

A COMPARATIVE STUDY OF THE EFFECT OF STUDENT-LED AND TEACHER-LED DEMONSTRATION METHODS ON STUDENTS' ACHIEVEMENT IN BIOLOGY (A CASE STUDY OF GOMBI EDUCATIONAL ZONE OF ADAMAWA STATE)

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Abstract

This study was carried out to investigate a comparative effect of student-led and teacher-led demonstration methods on students' achievement in biology, a case study of Gombi educational zone of Adamawa State. The design of the study was quasi-experimental of pre-test, post-test, non-equivalent, non-randomized control group design. The study was carried out with a sample of 150 SSII biology students selected by simple random sampling by ballot system from one school in the zone. The instruments of the study were a biology achievement test and lesson plans prepared by the researcher. Two research questions and one null hypothesis tested at 0.05 level of significance guided the study. Mean and standard deviation were used to answer the research questions while the t-test statistic was used to test the hypothesis. The result of the study revealed that student-led demonstration enhanced better achievement in biology than the teacher-led demonstration and lecture method going by their mean achievement scores. The mean achievement scores of the two treatment groups (teacher-led and student-led demonstration groups) had no significant statistical difference ($p < 0.05$). It was recommended among others that student-led demonstration method be encouraged among students while the teacher-led demonstration and lecture method be reduced because they do not lend themselves to active student participation in a lesson due to teacher dominated nature of the methods.

Education is regarded as an instrument for developing an individual's talents and also for developing the society socio-economically. In view of this fact, Aremu (1999) observed that all nations of the world have recognized education as a means through which individual and societal development can be achieved. The reason is that education offers experiences through which a child's potentials can be developed through the study of school subjects like: arts, sciences, mathematics, technology, etc. The society benefits from education when the child uses the acquired experiences, knowledge and skills to serve her to bring about changes; hence Akinpelu (1981) saw education as a powerful instrument of change in the society.

The changes that occur in society and the child through education result from among others, the effort of the teacher who implements the curriculum in the classroom with the use of various teaching methods like: the lecture, demonstration, discussion, inquiry methods, etc. Among the teaching methods is the demonstration method whose major components will be investigated in this study to find their relative effects on student's achievement in biology. The two components are the teacher-led and student-led demonstrations (Ogurmiji, 1984; Nwachukwu & Nwosu, 2007).

Demonstration method refers to displaying or showing materials to a group of audience e.g. students (Abdullahi, 1982; Ngada, 2004). The method is useful in biology teaching which involves showing biological specimens (plant and animal materials) to students for acquisition of scientific knowledge and skills. Nwachukwu & Nwosu (2007), defined the demonstration method as teaching strategy in the laboratory that involves experimentation while Ngada (2004) saw the method as important in emphasizing important points in a lesson. The method is activity-oriented and is useful for acquiring the cognitive, affective and psychomotor domains of instructional objectives (Nwachukwu & Nwosu, 2007).

The teacher-led demonstration is led by the teacher such that he is in direct control of the demonstration (Nwachukwu & Nwosu, 2007). The teacher dominance in the teacher-led demonstration as in lecture method reduces student active participation in the lesson unlike the student-led demonstration which involves students in the lesson. The student-led demonstration is led by students and there is learner-to-learner interaction. It is a form of co-operative learning strategy where students co-operate among themselves, share ideas together to solve a common problem (Esan, 2002; Banu, 1992). Nwachukwu & Nwosu, (2007), found out that the student- led demonstrations had the highest mean post test score than the teacher-led demonstration and the lecture method. Lee (2000) found out that only 11 out of 46 earners spoke during the question and answer discussion in the teacher fronted discussion while 46 out of 46 learners spoke during the group discussion among students. In the student-led demonstration, students had a better opportunity to think more for themselves due to active involvement and interest shown by group members. Backward students are opportuned to improve on their performance due to the coaching from their colleagues that know better (Banu, 1992; Muodumogu, 2007).

The biology topic on mammalian skeleton was used for this study. Students' achievement refers to students' cognitive score in biology. Literature has however, revealed that students' achievement in senior school certificate examination (SSCE) in biology is poor (WAEC Chief Examiner's report, 2002 & 2004; Okoli; 2006).

The problem of this study therefore is to compare the teacher-led and student-led demonstration methods to find out their relative effects on students' achievement in biology.

The main purpose of this study was to carry out a comparative study of the effects to teacher-led and student-led demonstrations on students' achievement in biology. The specific purpose of the study was to determine the effects of teacher-led and students- led demonstration on students' achievement in biology.

The following research questions were stated to guide the study;

1. What is the pre-test scores of students taught biology with teacher-led and students-led demonstration and lecture methods?
2. What is the post-test scores of students taught biology with teacher-led and student-led demonstration and lecture methods?

Hypothesis

The following null hypothesis was formulated and tested .at 0.05 level of significance to guide the study.

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H₀₁: There is no significant difference between the mean achievement scores of students taught biology with teacher-led demonstration and those taught with student-led demonstration.

Methodology

The research design for the study was the quasi-experimental design of pre-test, post-test, non-randomized, non-equivalent control group design. This design was adopted because subjects were not randomly assigned to groups instead intact classes were used and randomly assigned to experimental and control groups.

The study was carried out in Gombi educational zone of Adamawa state which has 38 senior secondary schools. The population of the study consisted of all senior secondary two (SS II) biology students in Gombi educational zone. All the schools are co-educational institutions and state-owned with a population of 12,400 SS II biology students.

The sample for the study was 150 SS II biology students from one school selected by simple random sampling technique by ballot system. The one school selected has six streams/classes. Three classes of 50 students (male and female) each were selected by ballot system which formed the sample of the study.

The instruments used for data collection were the biology achievement test (BAT) and lesson plans prepared by the researcher on the biology topic of study.

BAT contained 40 multiple choice objectives test items on the topic. Two experts in Science Education, Federal University of Technology, Yola validated the BAT for face and content validation. The validators were requested to assess the instrument for content coverage, suitability and use of language and to make amendment where necessary. The same validators validated the lesson plans and made corrections. All the corrections on the instruments were effected and the instruments were found to have both content and face validity.

The Kuder-Richardson formula 20 (K-R20) methods were used to calculate the reliability coefficient of BAT to estimate the internal consistency because BAT was dichotomously scored. The BAT items were administered on 30 students of a school outside the one used for the study for pilot study. Data collected were used to calculate the reliability coefficient using the stated method which was found to be 0.82.

Procedure for Data Collection

The researcher provided research assistants who helped him to collect data for the experiment. The three classes used for the study were assigned groups, A, B, & C. Group A was taught with teacher-led demonstration by one trained teacher, while group B was taught with student-led demonstration by one trained student. Group C was taught with lecture method by a teacher and the group served as control because the research assistant used the conventional lecture method. Later, each research assistant was given the validated lesson plan for its group for the study. Before the onset of the experiment, pre-test was administered on the three groups to determine their background with the BAT.

The trained student-peer leader taught group B students. After teaching, the group was divided into five students per group, each with a trained peer-leader for them to teach themselves and

share ideas on the topic taught to them. The trained peer-leader in each group ensured active participation of group members by raising relevant questions and answers which helped to increase understanding of the topic by members including the backward students. The researcher co-ordinated the exercise. After teaching, post-test was administered on all the groups with the BAT.

The scores were recorded for each group for data analysis using mean and standard deviation to answer the research questions and t-test statistic for testing the hypothesis at 0.05 level of significance. Each correct BAT item was awarded one mark giving a total of 40 marks.

Results

Research Question One: What is the mean pre-test scores of students taught biology with the three different methods?

Table 1: Mean and standard deviation of pre-test result of the groups taught with teacher-led, student- led demonstrations and lecture method.

Groups	n	\bar{X}	SD
Group taught with teacher-led demonstration method (male and female students)	50	21.76	3.24
Group taught with student-led demonstration method (male and female students).	50	21.74	3.21
Group taught with lecture method (male and female students) (control)	50	21.74	3.22
Total	150		

The result in Table I shows the mean pre-test scores of the three groups. It could be observed that the three groups are academically equivalent since their mean pre-test scores show small difference of 0.02. This answers research question number one.

Research Question Two: What is the mean post-test scores of students taught with teacher-led, student-led demonstrations and lecture method?

Table 2: mean and standard deviation of the post-test scores of students taught with teacher-led, student-led demonstrations and lecture method

Groups	n	\bar{X}	SD
Group taught with teacher-led demonstration method (male and female students)	50	36.36	2.86
Group taught with student-led demonstration method (male and female students)	50	36.76	2.34
Group taught with lecture method (male and female students)(control)	50	24.80	2.21
Total	150		

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Data in Table 2 show the mean post-test scores of the students taught with the three different methods. The result revealed that the student-led demonstration recorded the highest mean score of 36.76, followed by the teacher-led demonstration method with 36.36 while lecture method recorded 24.80. From the results, the student-led demonstration enhanced higher achievement of students in biology than the teacher-led demonstration and lecture method. This result answers research question number two. H_{01} : There is no significant difference between the mean achievement scores of students taught biology with teacher-led demonstration method and those taught with student-led demonstration method.

Table 3: t-test analysis of mean achievement scores of students taught biology with teacher-led demonstration and student-led demonstration methods.

Groups	\bar{X}	SD	n	df	Standard error (SE)	t-cal	t-crit
Group taught with teacher-led demonstration method	36.36	2.86	50		0.523	-0.765	1.980
Group taught with student-led demonstration method	36.76	2.34	50	98			

* Not significant at 0.05 level of significance.

Data in table 3 show that the t-calculated of -0.765 is less than the critical value of 1.980. Going by this result, the H_{01} is not rejected meaning that there is no significant difference between the mean achievement scores of students taught with teacher-led demonstration and those taught with student-led demonstration method.

The following findings resulted this study:

1. The mean pre-test result of students taught with teacher-led, student-led demonstrations and lecture method showed small difference of 0.02. The implication is that the three groups of students used for this study have equal academic background (Table 1).
2. The mean post-test result of the two treatment groups (teacher-led and student-led demonstrations) showed wide mean difference when compared with the mean pretest result. This implies that the mean score difference resulted from treatment effect. However, the difference in man score is still lowest with lecture method (table 2).
3. By comparison, students taught with student-led demonstration performed better than those taught with teacher-led demonstration and lecture method because the former had a higher mean score than the other two methods (table 2). The student- led demonstration enhanced better performance than teacher-led demonstration and lecture method in biology.
4. The mean achievement scores of the two groups of students that received treatment had no significant statistical difference since the H_{01} stated was accepted (table 3).

Discussion

The result of this study revealed that students taught with student-led demonstration performed better than those taught with the teacher-led demonstration and lecture method going by their mean achievement scores. This result agreed with the findings of Nwachukwu & Nwosu (2007) and Lee (2000). Nwachukwu & Nwosu (2007) found out that student -led demonstration had the highest mean post-test score than the teacher-led demonstration and lecture method. Lee (2000) found out that only 11 out of 46 learners spoke during question and answer discussion in teacher-fronted discussion while 46 out of 46 learners spoke during the group discussion among students. The major reason for the better performance from student-led demonstration group could be that the students cooperated among themselves to solve a common problem as opined Banu (1992) & Esan, (2006).

During the student-led demonstration lesson, the students had the opportunity to share ideas together and, ask questions which helped in proper understanding of the topic. Backward students through the method were able to cope with the lesson through the coaching of their colleagues who knew better and so were able to improve on their performance as Banu, 1992 and Muodumogu, 2005 observed. The brighter students (peer leaders) in the process of coaching others gained more knowledge and skills which enhanced more understanding as a result of active participation and brain storming that featured among members in the lesson.

The students taught with teacher-led demonstration in comparison may have performed poorly due to teacher-dominated nature of the lesson. The students had little or no interaction with the teacher, like asking questions and sharing of ideas. Since the teacher was in direct control of the lesson (Nwachukwu & Nwosu, 2007). With little or no student active participation, the students could not perform better than their colleagues in the student-led demonstration group who participated actively in the lesson. However, the mean achievement scores of the two groups had no significant statistically difference ($P < 0.05$) so this result is subject to further investigation to confirm it.

Conclusion

Student-led demonstration has proved more effective in enhancing students' achievement in biology than the teacher-led demonstration as revealed by the result of this study. Government and other stake holders in education should see the result of this study especially the effectiveness of student-led demonstration as an interesting one due to the result - oriented effort of the Nigerian child. This effort calls for encouragement and support to further help in the development of talents needed for the child's contribution to socio-economic development of the society which education is an important instrument in the society. (Aremu, 1999).

Recommendations

The following recommendations resulted the findings of this study;

1. Student-led demonstrations should be encouraged because it is more effective in enhancing students' achievement than the teacher-led demonstration going by the result of this study.
2. Teacher-led demonstration and lecture methods should be reduced to give more room
3. For student-led demonstration because the two methods do not lend themselves to student active participation due to teacher-dominated nature of the lessons.
4. A replication study should be conducted in order to confirm the result of this study.

5. Students of mixed ability and of different gender should be involved in student- led demonstration lesson so that they can continue to learn from each other in order to improve on their achievement in biology.

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