

Effectiveness of Computer Animation on a Progressive Learning Achievement of Secondary School Biology Students in Niger State, Nigeria.

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Abstract

The study investigated the effectiveness of Computer Animation Package on a progressive learning achievement and level of secondary school biology students in Niger State, Nigeria. Two research questions were raised and two null hypotheses were raised, tested at 0.05 alpha level. The pretest was not significant and suitable for co-variance with the posttest analysis. Two hundred and forty (240) students were selected through hat drawn 120 boys and 120 girls that pick Y out of X pieces of paper were used for the study from seven educational zones within three senatorial zones of Niger State. Six co-educational secondary schools. Two from each of the senatorial zones were randomly selected for the study. The design adopted for this study was Quasi-experimental pretest post-test experimental control group design treated with computer instructional aid (Computer Package) designed for three levels of education (SSS I, SSS II and SSSIII) with their scheme of works respectively. The same student from SSS I was carried along to SSS III progressively. Control groups were taught with lecture method. A 50 items structured Biology Achievement Test on a progressive learning Achievement (BATOPLOB) from SSS I – SSS III was developed and validated. Their reliability analysis was found to be 0.75, 0.80 and 0.85 respectively. ANOVA and ANCOVA Analysis were used to test the hypothesis. Scheffe's post hoc tests were conducted where significant differences exist among more than two groups. The major finding of the study showed that there was significant difference between the groups ($F_{cal} = 186.288$; $P < 0.05$). The package harmonized the academic achievement of the students from SS I – SS III.

Introduction

The competence that students demonstrate during or by the end of a teaching/learning experience in Science is of a major concern. Computer Animation Instruction is more effective way of teaching and learning Computer Animation is an electronic device or object of instruction in a physical world of matter through a machine with moving objects of many characteristics

(shape, pictures, graphic etc) indicating action, reactions, skills results, product in learning process. It transmits information in form of images, sound to be displayed on a screen projector through computer graphic. Computer animation gives life to teaching and learning of science (Wikipedia, 2007). It helps to transform the object properties, help in revolutionize sciences both in practical and theory. It is learner centered and it renews the learner's interest (Abdullahi, 2003; Olaleye, 2010).

The use of computer animation in learning makes cognitive and abstract information clearer Yisa (2014). Teaching and learning of reflex action, co-ordination nerve impulses are clearer and well understandable when computer animation package is used in teaching and learning (Yisa 2005), Olaleye, 2010; However it was observed by Yusuf (2006) that teachers do not make adequate use of instructional materials. Inadequate use of instructional material in the classroom has made teaching of biology boring, uninteresting, which contribute to students truancy during practical biology lessons. The use of Computer Animation package on a progressive learning achievement and ability level of biology students will go a long way in developing the students to respond positively towards learning and improve their creative skills and ability level irrespective of gender. Therefore Computer Animation Instructional package equalizes different ability level and gender disparity in learning biology in secondary schools in Niger State. Ume (2013) stated that all teaching can be greatly improved by using instructional materials because it makes learning memorable. Gana (2006) emphasized the need for teacher to produce and utilize various resources for effective teaching and learning a site makes teaching permanent.

Information and Communication Technology has created unique electronic communication system. Its existence has given man comfort but cannot transform practice itself. However ICT and CAI enable teachers to transform their practices and give sets of enabling conditions. The practices and reasoning of the teacher influences the uses of ICT, and the nature of the instructional media used by the teacher has a impacts on the student's achievement (Ojiaku, 2004). Information and communication technology has become a leading engine of economic growth of any nation (Anunobi 2012). According to Angel (2008), the world is gradually being saturated with information. Science and technology have given man comfort, improved his thinking process, his health, technological development vis-à-vis biological growth and self reliance. Teaching and learning opportunities can be expanded through appropriate application of technology (Nwaorgu, 2005). Several resources by (Olaleye 2010; Yaki 2011) and Yisa 2014 have revealed the effectiveness of CAI for instructions, they also emphasis that it has potentials to enhance students learning. Therefore, this study attempted to investigate the effects of computer animation package for progressive learning achievement and Wushishi and Ezenwa (2011) state that no enough time for constant practice, manipulation, characterization with the materials for learning was not given to the student for project development and performing different task in studying sciences in secondary schools. Computer Animation can transmit information in form of images clearer, and sound can be displayed on a screen projector through computer graphic. Computer animation gives life to teaching and learning of science (Wikipedia, 2007). It helps to transform the object properties, help in revolutionize sciences both in practical and theory. It is learner centered and it renews the learner's interest (Abdullahi, 2003; Olaleye, 2010).

Yisa revealed that animation brings lesson to life. However it was also observed by Yusuf (2006) that teachers do not make adequate use of instructional materials. Inadequate use of instructional material in the classroom has made teaching of biology boring, uninteresting, which contribute to

students' truancy during practical lessons. Short period of time given to biology lesson is not enough.

This study is unique in that it assesses the effect of computer animation package for progressive learning achievement of Secondary school biology Students in Niger State.

1.2 Statement of the Problem

The performance of students in science generally and Biology in particular have been quite unsatisfactory over the years. The West African Examination Council (WAEC) 2000-2012, and National Examination Council (NECO) 2000-2012 have repeatedly reported poor performance in Biology.

The WAEC Chief Examiners (2008) reported that large percentage of candidate could not relate the structures to their functions; some cannot give the advantages and disadvantages of the organs or parts of plants and animals and some could not deduce the relationship which they were expected to observe from drawing. James & Pamida (2001) attributed poor performance of the students to poor quality of diagram drawn by the candidates. Students tag their poor performance to abstraction of some of the concepts in Biology subject. In 2007, students could not represent cut surfaces with double lines (WAEC Chief Examiner's Report, 2008). Yisa (2014) stated that no enough time was allotted for biology subjects for practical's, project work, survey, drawing, excursions, familiarizing with their instructors and materials. This also contributes to poor performance in biology as many schools don't cover their syllabus before WAEC exams. The purpose of this study was to develop and find out the effects of computer Animation Instructional Package on Students progressive Learning Achievement of secondary school Biology students Niger State. Specifically, the study attempted to achieve the following objectives:

- (1) Determine the effect of Computer Animation package on a progressive learning achievement of secondary school biology student in Niger State.
- (2) Determine the effects of computer animation Instructional Package on male and female students progressive learning achievement on Biology from SSS I to SSSIII.

1.4 Research Questions

The following research questions were addressed in this study.

1. Is there any difference between secondary school students' progressive learning achievement when taught Biology with Computer Animation Instructional Package and lecture method from SSS I to SSS III?
2. Would there be any difference between male and female secondary school students progressive learning achievement when taught Biology with Computer Animation Instructional Package and lecture method from SSS I to SSS III?

1.5 Null Hypotheses

Based on the research questions, the following null hypotheses were tested at 0.05 significant level.

Ho₁: There is no significant deference between secondary school students' achievement when taught Biology with Computer Animation Instructional Package and lecture method from SSS I to SSS III.

Ho₂: There is no significant difference between male and female secondary school students' progressive learning achievement when taught Biology with Computer Animation Instructional Package and those taught with lecture method.

1.6 Significance of the Study

The results of this study will have positive influence on the teacher, students, government, curriculum developers, school administration and teaching and learning of Biology in secondary schools.

1.7 Scope of the Study

The study covered all the two hundred and thirty-two (232) senior secondary schools in seven educational zones of Niger State. Within the three senatorial zone. The content covered in SSI are ecology, food chain, biotic and biotic factor, association and others. In SSII, the topics covered are cell theory, structure and function, osmosis and diffusion, kidney, irritability, skin, tongue digestion, while in SSIII, the content are: life circle of tape worm, dispersal of fruits, and circulation of blood, excretion, nervous coordination and heredity. These contents were drawn from the senior secondary school Biology curriculum, text books and scheme of work from SSSI-SSSIII.

3.1 Research Design

The design adopted for this study was pre-test-posttest randomized experimental and control group design (Donald, Jacob and Razavieh, 2009).

3.2 Population of the Study

The total population of the school was 232 senior secondary school spreads are seven educational zones within the three senatorial zones of Niger State.

3.3 Sample and Sampling Technique

The sample for this study was Two Hundred and Forty (240) students selected randomly from each of the selected schools. 120 males and 120 females students that pick Y out of X pieces of paper through hat drawn were grouped and randomly selected. Six (6) co-educational senior secondary schools were selected to take care of the gender, two schools from each of the three Senatorial Zones in Niger State.

3.4 Research Instruments

Three instruments were used to generate data for this research.

- (1) Computer Animation Instructional Package for Progressive Learning of Biology (CAIPOPLOB) by senior secondary students at SSS I, SSS II and SSS III levels was used for improving the academic achievement of students in Biology.
- (2) Biology Achievement Test on progressive Learning of Students (BATOPLOS) for SSS I, SSS II and SSS III levels was also used for improving the academic achievement of students and to test their ability levels in Biology.
- (1) Development of Computer Animation Instructional Package for progressive Learning of Biology (CAIPOPLOB). Procedure for production of the CAIPOPLOB involves the shooting of Biology concepts in three stages, one contains the package for SSSI subjects from the Biology scheme of work and syllabus.

The second CAIPOPLOB consists of Animation for SSII students according to their scheme of work and syllabus. The third CAIPOPLOB consist of the computer Animation for SSIII students based on their scheme of work and term syllabus.

The cost of computer animation instructional package production is shown in appendix D.

- (2) Biology Achievement Test on progressive Learning of Students (BATOPLOS) The BATOPLOS consist of two parts. Part A, consist of Bio-data of students. While part B consists of fifty (50) validated multiple choice items to be responded to by the students. Each of the items consists of multiple choice answer A-E to which one of the option is the correct answer. Students will be required to respond to these items as post test.

The BATOPLOS is of three different types. This is because the subjects for the research are treated at different levels of senior secondary schools based on the Biology curriculum prepared by the Federal Government of Nigeria. For all the were developed by the researcher on the basis of the concepts to be taught at each of the levels. Therefore, there is BATOPLOS for SSSI level. Consequently, the same procedure was adopted for SSSII level. So, BATOPLOS for SSSIII was also produced through the same process.

3.6 Reliability of the Research Instruments

The instruments were pilot tested using 40 students from each class having the same characteristics with the same research subjects from one of the schools outside the sampled one. Test retest method was used to establish reliability of the instrument, after administering, the Pearson product moment correlation formula was used to get the reliability coefficients. For the SSS I BABOPLOB of 0.80 was obtained, for the BABPLOB for SSS II 0.85 was obtained coefficient. For the SSS III BABPLOB, 0.86 was obtained.

The data collected were analyzed using Pearson product Moment Correlation Analysis. The correlation analysis of 0.80, 0.85 and 0.86 were obtained from the analysis at 0.05 significant level for SSSI, SSS2 and SSS3 BATOPLOS respectively. The values therefore revealed that the instruments were reliable.

3.7 Method of Data Collection

Descriptive and Inferential analysis were used to provide answers to research questions. Analysis of Co-variance (ANCOVA) statistic was also used to analyze the Before the experiment the researcher visited the selected schools for official permission from the school authority. The research assistants were trained based on how to administer the CAIPOPLOB. During the first week of the experiment, pretest was given to experimental groups and control groups to determine their equivalent level. Therefore, the treatment commenced in the second week of the research. The score of experimental and control groups was computed and used for data analysis.

The randomized schools with enough computers were used so that each student was assigned to one computer system for effective interaction with the lesson which lasted for 45 minutes. Immediately after the completion of the studies, the BATOPLOBS was administered. The result was use to stratify the students into performance levels (scoring ability). The sample size of students was 120 boys and 120 females).

3.8 Method of Data Analysis

Descriptive and Inferential analysis were used to provide answers to research questions. Analysis of Co-variance (ANCOVA) statistic was also used to analyze the pretest data.

The data collected were analyzed and the findings presented. The mean scores of the two groups of students who were taught Biology with Computer Animation Instructional Package on progressive learning achievement and ability levels from SSSI to SSIII were used.

Computer statistical package for the Social Sciences (SPSS) version 16 was used I analyzing the data. The probability level of 0.05 was used for retaining or rejecting the hypotheses. To determine the sources of the differences, a scheffe's post hoc analysis was performed on the basis of the results obtained through ANCOVA analysis.

Research Questions

Research Question One

Is there any difference between secondary school students progressive learning achievement when taught Biology with computer animation Instructional Package and lecture method from SSSI to SSIII?

The results presented in table 1.2 revealed that there were significant differences in the academic achievements of student taught biology with computer Animation on a progressive learning from SSSI to SSSIII.

The table further revealed that there is significant difference with the students taught biology on a progressive learning from SSSI to SSSIII with computer Animation with below mean score from Scheff multiple comparisons

Control SSS 2 VS experimental SSS 1 12.7167 is significant

Control SSS 3 VS experimental SSS 2 15.1833 is significant

Control SSS 3 VS experimental SSS 3 17.7667 is significant

In the treatment with the ANCOVA Analysis

In ANCOVA Analysis Fcal.028 not significant it 0.05 significant level while post expt Fcal = 51.158 is significant at 0.0588 in df 1 shows statistical difference in the mean score of the experimental group control group. Hypotheses one is rejected.

Research Question Two

Would there be any difference between the main score of male and female secondary school biology students progressive learning achievement when taught biology with computer Animation.

The result presented on table 1.3 shown ANCOVA analysis of posttest male and female progressive learning achievement of experimental and control groups.

Gender of poscont Fcal = .276 significant .599

Posexpt Fcal = 3. 133 significant .079

There is no significant difference $P < 0.05$ therefore hypothesis two is retain

Table 1.2 Sheffe multiple comparison test on post mean scores of male and female SSS1, SSSII and SSSIII students progressive learning achievement when taught with computer Animation package as agent lecture method.

At the initial experimental stage there is significant difference but as they proceed in teaching experimental groups there is no significant difference.

(1) Dependent variable control expt 1, 2, 3 value

Gender SSSI13

Male Expt SSSI (j) Gender SSSI 2, 3 mean Difference significant remark

Male Expt SSI	Female Expt SSSI	2.91111	.995	not significant
Male Expt I	Female expt SS2	-13.98667	000	significant
Male Expt I	Female expt SS3	-12.95556	000	significant
Female expt I	Male expt SSS2	- 16.89778	000	Significant
Female expt I	Male Exp SS 2	- 1526667	000	Significant
Male expt SSS 2	Female expt SSS 2	- 1.63111	1.000	Not significant
Male expt SSS2	Male exp SSS 3	- 3.06667	.975	Not significant
Male expt SSS 2	Female expt SSS 3	1.03111	1.000	Not significant
Female expt SSS2	Male expt SSS 3	- 4.69778	.820	Not significant
Female expt SSS2	Female exp SSS 3	- 60000	1.000	Not significant
Mae expt SSS3	Female exp SSS3	4.09778	.925	Not significant

The table shows as they proceed from SSSI – SSSIII computer Animation Instructional Package harmonies the difference between the different group and there was no significant different group and there was no significant difference ($P > 0.05$) therefore hypothesis was retained.

1.1 Pretest Analysis of Control and Experimental Groups

Table 1.1 ANOVA Analysis on Pre-Test Performance of Biology Students in Control and Experimental Groups

Sources of Variation	Sum of square	Df	Mean Square	Fcal	Sign Level
Between Groups	91.604	2	45.802	.30	.483
Within groups	14879.329	237	62.782		
Total	14970.933	239			

Significant at 0.05 level of significance

Table 1.1 shows the ANOVA comparison of pretest mean scores of control and experimental groups on the Achievement of learners in Biology. From the table there is statistically significant difference between the mean scores of the experimental and control Groups (Fcal - .730; $P > 0.05$). The calculated level of the pretest was used as co-variates for further analysis.

1.2 Hypothesis One (H_{01})

There is no significant difference between secondary school students progressive learning achievement when taught Biology with computer animation instructional package and those taught with lecture method from SSSI – SSSIII.

Table 1.2 Analysis of Covariance (ANCOVA) for Progressive learning achievement of students taught Biology with CAIPOPLOBS and lecture method.

Sources	Dependent Variable	Type III sum of squares	df	Mean square	F	Sig.
Corrected	Poscont	2774.527 ^a	2	1387.263	28.452	.000
	Posexpt	2445.763 ^b	2	1222.881	36.870	.000
Intercept	Poscont	800.479	1	800.479	16.417	.000
	Posexpt	3755.997	1	3755.997	113.243	.000
Precont	Poscont	2464.901	1	2464.901	50.553	.000
	Posexpt	171.402	1	171.402	5.168	.25
Treatment	Poscont	1.356	1	1.356	.028	.868
	Posexpt	1696.790	1	1696.790	51.158	.000
Error	Poscont	5704.773	117	48.759		
	Posexpt	3880.604	117	33.168		
Total	Poscont	178582.000	120			
	Posexpt	436648.000	120			
Corrected Total	Postcont	8479.300	119			
	Posexpt	6326.367	119			

a. R squared = .327 (Adjusted R Squared = .316)

b. R squared = .387 (Adjusted R Squared = .376)

Table 1.2 shows ANCOVA for the posttest of control and experimental groups with pretest covariance. From the table, the intercept of the control and experimental shows significant difference, this indicates that there is statistically significant difference in the mean scores of the experimental groups and the control groups ($P < 0.05$). Therefore, hypothesis one was rejected.

1.3 Hypothesis Two (H_{02})

There is no significant difference between male and female secondary school student's progressive learning achievement when taught Biology with Computer Animation Instructional Package.

Table 1.3 ANCOVA Analysis of Posttest Scores of Male and Female Experimental and Control Groups Progressive Learning Achievement when Taught with Computer Animation Instructional package.

Source	Dependent Variance	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Poscont	328.970 ^a	2	164.485	2.361	.099
	Posexpt	2380.048 ^b	2	1190.024	35.282	.000
Intercept	Poscont	3794.123	1	3794.123	54.468	.000
	Posexpt	6209.648	1	6209.648	184.103	.000
Preexp	Poscont	291.990	1	291.990	4.192	.043
	Posexpt	2159.548	1	2159.548	64.026	.000
Gender	Poscont	19.344	1	19.344	.276	5.599
	Posexpt	105.687	1	105.687	3.133	0.79
Error	Poscont	8150.330	117			
	Posexpt	3946.319	69.661			
Total	Poscont	178582.000	117			
	Posexpt	436648.000	33.729			
Corrected Total	Poscont	8479.300	120			
	Poscont	6326.367	120			
			119			
			119			

a. R squared = .039 (adjusted R squared = 0.22)

b. R squared = .396 (adjusted R squared = .366)

Table 4.3 shows ANCOVA analysis of posttest male and female progressive learning achievement of experimental and control groups. From the table, there was no significant difference between male and female experimental groups because gender has no effect on the performance of the groups ($P > 0.05$). Therefore, hypothesis two was retained.

A computer Animation Instructional Package has been developed for progressive learning achievement of biology students from SS I to SSS III. Findings arising from hypothesis one showed that there was significant difference in the mean score achievement of secondary school biology students taught with computer Animation Instructional Package from SSS I to SSS III. It was observed that in H_02 there was no significant difference in the mean academic achievement scores of the male and female biology students from SSS I to SSS III. Therefore hypothesis two was retained. It is gender friendly. Teachers can easily give suitable feedback of the students they have for a long period of time. Effective manipulation of materials.

Discussion of Results

From the result obtained in research question one, shows that majority of the respondents have progressive understanding of the biology concepts when Computer Animation Instructional Package was used for progressive learning of biology (From SSSI –SSSIII) after being taught for three progressive years. The students agreed that the package did not only improved their performance but also serve as motivation in the study of biology. The result obtained from table 4.1 shows that Computer Animation Instructional Package influenced the students positively in their progressive learning for better academic performance. This result is in agreement with

Luka, Wushishi and Ezenwa (2011) on the analysis of progression in secondary school chemistry students understanding of matter in Minna metropolis. Nwagbo (1999) also specified that when instructions are heard and visualized, they seek to arouse interest, clarify concepts, modified attitude and possess the capacity of enhancing quality learning. Akor (2000) states that good interaction provides appropriate behavior and give new ways of relating more easily. Yisa (2005) stated that any instructional material that evokes human sensory organs tends to facilitate permanency and learning. The finding agreed with Umeh (2013) who states that instructional material use in teaching encourage individualize; also Yisa (2014) opined that progressive learning gives room for familiarization effective feedback of what learnt.

Contribution to Knowledge

This study has contributed to knowledge in the following ways:

The successful development and use of the Computer Animation Instructional Package for progressive learning of biology in secondary schools is a major contribution to knowledge. The package makes teaching real, interesting, motivating, understandable, helps students develop skills and positive attitude towards teaching and learning of biology. It has added to the number of innovative instructional materials available in schools. It also encourages individualized learning.

Conclusion

Computer Package makes teaching and learning clear, fast, interesting progressive learning provides effective feedback. It creates familiarization of the subject material and instructor. It develops skills and permanent learning. It is gender friendly.

Recommendation

- (1) Government should provide at all level supervisors to all schools.
- (2) They should provide instructional materials, facilities and infrastructures to school.
- (3) Teachers should be allow to go for in service training workshops, seminars and conferences to upgrade their knowledge and teaching method strategies.
- (4) Progressive learning should be introduced by the curriculum planners for more familiarization with the material and their teachers.

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