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EFFECTS OF SCAFFOLDING AND LECTURE METHODS ON SENIOR SECONDARY STUDENTS' ACHIEVEMENTS IN BIOLOGY IN RIVERS STATE

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ABSTRACT
This study investigated the effect of scaffolding and lecture methods on senior secondary students' achievement in biology. This study which adopted a non-equivalent group quasi-experimental design was carried out in Obio/Akpor local government Area of Rivers State Nigeria. Three research questions were posed and answered while three null hypotheses were formulated and tested at 0.05% level of significance. Three (3) governments owned senior secondary schools were randomly drawn for the study. In each of the schools used, intact classes were drawn from senior secondary two classes and assigned to scaffolding group and lecture method respectively and then compare their effects on the achievement of the students. The population of the study was 1173 Biology students in SS 2 of these schools and the sample of the study was 122 students in SS 2 assigned randomly. These groups were taught using scaffolding and lecture method respectively using periodic lesson plans, Biology achievement Tests were used to obtain data which provides answers to the research questions and null hypotheses. Mean and Standard Deviation were use in answering research questions while Analysis of Covariance (ANCOVA) were used in testing the null hypotheses. Result indicated significant differences existed at post-test and retention for the two groups and recommendations were made.

Keywords*:* Scaffolding; Lecture Method; Achievement; Biology.

Introduction

Whenever teaching is properly organized, it becomes an interesting activity. As a result, concerted effort must be expanded towards actual teaching. The contribution from most research done in student's achievement in Biology, it was found that inadequate exposure of student has affected their achievement, Opuende (2009). The strategies used in the teaching of biology have been identified as a factor that affects students' knowledge and achievement in science significantly, according to Alamina (2008), Effective Strategies are not applied in the teaching and learning of science in secondary school, teaching strategies usually applied to teach science are lecture method, (or expository technique), guided discovery method, laboratory method, demonstration method, project method, field trip, questioning method etc. The predominant method of instruction in science in senior secondary school is considered to be lecture method (expository techniques),

Duru (2011). To increase the student achievement in biology it is important to take cognizance of what happened in the classroom. A science teacher should no longer pose as the main reservoir of knowledge but should be a guide and a resource person at student activities. In view of the fact that very many teaching method or strategies and approaches abound, this research is making use of lecture and scaffolding strategies respectively to test or teach in order to find out whether teaching method really have effects on the achievement of student. And it is because of the over whelming cumulative instructional merits /advantages of these two methods (lecture and scaffolding) that informed their choice of preference by the researcher. Ormrod, (2004) states that the teacher does not pour knowledge into the head of the student.., rather the learners are in the driver's seat in the learning process, teacher provide a road map and offer suggestions about how to move the (vehicle) forward. Furthermore, Agulanna and Nwachukwu (2004), states that teachers should assist learning through scaffolding. As students become more efficient in performing tasks scaffolding is gradually withdrawn and students eventually perform those tasks on their own. Ibe (2007), also states that scaffolding is teaching strategies that involves the teacher controlling learning task so that the child is able to solve a problem or perform a task which would not have been possible without assistance. Alber (2014), states that scaffolding strategies are breaking up of learning into chunks and then providing a tool, or structure, with each chunk. He states that when scaffolding reading for example, you might preview the text and read and discuss as you go. He further explains that scaffolding is what you do first with kids, then for those students who still struggling, you may need to differentiate by modifying an assignment and /or making accommodation for a students.

Idoko, (2001) specifically identified gender as one of the significant factors that affect academic achievement particularly science education. Rosaldo in Anidu (2007) also holds this view in his discussion on women, culture and society, where he stated that there is a difference in academic achievement between males and females. Idoko, (2001) observed that other studies have contradicting findings with regards to the academic achievement of males and females in science subjects both as students and as employees. Therefore, an investigation of such gender influences as intended in this research work would shed further light on the issue concerning the influences of gender on students' academic achievement and retention, using two instructional strategies, namely, the scaffolding instructional strategy and lecture method.

According to Ibe (2007), a classroom built around scaffolding instructional strategies provides more opportunities for students especially girls. Gender is the range of characteristics pertaining differentiating between masculinity and feminity. According to oxford advanced learners dictionary (2000), gender is the fact of being male or female, especially when reference to social and cultural differences. It is refer as a way of talking about men and woman. According to Oakley, Nwagbara, Okeke and World Bank policy Research Report in Nwagbara (2009), the term gender refers to socially constructed roles and socially learned behaviours and expectations associated with males and females. It also refers to socially ascribed roles, responsibilities and opportunities associated with women and men as well as the

hidden power structures that govern relationship between them. Gender in essence is a term used to emphasize that sex in equality is not caused by the anatomic and physiological differences that characterized men and women but rather by the unequal and inequitable treatment socially accorded to them, Igwe, (2000).

All teachers want to provide the instruction and create the best learning environment for the students. Yet, the research indicates that females are getting poorer in science education than male, even when they are in the same classroom. The consequences of this poorer education can be seen in gender differences in attitude toward science and differential course enrollment patterns. Females hold more negative attitudes towards science than males and are less likely to studying science in higher school and beyond. Of course these male-female differences in attitude and enrollment are not solely the result of what happens in the classrooms. However, many teachers' behaviours and teaching strategies have been identified that contribute to these problems. These teachers' behaviours and strategies are often employed without malicious intent. The study of science in the senior secondary school is ineffective, Gbamanja (1999). Students have poor knowledge of the subject matter of science and cannot apply their knowledge of science to practical problems to our daily experience. It has also been observe that in spite of government effort to improve the standard of education in Nigeria by employing more teachers in various subject areas and disciplines, students do perform poorly. In publication released by West African Examination Council (WAEC), students of biology perform poorly. Small percentages of student pass the examination on yearly basis (West African Examination Council (WAEC, 2002). The poor achievement of student in biology in both JAMB (Joint Admission and Matriculation Board) and WAEC in recent time may likely be attributable to teachers attitude in teaching or as a result of teaching strategy adopted while in class teaching, Adeokan in Opuende (2009). It may also be due to attitude of student towards the study of biology, Oledibe (2011). Despite the effort aimed at bringing about effectiveness in the study of biology the objective are yet to be achieved. This situation calls for the use of other method of instruction such as scaffolding teaching strategies.

Also in a survey conducted by William in Opunde, (2009) on teaching strategies he attributed the poor performance of students partly to the teaching method adopted by the biology teachers. Again contributing partly to the poor achievement is the fact that majority of the biology teachers in our secondary school are not professionally trained teachers.

From the foregoing background the relationship between achievements of students to strategies used to teach them was determined, the researcher sought to find out whether teaching strategy really have effect on the achievement of student in biology. However, an inverse relationship appears to the existing between effort being made to boost achievement in science and the actual achievement of students in biology.

Research Questions

1: What are the mean scores in a researcher - made biology achievement test (BAT) of students taught using Scaffolding and Lecture method at posttest?

2: What are the mean scores in a researcher - made biology achievement test (BAT) of students taught using Scaffolding and Lecture method at posttest by gender?

3: What is the interaction effect of teaching methods and gender on students' mean performance score in Biology at posttest?

Hypotheses

Ho1: The mean scores in a RMBT of students taught using Scaffolding and lecture method do not differ significantly at posttest ($p<0.05$).

Ho 2: The mean scores in a RMBT of students taught using Scaffolding and lecture method do not differ significantly at posttest by gender ($p<0.05$).

Ho 3: The interaction effect of teaching methods and gender on students' mean performance score in Biology at posttest do not differ significantly.

Research Method

The study adopted the quasi-experimental design. In particular, the design applied the non-randomized, pretest-posttest, control-group design. The design is represented symbolically thus:

0_1 x 0_{11}

0_3- Control group

Where 0_1 - pretest

0_{11}- Post-test

X- Treatment

In this study, the quasi-experimental design has been modified to have one experimental group of students and two control groups of students; namely the experimental group or (scaffolding group), the (first control group or lecture group) and the second control group (or concept mapping group). The modified experimental design is represented schematically as shown in fig 3.2 .

Groups	**Pre-test**	**Treatment**	**Post-test**
Scaffolding (Experimental)	0_1	X	0_2
Lecture (Control)	0_3	X	0_4

Intact classes were used to avoid disrupting the schedules of the schools, such as normal classes. Since randomization was not done, efforts were made to ensure that the two groups of students were equivalent at the beginning of the study. To achieve this, the two groups were chosen randomly and treatments (methods of instruction) were assigned to the groups randomly.

In this study, the effect of scaffolding instructional strategies was determined and compared with the effects of the lecture method instructional strategies. Therefore, the effects of two methods of instruction on conceptual understanding of tissues and supporting system were determined. The independent variables were the scaffolding and lecture method instructional strategies. The dependent variables

are conceptual understanding of tissues and supporting system in Biology.

The study was conducted in Obio/Akpor Local Government Area of Rivers State. The population for the study comprised all the senior secondary school class two (SS2) students in the three (3) public secondary schools selected for the study in Obio/Akpor LGA in Rivers State. The researcher decided to use SS2 Classes because students have well better experienced than those in SS1, and they had no external examination facing them.

The sample for the study was selected as follows; first one (3) schools were selected out of the fourteen (14) public schools in Obio/Akpor LGA of Rivers state by simple random sampling using the ballot method. The names of the fourteen (14) public schools were written on fourteen identical pieces of paper, each name on the piece of paper. These pieces of paper were then folded to hide the names on them. One (3) of the pieces of papers were then picked (without replacement), unfolded and the name on these pieces of paper were identified. This name were that of the school from which the sample was drawn.

Next, the SS 2 Biology class in this school was chosen purposively, based on the facts that the topic of the treatment (tissue and supporting system) was on the work schedule of SS2 and they had no external examination facing them. Simply put, treatments (methods of instruction) were randomly assigned to the classes of students. One group of students (experimental) were taught based on the scaffolding strategies, another group (first control) were taught based on lecturer technique and the third group (second control) were taught based on concept mapping strategies. The age range for the participants/ students was 15-18 years.

The following types of instruments were developed and used for the study, namely, periodic lesson plan on Biology and achievement tests on Biology. Specifically, the instruments used were:

1) Biology periodic lesson plan on Tissues and supporting system based on the scaffolding instructional strategies
2) Biology periodic lesson plan on Tissue and supporting system based on lecture technique.
3) Biology Achievement pre-test on Tissue and supporting system (BAPRTOTASS) which is the pretest;
4) Biology Achievement posttest on Tissue and supporting system (BAPOTOTASS) which is the post-test;
5) Biology Achievement retention post-test on Tissue and supporting system (BARETOTASS), which is retention post-test.

The lesson plans, which were written by the researcher, specified the content and objectives of instruction; instructional methods, activities and instructional materials; previous knowledge; instructional procedure/presentation; evaluation and assignment. The lesson plans were based on the scaffolding instructional strategies and lecture method and emphasized conceptual understanding of tissue and supporting system.

The Biology Achievement Tests (BAPRTOTASS, BAPOTOTASS and BARETOTASS) which were constructed by the researcher consist of past SSCE examination questions of West African examination Council

(WAEC) and National examination Council of Nigeria (NECO). The Achievement Tests which were based on the content of the topic Tissues and supporting system in Biology consisted of multiple choices (objective questions). The Biology Achievement Tests emphasized acquisition, application and retention of conceptual understanding Tissue and supporting system.

The Biology Achievement Tests (BAPRTOTASS, BAPOTOTASS AND BARETOTASS) consisted of questions (objective items) obtained from past WAEC and NECO EXAMINATIONS. Those questions have been validated and used by WAEC and NECO, respectively, over the years. The periodic lesson plans and the Biology Achievement test value were also given to the supervisors of the research and two senior Biology teachers as well as measurement and evaluation experts who gave their approval to it and their corrections and contribution were adhered to in making the instruments valid- that is having enough content to measure the variables of the study.

The reliability coefficient of the Biology Achievement pretest (BAPRTOTASS) is 0.68; that of the Biology Achievement posttest (BAPOTOTASS) is 0.79; whereas that of the Biology Achievement retention –test (BARETOTASS) also is 0.68. The reliability coefficients of the instruments were obtained by splitting the scores into two halves and then using the splitting half method Pearson product moment correlation coefficient, techniques to calculate the reliability coefficients of half the instruments and Spear man –Brown prophecy formula to calculate the reliability of the full or total instruments. The coefficients obtained gave measures of the internal consistency of the instruments.

The reliability coefficients of the Biology Achievement Tests (BAPRTOTASS, BAPOTOTASS AND BARETOTASS) was determined during the pilot tests, using students of a school that was not part of the main study. The test was administered to 30 students in SS2, to assess the problems that might be encountered in the main study and to find solutions to these problems. During this pilot test, the students were first, tested on the topic "Tissue Supporting system" in Biology using lecture method and concept mapping strategies. The data obtained from the pretest were used to calculate the reliability coefficient of the pretest instrument (BAPRTOTASS). The split half method was used to obtain two sets of scores (odd scores and even score). Pearson product moment correlation coefficient method was used to calculate the reliability coefficient of half the instrument and Spear man – brown prophecy formula was used to calculate the reliability coefficient of the total or full instrument (0.68). Next the students were taught the topic "Tissue and supporting system (in Biology) using scaffolding instructional strategies. The students were then tested on the topic. The data obtained from the test (post-test) were used to calculate the reliability coefficient of the posttest instrument (BAPOTOTASS). The split –half method was used to obtain two set of scores. Pearson product moment correlation coefficient method was used to calculate the reliability coefficient of half the instrument and spearman –brown prophecy formula was used to calculate the reliability coefficient of the full instrument (0.79).

Finally, two (2) weeks after instruction, the same students were tested again tested on the "Tissue and Supporting systems" using an equivalent form of the posttest instrument. The results of the (PARETOTASS) were used to calculate the reliability coefficient of instrument (PAPRTOTASS). The split –half method was again used to obtain two sets of scores. Pearson product moment correlation coefficient method was again used to calculate the reliability coefficient of half of the instrument, whereas spearman-brown prophecy formula was used to calculate the reliability coefficient of the full instrument. All the three groups of students were tested first on the topic "Tissue and supporting systems" using conventional methods of evaluation, to find out if the students in the groups were equivalent or significantly different from one another (pretest). Next, the scaffolding and lecture method groups of students were taught the topic "Tissue and supporting systems "using scaffolding strategies, concept mapping and lecture methods respectively (treatment). Also, the scaffolding and lecture methods group students were tested on the topic "Tissue and supporting system" using an equivalent form of the Biology achievement pretest at the post-test. This was to determine students' achievement or conceptual understanding of "Tissue and supporting system" soon after instruction (post-test).

Finally, the lecture and scaffolding groups of students were tested again on the topic "Tissue and supporting system" long after instruction (4 weeks) using an equivalent form of the Biology Achievement post –test as retention post-test. This was to determine students' ability to retain their conceptual understanding of Tissue and supporting systems, long after instruction (4 weeks). Teaching (treatment) and testing (pre-test, post –test and retention posttest) were all carried out by the researcher.

Data obtained by means of the achievement tests were used to provide answers to the research questions. In each case, the mean scores and standard deviation of the groups were determined. Data obtained by mean of the achievement test was used to test the null hypotheses. In each case, the analysis of Covariance (ANCOVA) was be used to test the hypotheses.

Presentation of Results

Research Question one: What are the mean scores in a researcher-made biology achievement test (BAT) of students taught using Scaffolding and Lecture method at posttest?

Research Question 2: What are the mean scores in a researcher-made biology achievement test (BAT) of students taught using Scaffolding and Lecture method at posttest by gender?

Research Question 3: What is the interaction effect of teaching methods and gender on students' mean performance score in Biology at posttest?

Table 1: Means and Standard Deviations of the students' mean scores on BAT (Teaching Methods and gender) at Post test

Gender	Groups	Mean (X)	S.D	N
M	Scaffolding (SCA)	25.8889	2.95262	27
F	SCA	27.6000	4.92515	15
Total	**SCA**	**26.5000**	**3.80789**	**42**

M	Lecture Method (LM)	15.6429	5.31481	14
F	LM	13.0000	2.63818	26
Total	**LM**	**13.9250**	**3.93790**	**40**

Where N= No. of subjects; X= mean; SD= Standard Deviation

Data presented on Table 1 show that the mean performance score of students taught using scaffolding is (26.50 with S.D 3.81), Lecture method had mean 13.93 with S.D 3.94. Data still presented on table 1 show the mean score for male students using the Scaffolding method is (25.89with S.D 2.95) and females (27.60 with S.D 4.93). For lecture method, males have (15.64 as mean and S.D 5.31) while females have (13.00 as mean and S.D 2.64). In other words, students' mean performance scores in biology appear to vary across both teaching methods and gender.

Hypotheses

Ho1: The mean scores in a RMBT of students taught using Scaffolding and lecture method do not differ significantly at posttest ($p<0.05$).

Ho 2: The mean scores in a RMBT of students taught using Scaffolding and lecture method do not differ significantly at posttest by gender ($p<0.05$).

Ho 3: The interaction effect of teaching methods and gender on students' mean performance score in Biology at posttest do not differ significantly.

Table 2: Analysis of Covariance (ANCOVA) of Biology Students' Overall Performance Scores by Teaching Methods and Gender at Posttest.

Sources of Variation	Sum of Squares	Df	Mean squares	Fcal	Sig	Decision at P<0.05
Pre-test (Covariates)	323.975	1	323.975	27.243		
Groups	2155.441	2	1077.720	90.626	.000	S
Gender	.070	1	.070	.006	.939	NS
Groups*Gender	148.727	2	74.364	6.253	.003	S
Error	1367.572	115	11.892			
Corrected Total	5109.385	121				

- S-Significant; NS- Not Significant

Data presented on table 2 show that teaching method as a main effect on students' performance in biology is significant. This is because the probability value of 0.000 at which this main effect is shown to be significant is lower than the level of 0.05 at which it is

being tested. This implies that teaching methods have statistically significant effect on students' mean performance score in biology. In other words, the null hypothesis of no statistically significant effect is rejected at 0.05 level of confidence. Thus, the earlier observed difference between the overall mean performance scores of the method groups as in table 1 is a real difference which could not be attributed to chance associated with the study. However, data on table 2 reveal that gender is not significant on students' performance in biology. This is so since the probability value is 0.939 is greater than 0.05. The interaction of teaching method by gender is significant as shown on table 2. The probability value of 0.003 is less than 0.05.

Table 3: Means and Standard Deviations of the students' Mean scores on BAT (Teaching Methods and gender) at Retention

Gender	Groups	Mean (X)	S.D	N
M	Scaffolding (SCA)	23.8148	4.29702	27
F	SCA	24.8667	5.42305	15
Total	**SCA**	**24.1905**	**4.69165**	**42**
M	Lecture Method (LM)	15.0000	2.28709	14
F	LM	13.9231	1.57285	26
Total	**LM**	**14.3000**	**1.89737**	**40**

Where N= No. of subjects; X= mean; SD= Standard Deviation

Data presented on Table 4 show that the mean performance score of students taught using scaffolding is (24.19 with S.D 4.69), Lecture method had mean 14.30 with S.D 1.89 while Concept map had mean (18.78 with S.D 3.42) at retention. Data still presented on table 4 show the mean score for male students using the Scaffolding method is (23.81with S.D 4.29) and females (24.87 with S.D 5.42). For lecture method, males have (15.00 as mean and S.D 2.29) while females have (13.92 as mean and S.D 1.57). Concept map had mean for males as (19.05 with S.D as 3.84, females had 18.44 mean and S.D 2.91). In other words, students' mean performance scores in biology appear to vary across both teaching methods and gender.

Discussion of Findings

During the period of the study, the researcher find out the students of the study achieved better during scaffolding instructional strategies, followed by lecture method. The results of the study as presented in table 1 indicated that the scaffolding group achieved better in Biology than and lecture method group. The mean and standard deviations of the students' mean scores of the students by gender as contained in table I proved the effect of the scaffolding group over lecture method.

Data presented in table I also showed that the mean performance score of student taught using scaffolding is 26.50 with S.D 3.81, Lecture

method had mean 13.93 with S.D 3.94. Furthermore, table I shows that the mean score for male students using the scaffolding method is 25.89 with S.D 2.95 and females 27.60 with SD 4.93. For lecturer method, male have 15.64 as mean and S.D 5.31 while female have 13.00 as mean and S.D 2.64. This shows that the students' means scores in biology appear to vary across both teaching method and gender. The extent of this variation of students' mean performance scores in biology with teaching method was further inferred from table 2, which showed that teaching method as a main effect on student's performance in biology is significant. This is because the probability value of 0.000 at which this main effect is shown to be significant is lower than the level of 0.05 at which it is being tested. This implies that teaching methods have statistically significant effect on students' means performance score in biology. In other words, the null hypothesis of no statistically significant effect is rejected at 0.05 level of confidence.

Thus, the earlier observed difference between the overall mean performance scores of the method groups as in table I, is a real difference which could not be attributed to chance associated with the study. This type of result corroborates the findings of researchers, like Onyeneto and Oyibor (2000), Onyeneto in Anidu (2007), Igwe (2006), Anidu (2007) who in their respective studies and investigations ascertained that teaching methods has effects on students' achievement. In their studies, the researchers applied one or two or the combination of any of the three instructional methods to find out its effects on students achievement and affirmed that the performance of student vary across the teaching methods. The findings as shown in the table 1 also revealed that the teaching methods are effective, in the mean and standard deviation of the students mean scores on BAT (Teaching methods and gender) at posttest. Although, their effects vary across the teaching methods. The result showed that scaffolding instructional strategy was superior over lecture method. The effectiveness of this method over lecture method may be attributed to the fact that the students were able to learn as a result of scaffolding which refers to a variety of instructional techniques used to move students progressively toward stronger understanding and ultimate greater independence in the learning process, Sawyer (2006). He argued that scaffolding is the support given during the learning process which is tailored to the needs of the students with the intention of helping the students achieve his/her learning goals. It can also be as a result of their ability to construct and interact with their fellow students in the class while teaching and learning is going on. This type of result is in consonance with the findings of MDGS Project (2012). Where it argued that the teacher is a builder who can use the gifted and fast learning as scaffolds to aid or build up the slow learners, having understood them serve as go between thorough interactions with the slow learners after the class because students learn better and faster from each other.

The results on interaction effect by gender (male and female) revealed that gender is not significant on students' performance in biology since the probability value (0.939) is greater than (0.05). However, the interaction of teaching method by gender is significant because the probability value of (0.003) is less than (0.05). This result rejects the null hypothesis which says that the interaction effect of teaching methods and gender on students mean performance score

in biology at posttest do not differ significantly. This finding is in line with the findings of Igwe (2006), who observed that male students performed better than female student when taught with scaffolding.

The findings of the study on retention showed that teaching methods as a main effect on students' performance in biology at retention is significant. This is because the probability value of (0.000) at which this main effect is shown to be significant is lower than the level of (0.05) at which it is being tested. This implies that teaching methods have statistically significant effect on students mean performance score in biology. Hence, the null hypothesis of no statistically significant effect is rejected. Thus, the earlier observed difference between the overall mean performance scores of the method groups as in table 4 is a real difference which could not be attributed to chance associated with the study. This finding is in consonant with the finding of Igwe (2006) who examined the effects of scaffolding method of instruction on student achievement and retention. The effectiveness of the teaching methods was also maintained at retention. Among the two teaching methods, scaffolding still remain the most effective over the other at retention. It was also deduced that gender is not significant on students' performance in biology. This is so since the probability value of (0.54) is greater than (0.05).

Conclusion

The study was on the effect of scaffolding and lecture method on Senior Secondary Student's achievements in Biology Rivers State. The conclusion is that students mean performance score in biology appear to vary across both teaching methods and gender with scaffolding group achieving better. This implies that scaffolding teaching methods have statistically significant effect on students mean performance score in biology, followed by lecture method.

Recommendations

Based on the findings of the study and the discussion that followed, the following recommendations were made:

1) Teachers in secondary schools should use scaffolding teaching method to improve on students' performance in biology.
2) Ministry of Education should organize seminars and workshops on scaffolding teaching method.
3) On their own, teachers in secondary schools should attend conferences on use scaffolding teaching method in order to update their knowledge on the use of the teaching strategy.

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