught with Video and Audio Aided Instruction (VAAI) were higher than those with the conventional lecture method.

The result of testing hypothesis two showed that there was a no significant difference among mean achievement scores of male and female Biology students in the concept of circulatory system. This result could be attributed to the fact that all students were exposed to the same treatment and they performed equally. Also, the instructional package was appealing to both male and female students. The result of this finding agreed with the findings by Atadoga and Lakpini (2013), who reported no significant difference in academic achievement with male and female students when taught Biology using the jigsaw method.

The result of testing hypothesis three showed that there was no significant interaction effect of media instructional packages and gender on Biology students' achievement scores when taught the concept of Circulatory system. The result of this finding agreed with the findings by Gbamanja (2019), who reported no significant interactive effect of Video and Audio Aided Instruction (VAAI) and gender on academic achievement.

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CONCLUSION AND RECOMMENDATIONS

Based on the findings of the instructional packages investigated, the online package is the most effective in facilitating students' academic achievement in biology. This is because students taught using online packages had the best mean achievement scores. Gender had no statistically significant influence on students' academic achievement in biology. There was no interactive effect of the use of media instructional packages and gender on Biology students' achievement scores when taught the concept of the circulatory system.

Based on the conclusion, the following recommendations are made:

1. Biology teachers should use multimedia instructional packages in teaching concepts in biology.
2. Curriculum planners should ensure the incorporation of multimedia instructional packages in the teaching and learning of biology.

Government, with professional bodies like STAN should organize and sponsor regular workshops to train science teachers on multimedia instructional packages, especially audio and video-based devices in teaching science concepts.

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