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Effects of Computer Assisted Multimedia Instruction on Senior Secondary School Students' Achievement In Biology In Two Educational Zones of Niger State, Nigeria, West Africa.

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Abstract: *This study investigates the "Effects of Computer Assisted Multimedia Instructional (CAMI) package on Secondary School Students 'Achievement in Biology in Two Educational Zones of Niger State, Nigeria". The sample comprised of 364 (206 boys and 158 girls) students selected from six senior secondary schools in Two Educational Zone of Niger State, Nigeria. There were two experimental groups and a control group. One courseware version named Computer Assisted Multimedia Instructional (CAMI) package was developed to examine the effect on students' achievement. The research design was a quasi-experimental pre-test, post-test and control group design. The experimental groups were taught using Computer Assisted Multimedia Instructional (CAMI package and the control group was taught using lecture method. The Biology Achievement Test (BAT) of a 40 items was validated by expert for data collection. The reliability co-efficient of 075 was obtained. Five (5) hypotheses were formulated and tested at 0.05 alpha levels. The data was analyzed using ANCOVA. The findings of the study showed that student's in experimental groups achieved significantly better than their counterpart in control group. There was statistically significant difference in the achievement of Male and Female students when compared with the control group. Also, there was no statistically significant difference in the achievement of Male and Female students when compared within the same experimental groups. Based on my findings, it was recommended among others that the use of Computer Assisted Multimedia Instructional package for teaching and learning should be encouraged in our schools.*

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I. Introduction

Science is defined as an organized body of knowledge in form of concepts, laws and theories (Abdullahi, 1982). It has been seen as the structure upon which technological advancement is built. Science enhances national advancement and exposes the nation to current happenings through observing, thinking and reasoning (Akale, 2006) Thus, any nation that does not lay appropriate emphasis on science, especially Biology, runs the risk of greatly slowing down the rate of its technological advancement. The common errors committed by the students as published by West African Examination Council (WAEC) chief examiner report (2009-2013) includes;

i. Inability to draw good diagrams and wrong labelling of specimens.
ii. Wrong spellings
iii. Wrong /poor identification of specimens.
iv. Wrong tabulation
v. Lack of providing the correct answers to the questions.
vi. Wrong numbering of questions.

Biology is occupies a unique position in the school curriculum. Biology as a science, in science education emphasize the teaching and learning of science process and principles.Participatory methods and activity oriented have been recommended for effective and learning, efficient mastery and conduct of practical biology in secondary school (FME, 2004).Collaborative learning is a method of teaching and learning in which students' team together to explore a significant question or create a meaningful project. Collaborative learning teams are said to attain higher level of thinking and preserve information longer times than students working individually. There is an old adage that says ''two good heads are better than one''. A Computer Assisted Multimedia Instructional package involves the use of more than one presentation medium to communicate with students Thus, rather than incorporating text or sound, multimedia would incorporate the use of two presentation formats such as; text, sound, and animated images, or text, sound, images from videos, multiple display areas, presentations, or speakers or actors who make use of 'props' with text, sound, images and motion videos. While Computer Assisted Instruction (CAI) is a self-learning technique usually off-line or on- line. It refers to the use

of the computer as a tool to facilitate and improve instruction. CAI programme use tutorial, drill and practice, simulation and problem solving approaches to present topic.The deficiency in learners when using Cooperative learning intend to resolve including the following; help students in learning and acquiring knowledge, skills, and experiences in biology. It will foster positive and cordial relationship among the students, such as tolerance and hard work. It involves the students in reasoning and in higher learning, thereby brings about a positive attitude toward learning biology and it will improve their performance. Students' participation and interest in biology shall be aroused with this method of learning. Thereby, help students to express or convey ideas. The issue of gender is an important one in Science education especially with increasing emphasis on ways of boosting manpower for technological development as well as increasing the population of females in science and technology fields (Ogunkola&Bilesanmi-Awoderu, 2001). In Nigeria, and perhaps the whole of Africa, gender bias is still very prevalent (Arigbabu&Mji, 2004). This is a view to which Onyezuligbo (2003) has also alluded in pointing out that ''sex role are somewhat rigid in Africa particularly in Nigeria, gender differences are emphasized.'' It is common place to see gender stereotypes manifested in the day-to-day life of an average Nigerian. In a nutshell, what are regarded as complex and difficult tasks are allocated to boys, whereas girls are expected to handle the relatively easy and less demanding tasks.

II. Material And Methods

The research design that was adopted for this study is a quasi-experimental design. It adopted a pre-test and -post-test non- equivalent, non- randomized control group design was used. The use of quasi experimental design is further supported by Daramola (2001) who opined that this sort of design involves periodic measurement of one group before and after treatment, which make it possible to ascertain the effect of treatment on the group. They are two variables; they are Computer Assisted Multimedia Instruction (CAMI) and Biology Achievement Test (BAT), gender (male and female) as moderating variables. The design involved two experimental groups and one control group (involving three separate intact classes). The Experimental group were exposed to treatment by using (CAMI) package and the Control group were taught using conventional lecture method. It was adopted because it was not possible to randomize the subject without disrupting the school programme, time table and among others. Table 3.1 Research design layout.

Table 3.1 Research Design Layout

GROUPS	PRE TEST	TREATMENT	POST TEST
Experimental Group l	O_1	X_1	O_2
Experimental Group ll	O_3	X_2	O_4
Control Group	O_5	----	O_6

Where;

O_1, O_3, O_5 ---------- Pretest scores
O_2, O_4, O_6 ---------- Posttest scores
X_1 ---------- CAMI (Individualized)
X_2, ---------- CAMI (Cooperative)
------ ---------- No Treatment (Control).

The target population of the study comprised of population of Senior Secondary Schools One students in two Senatorial Zones of Niger State. There were six (6) senior secondary schools in Minna and Bida senatorial zones with 180 Senior Secondary One (SS 1) students. There are Twenty-one (21) schools in Bida senatorial zone. A population of Five Thousand One Hundred and Forty One (5,141) students and Forty- four (44) schools in Minna Senatorial Zones with a population of Nine Thousand Two Hundred and Fifty Seven (9,257) students. Therefore, the target population of students for this study is Fourteen Thousand Three Hundred and Ninety Eight (14,398).The distribution of students' population in SS 1 in various secondary schools in Minna and Bida senatorial zones. The sample of this study was made up of One Hundred and Eighty (180) students drawn from six Co-educational Senior Secondary Schools in the two Senatorial Zones of Niger State. A purposive sampling technique was used to select schools with well- equipped computer laboratories facilitiesand manpower and were used as Experimental schools. The other two schools were randomly selected and tagged as Control schools. The four schools purposively selected were classified into Experimental group one (Individualized) with Twenty -nine (29) females and Thirty-one (31) males, a total of Sixty (60) students. Experimental group two (Cooperative) withThirty-two (32) females and Twenty-six (26) males, a total of Fifty-eight (58) students. Experimental group one were taught with CAMI package (Cooperative), while the Experimental group two were taught with CAMI package (Individualized) and the Control group with Thirty-two (32) males and Thirty (30) females were taught with Conventional Lecture Method.

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Thirty-one (31) males, a total of Sixty (60) students. Experimental group two (Cooperative) with Thirty-two (32) females and Twenty-six (26) males, a total of Fifty-eight (58) students. Experimental group one were taught with CAMI package (Cooperative), while the Experimental group two were taught with CAMI package (Individualized) and the Control group with Thirty-two (32) males and Thirty (30) females were taught with Conventional Lecture Method. The test instrument; Biology Achievement Test (BAT), consisted of two major sections, A & B. Section A required the students to supply information or demographic data such as name of school, student's name, sex and continuous assessment number. Section B of the BAT comprised 40 multiple choice test items, with five options (A-E), which were carefully selected from different past senior secondary school examination questions by West African Examination Council(WAEC). Students were required to indicate the correct answer by ticking the letter (A-E) that corresponds with the correct option for each item It covered all the selected concepts in Biology which was taught using CAMI package (Individualized and Cooperative) and Conventional Lecture Method.

III. Results

The results of the analysis of data for this study are presented below. The analysis and result are done according to the research hypotheses.

Table 4.1: Mean and Standard Deviation of the Pretest scores of the Experimental and Control Groups

Variable	No of Sample	Mean (x)	SD
Experimental Group l (CAMIP Individualized)	30	27.30	4.43
Experimental Group ll (CAMIP Cooperative)	29	28.30	5.40
Control Group (Lecture)	31	28.40	5.37

Table 4.1 shows the mean and standard deviation of the scores of the two experimental groups and control group. From the table, the mean and standard deviation scores of the experimental and control groups did not show any significant difference. This implies that the groups were fairly comparable (x = 27.30; x =28.30 & x = 28.40).

Table 4.2: Summary Analysis of Variance (ANOVA) Comparison of the Pretest Mean Scores of Experimental Group I, II and the Control Group

Source of Variation	**Sum of Square**	**df**	**Mean Square**	**F**	**P**
Between Groups	44.400	2	22.200	0.86^{ns}	0.423
Within Groups	4579.600	177	25.873		
Total	4624.000	179			

NS= Not Significant at P > 0.05 level

Table 4.2 shows the ANOVA comparison of the two experimental groups and control group. An examination of the Table show no significant difference in the pretest scores of the three groups F (2, 177) = 0.86, p > 0.05). Hence, there was no significant difference at 0.05 alpha level between the three groups. This implies that there was no significant difference among the mean scores of the experimental group l, experimental ll, and control group at 0.05 level of significance.

HO_1: There is no significant difference in the mean achievement scores of students taught Biology with Computer Assisted Multimedia Instructional Package (CAMIP) in individualized learning setting, cooperative learning setting and those taught with conventional lecture method.

Table 4.3: Mean and Standard Deviation of Scores of Experimental Group I, II and the Control Group at Pretest and Posttest

Group		Pretest		Posttest		Mean Difference
	N	X	SD	X	SD	
Individualized	60	27.30	4.43	59.27	11.29	31.39
Cooperative	60	28.30	5.40	62.53	9.39	34.23
Lecture	60	28.40	5.37	36.43	8.61	8.03

Table 4.3 shows the mean and standard deviation of scores of students taught Biology with Computer Assisted Multimedia Instructional Package (CAMIP) in individualized learning setting, cooperative learning setting and those taught with conventional lecture method at pretest and posttest. The Table reveals that the three groups recorded increase in their mean difference.

Table 4.4: Summary of Analysis of Variance (ANOVA) Result of the Posttest Scores of Experimental Group I, II and the Control Group

Source of Variation	Sum of Square	Df	Mean Square	F	P
Between Groups	24264.844	2	12132.422	125.571*	0.000
Within Groups	17101.400	177	96.618		
Total	41366.244	179			

*: Significant at 0.05 level

Table 4.4 shows the ANOVA result of the comparison of posttest scores of students in Experimental Group I, II and the Control Group. An examination of the Table shows a significant difference in the mean scores of the three groups ($F(2, 179) = 125.571$, $p < 0.05$). On the basis of this, hypothesis one was rejected.

Table 4.5: Scheffe Post-hoc Analysis of the Posttest Mean Scores of Students in Experimental Group I, II and the Control Group

Groups	Treatment	Mean Difference	Sig.
Exp. I (Individualized)	Exp. II (Cooperative)	-3.267	0.194
	Control (Lecture)	22.833*	0.000
Exp. II (Cooperative)	Exp. I (Individualized)	3.267	0.194
	Control (Lecture)	26.100*	0.000
Control (Lecture)	Exp. I (Individualized)	-22.833*	0.000
	Exp. II (Cooperative)	-26.100*	0.000

*.Significant at P < 0.05 level.

Table 4.5 shows the Scheffe post-hoc analysis of posttest mean scores of students in Experimental Group I, Experimental Group II and the Control Group. The table indicates that there was significant difference between the mean scores of students taught Biology using CAMIP in individualized and cooperative learning settings (mean difference = 3.267). The table however shows that there was significant difference between the mean scores of students taught Biology using CAMIP in individualized learning setting and those taught using lecture method (mean difference = 22.833) and also between the mean scores of students taught Biology using CAMIP in cooperative learning setting and those taught using lecture method (mean difference = 26.100).

HO_2: There is no significant difference in the mean achievement scores of male and female students taught biology with Computer Assisted Multimedia Instructional Package in individualized learning setting.

Table 4.6: Mean and Standard Deviation of Achievement Scores of Male and Female Students taught Biology through CAMIP in Individualized Learning Setting at Pretest and Posttest

Group	N	Pretest		Posttest		Mean Difference
		X	SD	X	SD	
Male	31	27.07	4.24	60.13	12.19	33.06
Female	29	27.53	4.67	58.40	10.45	30.87

Table 4.6 reveals the mean and standard deviation of scores of male and female students taught biology with Computer Assisted Multimedia Instructional Package in individualized learning setting at pretest and posttest. From the Table, it is observed that the two groups recorded increase in their mean difference. It is also observed that there is difference between the mean scores of the two groups at posttest where Male students had mean scores of 60.13 with standard deviation of 12.19 while female students had mean scores of 58.40 with standard deviation of 10.45.

Table 4.7: t-test Analysis of Achievement Scores of Male and Female Students taught Biology through CAMIP in Individualized Learning Setting

Group	N	Mean	SD	df	t-value	P-value
Male	31	60.13	12.40			
				58	0.591^{ns}	0.557
Female	29	58.40	10.64			

ns: Not Significant at 0.05 level

Table 4.7 presents the t-test comparison of the mean achievement scores of male and female students taught Biology through Computer Assisted Multimedia Instructional Package in individualized learning setting. The table reveals that the calculated t-value ($t=0.591$, $df=58$, $p>0.05$) was not significant at 0.05 alpha level. The p-value of 0.591 was greater than 0.05 alpha level. This implies that there is no significant difference in the posttest mean scores of male (60.13) and female (58.40) students taught biology using Computer Assisted Multimedia Instructional Package in individualized learning setting. Hence, hypothesis two is retained.

HO_3: There is no significant difference in the mean achievement scores of male and female students taught biology with Computer Assisted Multimedia Instructional Package in cooperative learning setting.

Table 4.8: Mean and Standard Deviation of Achievement Scores of Male and Female Students in CAMIP (Cooperative Learning Setting) at Pretest and Posttest

Group	N	Pretest		Posttest		Mean Difference
		X	SD	X	SD	
Male	27	28.07	5.31	60.33	11.72	32.26
Female	33	28.53	5.57	64.73	5.69	36.20

Table 4.8 reveals the mean and standard deviation of scores of male and female students taught biology with Computer Assisted Multimedia Instructional Package in cooperative learning setting. From the Table, it is observed that the two groups recorded increase in their mean difference.

Table 4.9: t-test Analysis of Achievement Scores of Male and Female Students taught Biology through CAMIP in Cooperative Learning Setting

Group	**N**	**Mean**	**SD**	**df**	**t**	**P**
Male	27	60.33	11.72			
				58	1.850^{ns}	0.069
Female	33	64.73	5.69			

ns: Not Significant at 0.05 level

Table 4.9 presents the t-test comparison of the mean achievement scores of male and female students taught Biology through Computer Assisted Multimedia Instructional Package in cooperative learning setting. The table reveals that the calculated t-value (t=1.850, df=58, p>0.05) was not significant at 0.05 alpha level. This implies that there is no significant difference between the achievement of male and female students taught Biology through Computer Assisted Multimedia Instructional Package in cooperative learning setting. Hence, hypothesis three is retained.

HO_4: There is no significant difference in the mean achievement scores of male students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting.

Table 4.10: t-test Analysis of Achievement Scores of Male Students taught Biology with (CAMI) Package in Individualized setting and those (CAMI) Package in Cooperative Setting**.**

Group	**N**	**Mean**	**SD**	**df**	**t**	**P**
Individualized setting (Male)	30	60.13	12.187			
				58	0.892^{ns}	0.019
Cooperative Setting (Male)	30	60.33	11.719			

ns: Not Significant at 0.05 level

Table 4.10 presents the t-test comparison the mean achievement scores of male students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting. The table reveals that the calculated t-value (t=0.892, df=58, p<0.05) was significant at 0.05 alpha level. This implies that there is significant difference between the achievements of male students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting.

HO_5: There is no significant difference in the mean achievement scores of female students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting.

Table 4.11: t-test Analysis of Achievement Scores of Female Students taught Biology with (CAMI) Package in Individualized setting and those (CAMI) Package in Cooperative Setting.

Group	**N**	**Mean**	**SD**	**df**	**t**	**P**
Individualized setting (Female)	30	58.40	10.451			
				58	0.013^{ns}	6.575
Cooperative Setting (Female)	30	64.73	5.687			

ns: Not Significant at 0.05 level

Table 4.11 presents the t-test comparison the mean achievement scores of female students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting. The table reveals that the calculated t-value (t=0.013, df=58, p>0.05) was significant at 0.05 alpha level. This implies that there is no significant difference between the achievements of female students taught biology with (CAMI) package in individualized setting and those with (CAMI) package in cooperative setting.

IV. Discussion

The results indicated that there was significant difference between the mean achievement scores of students taught with CAMI package. This was supported by Mayer (2005) who observed that the experimental group students were significantly more rewarding than the control group and students enjoyed listening, observing and comparing their environment when presented with meaningful information through computer packages. Results of statistical analyses of the post-test score of the experimental and control groups as presented in Tables 4.2 and 4.3 revealed that CAMI package (Cooperative) improved the achievement of students in Biology better than conventional method. Also the result revealed that there is significant difference between the mean achievement score of students taught Biology using CAMI package (individualized and cooperative) and those taught biology using conventional method. This is in agreement with Adegoke and Adegoke (2010) who examined the effect of multimedia instruction on students and discovered that students in the group had the highest post mean scores in physics achievement test and interest in physics inventory. It is also in line with Akram, Athar and Ali (2011) who investigated the influence of computer assisted instruction on the student's achievement in chemistry and to compare the effectiveness of CAI with conventional instruction at higher secondary school level and observed that there was significant influence of CAI on the student's achievement in both, government and private sectors.

Recommendations

1.Curriculum planners should enforce and inoculate the use of CAMI package and computer education/training into the curricula.

2. CAMI packages should be used to address the current poor academic achievement of students in biology. Educators should continue to lay more emphasis and implement the concepts of educational technology as a means of enhancing the quality of education.

3. The government should establish a computer assisted multimedia instruction promotion department under the Federal and State Ministries to plan, organize and co-ordinate effort to utilize computer assisted instruction. Development of CAMI package software and administration and control regarding hardware in educational institutions should be major tasks of these department.

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