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COMPUTER ANIMATION AS VEHICLE FOR ENHANCING SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN BIOLOGY

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ABSTRACT
The study investigated computer animation as a vehicle for enhancing secondary school students' academic achievement in Biology in Anambra State. Two research questions guided the study and two hypotheses were tested at .05 level of significance. Quasi-experimental pre-test, post-test non-equivalent control group research design was adopted for the study. The population of the study consisted of 20,836 SS1 students made up of 9,737 males and 11,099 females in 2022/2023 academic session in Anambra State. A sample size of 655 SS1 students was drawn for the study using Multistage sampling procedure. The instrument titled ''Biology Achievement Test (BAT)'', was used for data collection. The instrument was validated by three experts, two from Department of Science Education and the other in Measurement and Evaluation, all from Faculty of Education, Chukwuemeka Odumegwu Ojukwu University, Uli. The reliability of the instrument was determined using Kudder-Richardson formular 20 which yielded coefficient of 0.94. Mean and standard deviation were used to answer the research questions and ANCOVA was used to test the hypotheses. The findings of the study revealed among others that the students taught biology using computer animation yielded greater achievement mean gain score than those taught using expository method. It was also reported that there is significant difference in the mean achievement scores of students taught biology using computer animation and that of those taught using expository method in favor of computer animation. Based on the findings, it was recommended among others that Anambra State Post Primary School Service Commission should pay regular visit to schools to observe and encourage the use of computer animation in teaching biology.

Keywords: Computer Animation, School, Students, Academic Achievement, Biology

Introduction

Biology is one of the science subjects in senior secondary school curriculum in Nigeria. Anenye and Osuafor (2023) defined biology is a branch of science that studies life and its characteristics. It is scientific study of plants and animals. According to Omeligwe and Kpangban (2023), Biology is a natural science which describes different features of living and non-living things such as human body anatomy, which includes different types of cells, tissues, muscular system, types of teeth, types of joints, types of organs and how the organs function to keep one healthy and alive. Furthermore, they noted that Biology teaches individuals about plants and how they can be beneficial to them. One of the requirements of students to gain admission in tertiary institutions for study science disciplines such as medicine, microbiology, biotechnology, agriculture, pharmacy and food technology is good academic achievement in Biology at senior secondary school level.

The term 'academic achievement' has been variously conceptualized. However, the multiplicity of the definition has always pointed to one direction; that it is extent of attainment of predetermined education objective which is determined by scores (grade). Ikwuka and Samuel (2017) defined academic achievement as the outcome of education which indicate the extent to which a student, teacher or institution has achieved their educational goals and this is commonly measured by examinations or continuous assessment. It is the knowledge attained and skills developed by students as a result of learning experience in a subject. It is usually determined by test and examination scores of students. In the same vein, Ouma and Munyua (2018) defined academic achievement as the extent to which a student has achieved the educational goals and is measured by examination or continuous assessment test through the grading system. Arguing in the same line, Omomia, Chimezie and Akinwale (2014) defined academic achievement as the display of knowledge attained or skills developed in the school subjects which is commonly measured by examination scores or continuous assessment scores. In the context of this study, students' academic achievement is the sum of the scores obtained by students in a given test or examination.

The academic achievement of students in biology in external examinations tends to be unsatisfactory. To buttress this, Osuafor and Chukwuemeka (2023) noted that the achievement of students in the subject at external examinations in recent times in biology is not encouraging. They added that the available record from Post Primary School Service Commission, Anambra State showed the academic achievement of students in biology in WAEC in the State from 2018 to 2021 recorded that only 47.00 percent passed the subject in 2018, 48.70 percent in 2019, 49.00 percent in 2020 and 49.20 percent in 2021. In the same vein, Anenye and Osuafor (2023) noted that the WAEC Chief Examiner's report from 2018-2022 stated that the performance of students in biology, over the years, have remained unsatisfactory. According to Omeligwe and Kpangban (2023) noted that the West African Examination Council (WAEC) Chief Examiner's Report (2018-2019) points out that among the factors that cause low

achievement of students in Biology is the poor instructional delivery approach adopted by the bio logy teacher. The commonly method of teaching biology in secondary schools in Nigeria is expository method.

Expository method is a teacher-centered method whereby they present lesson using chalk, chalk-board with little or no explanation, while the students passively listens and take down notes. According to Nnorom (2015), expository method is a teaching method in which the teacher presents a verbal discourse on a particular subject, theme or concept to the learners with little or no instructional aids. Expository method tends to make instructional activities to very boring and monotonous to students in the classroom. The students taught Biology using expository method tend to learn at slow pace as lesson appeared abstract to them. The use of expository method in teaching biology could be associated with poor academic achievement in external examinations in recent years. One of the innovative strategies to improve the academic achievement in Biology could computer animation.

Computer animation is the use of combinations of text, still images, texts, animation, video, and sound. Ala, Onojah, Ishyaku and Adamu (2023) defined computer animation as the use of compelling graphics, including images, audio and video in the teaching and learning process. Furthermore, the authors stressed that the use of computer animation in teaching Biology has the ability to demonstrate multifarious complex concepts by bringing them to life for students' comprehension. Computer-animation is the use of electronic devices to create moving texts and images to aid illustration of a concept. According to Ala, Onojah, Ishyaku and Adamu (2022), computer animation is the manipulation of electronic illustration to create an illusion of moving images for presenting ideas and lessons. They added that the use of computer animation makes learning real and permanent to students. Mustafa (2023) noted that learners can easily create mental connections between corresponding words and pictures when computer animation is used in lesson presentation irrespective of their gender.

Gender is the physical characteristics, cultural and societal roles and expectations that distinguish males and females. Udowong, Nneji and Ighereno (2023) defined gender as the range of physical, biological, mental and behavioural features pertaining to and differentiating between the feminine and masculine population. Hamzat, Bello and Abimbola (2017) revealed that there was no significant difference between the achievement of male and female students taught biology with computer animation and expository method. The significant difference reported in academic achievement of male and female students could be connected to the biological and behavioural characteristics associated with gender. On the contrary, Owolabi, Babatunde and Gambari (2019) indicated that there was no significant difference in the mean achievement score of male and female students taught biology using computer animation and that taught using lecture method. The possible explanation for these controversial findings might be probably because the studies were carried out with different classes and on different biology

content areas under different testing condition. The need arises for further studies to take gender into consideration in an attempt to build a new evidence of the effect of computer animation on secondary school students' academic achievement in biology in Anambra State.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Biology using computer animation and those taught using expository method?
2. What are the mean achievement scores of male and female students taught Biology using computer animation and that of those taught using expository method?

Hypotheses

The following hypotheses were tested at .05 level of significance.

1. There is no significant difference in the mean achievement scores of students taught Biology using computer animation and that of those taught using expository method.
2. There is no significant difference in the mean achievement scores of male and female students taught Biology using computer animation and that of those taught using expository method.

Research Method

Quasi-experimental research design was adopted in this study. Specifically, the non-randomized pre-test and post-test control group design was used. Nworgu (2015) defined quasi-experimental research design as an experiment where random assignments of subjects to experimental and control groups are not possible. This research design is appropriate for this study because it allowed the researcher to manipulate variables under carefully controlled conditions so that the effect of these manipulations could be observed without random assignments of subjects to experimental and control groups. The study was conducted in secondary schools in Anambra State.

The population of the study consisted of 20,836 SS1 students made up of 9,737 males and 11,099 females in 2022/2023 academic session in public secondary schools in Anambra State. The sample for the study comprised 655 SS 1 biology students from three education zones. Stratified random sampling technique was used to select 3 education zones out of the six education zones in Anambra State. Purposive sampling technique was used to draw two schools, each from the three education zones. Therefore, six schools participated in the study. Schools with double streams and qualified teachers were purposively sampled. Therefore, intact classes were randomly assigned to experimental and control groups. The treatment groups which were exposed to computer animation were made up of 319 students (141 males and 178 females), while the control group constituted 336 students (150 males and 186 female).

The instruments for data collection were Biology Achievement Test (BAT) and Biology Interest Scale (BIS). The BAT consisted of 20 items taken from West

African Senior School Certificate Examination (WASSCE) biology past questions but modified based on the focused topics. BAT are based on ecology and conservation of natural resources. The instruments were also designed to elicit information on gender of the respondents. The face validation of the instruments was determined. To ascertain the face validation, the researcher presented the title, purpose of the study, research questions, hypotheses, table of specification, BAT, lesson notes and BIS to three experts who are lecturers, two are from the Department of Science Education and one in Measurement and Evaluation, all from Faculty of Education, Chukwuemeka Odumegwu Ojukwu University Uli. The experts suggested among others that interactive effect should be mapped out.

The reliability of the instrument was determined using Kudder-Richardson formular 20. The instrument was administered once to 40 SSS one students in secondary schools in Enugu State. The choice of Enugu state was because secondary school teachers in Anambra and Enugu states share similar characteristics in teaching Biology. The overall reliability of the instrument was found to be 0.94 for BAT.

A two weeks intensive training was given to the research assistants from the sampled schools teaching Biology in SSS one class. To control for experimental bias regular Biology teachers were used for the study. The Biology teachers were trained by the researcher on how to use the developed lesson plan in order to minimize errors which might arise as a result of teacher difference. The researcher also supervised the teaching to ensure that the teachers performed according to specified procedure. For the researcher to control the Hawthrone effect in which there is tendency that noticeable difference may occur, if the students become aware that they are engaging in an experiment, the experimentation was done using the classroom teachers of the students. In addition, both the experimental group and control groups were in different schools. To estimate initial group difference, analysis of covariance (ANCOVA) was used. The study lasted for four weeks. The pre-test was administered in the first week, thereby allowing extra three weeks before the post-test. Also the post-test was reshuffled. The research questions were answered using mean, while Analysis of Covariance (ANCOVA) was used in testing the hypotheses at .05 level of significance. The reason for adopting the ANCOVA procedure was to help eliminate any initial differences in the entry abilities of the participants that extraneous-variable control measures could not properly addressed. If the p-value $< .05$, reject H_o and if p-value is $\geq .05$, accept H_o.

Presentation of Results

Research Question 1: What are the mean achievement scores of students taught biology using computer animation and those taught using expository method?

Table 1: Mean Pre-test and Post-test Achievement Scores of Students taught Biology using Computer Animation (CA) and those taught using Expository Method (EM)

Method	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
CA	319	31.28	82.65	51.37	4.39	3.69
EM	336	22.81	52.50	29.69	5.08	4.55

As shown in Table 1, the pretest mean achievement score of students taught biology using the computer animation was 31.28 with standard deviation of 4.39; their posttest mean achievement score was 82.65 with 3.69 value of standard deviation and 51.37 mean gain. The pretest mean achievement score of students taught biology using the expository method was 22.81 with standard deviation of 4.39; their posttest mean score was 52.50 with 4.55 standard deviation and 29.69 mean gain. The mean achievement gain difference between students taught biology using the computer animation and those taught biology using the expository method was 21.68 in favour of the experimental group. The results show that the students taught biology using computer animation yielded greater achievement mean gain score than those taught using expository method.

Research Question 3: What are the mean achievement scores of male and female students taught biology using computer animation and those taught using expository method?

Table 3: Mean Pre-test and Post-test Achievement Scores of Male and Female Students taught Biology using Computer Animation (CA) and those taught using Expository Method

	Gender	N	Pretest Mean	Posttest Mean	Mean Gain	Pretest SD	Posttest SD
CA	Male	141	33.01	90.41	57.40	5.20	3.99
	Female	178	29.54	74.89	45.35	3.57	3.30
EM	Male	150	25.76	70.46	44.70	6.02	5.01
	Female	186	19.86	34.54	14.68	4.14	4.09

Table 3 shows that the male students taught biology using computer animation has mean gain achievement score of 57.40, while the females have mean gain achievement score of 45.35. The mean achievement gain difference between male and female students taught biology using the computer animation was 12.05 in favour of male students. The results show that the male students taught biology using computer animation yielded greater achievement mean gain score than female students. On the other hand, the male students taught biology using expository method has mean gain achievement score of 44.70, while the females have mean gain achievement score of 14.68. The mean achievement gain difference between male and female students taught biology using expository method was 30.02 in favour of male students. The results show that the male students taught biology using expository method yielded greater achievement mean gain score than female students. The findings indicated that male students taught biology

using computer animation and expository method yielded greater achievement mean gain score than female students.

Hypothesis 1: There is no significant difference in the mean achievement scores of students taught biology using computer animation and that of those taught using expository method

Table 3: ANCOVA on Difference between the Mean Achievement Scores of Students taught Biology using CA and those taught using EM

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	20211.650[a]	2	10105.825	443.345	.000	
Intercept	65143.223	1	65143.223	3411.507	.000	
Pretest	.309	1	.309	.024	.906	
Method	20565.489	1	20565.489	839.124	.001	Sig.
Error	1898.789	78	24.343			
Total	424567.009	87				
Corrected Total	21723.381	85				

Table 3 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 839.124 with Pvalue of .001 which is less than .05. Thus, the null hypothesis was rejected. Therefore, there is significant difference in the mean achievement scores of students taught biology using computer animation and that of those taught using expository method in favour of computer animation.

Hypothesis 2: There is no significant difference in the mean achievement scores of male and female students taught biology using computer animation and that of those taught using expository method.

Table 4: ANCOVA for Testing Significance Difference in the Mean Achievement Scores of Male and Female Students taught Biology using Computer Animation and that of those taught using Expository Method

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	31948.441[a]	4	7987.110	235.342	.000	
Intercept	63912.514	1	63912.514	3628.809	.000	
Pretest	.056	1	.056	.004	.934	
Gender	21132.135	1	21132.135	977.642	.073	
Method	138.115	1	138.116	6.238	.054	
Method * Gender	8.345	1	8.245	.512	.497	Not Sig.
Error	1932.734	85	22.738			
Total	423546.113	90				
Corrected Total	21246.169	89				

Table 4 shows that at 0.05 level of significance, 1df numerator and 91 df denominator, the calculated F is 0.512 with p-value of 0.07 which is greater than .05. Thus, the null hypothesis was not rejected. Therefore, there is no significant difference in the mean achievement scores of male and female students taught biology using

computer animation and that of those taught using expository method.

Discussion of Findings

The finding of the study indicated that the students taught biology using computer animation yielded greater achievement mean gain score than those taught using expository method. This supported the finding of Hamzat, Bello and Abimbola (2017) who reported that the mean achievement gains of students taught biology using computer animation is higher than that of the students taught using expository teaching method. The possible explanation for this finding is that the use of computer animation has encouraged biology students to internalize what they have taught. This finding could also be attributed to the fact that computer animation provides opportunity for students to learn, see and understand abstract concepts in biology textbooks. Computer animation provide opportunity to learn with a variety of graphics or slides which promote understanding of lesson which contribute to academic achievement, unlike the use of expository method which involve the use of chalk and chalkboard in instructional delivery. Computer animation provides visible graphic which turn abstract concept into real life phenomenon to promote students' academic achievement. The use of computer animation makes teaching and learning of biological concept clearer and appealing which promote students' participation in the instructional process. This motivates students and also enhances retention of ideas which lead to better academic achievement of students in biology.

It was also found out that there is significant difference in the mean achievement scores of students taught biology using computer animation and that of those taught using expository method in favour of computer animation. This is in agreement with the finding of Owolabi, Babatunde and Gambari (2019) which indicated that there was no significant difference in the mean achievement score of students taught biology using computer animation and those taught using conventional method in favour of experimental group. This is also in line with the finding of Bamidele and Yoade (2017) who reported that there exists a significant difference in the academic achievement of students exposed to the computer animation and those exposed to conventional method. The agreement between the findings could be due to the fact that the studies were all conducted in Nigeria.

It was found out that male students taught biology using computer animation and expository method yielded greater achievement mean gain score than female students. This is in disagreement with the finding of Hamzat, Bello and Abimbola (2017) female students mean gain score was higher than that of the male students taught using computer animation and expository method. The two studies were conducted in Nigeria relation to biology and this could account for the similarity in the findings. This finding indicated that male students obtain better academic mean achievement score than female students when both groups are taught biology using computer animation and expository method. The reason deduced from the disparity was that biology is practical and skills oriented subject which seems to be

inclined to males than females because of the feminine nature that could make them prefer subjects that include domestic tasks like home economics.

The result of this study revealed that there is no significant difference in the mean achievement scores of male and female students taught biology using computer animation and that of those taught using expository method. This finding is in agreement with that of Owolabi, Babatunde and Gambari (2019) which indicated that there was no significant difference in the mean achievement score of male and female students taught biology using computer animation and that taught using lecture method. The supported the finding of Hamzat, Bello and Abimbola (2017) which revealed that there was no significant difference between the achievement of male and female students taught biology with computer animation and expository method. The possible explanation for the agreement in findings could be attributed to the fact that the two studies were conducted in the same country where students share similar characteristics and in relation to biology. This contradicted the finding of Ikwuka and Samuel (2017) which indicated that gender had significant effect on the academic achievement of students who were taught using computer animation and those taught using conventional method. This contradiction could be due to the fact that the two studies were conducted in relation to different subjects.

Conclusion

Based on the findings, it is concluded that computer animation is an effective method of teaching biology to enhance students' academic achievement. The students taught biology using computer animation have significantly greater academic achievement than those taught using expository method.

Recommendations

Based on the findings, it was recommended among others that

1. Education policy makers and curriculum planners should popularize the relevance of the use of computer animation in teaching biology.
2. Anambra State Post Primary School Service Commission should pay regular visit to schools to observe and encourage the use of computer animation in teaching biology.
3. Teachers Association of Nigeria (STAN) should develop standard computer animation packages and guide teachers on the usage in teaching biology.

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