EFFECT OF COOPERATIVE LEARNING STRATEGY ON BIOLOGY STUDENTS' ACADEMIC ACHIEVEMENT IN YOLA EDUCATIONAL ZONE OF ADAMAWA STATE

O. R. Ugwuadu and Shuaibu Abdullahi

Abstract

This study investigated the effect of co-operative learning strategy on SSII Biology students' academic achievement in unisex and mixed schools in Yola educational zone of Adamawa State. The design of the study was quasi-experimental, non-equivalent control group design. The sample of the study consisted of two unisex (boys or girls) schools and six randomly selected mixed schools. One hundred and twenty-eight students each, from two intact classes in each of the two unisex schools randomly selected participated in the study, made up of 64 students from one intact class for experimental and another 64 students as control group. For the mixed schools, the sample was 186 randomly selected students from three intact classes from three of the six schools used as experimental group and another 186 randomly selected students from three intact classes of the other three schools used as control group. Six research questions and three null hypotheses tested at 0.05 level of significance guided the study. The instrument for data collection was a Biology Achievement Test which consisted of 40 multiple-choice objective test items that were both face and content validated. The reliability coefficient was established with Kuder-Richardson formula 20 (K – R20) method which gave an internal consistency reliability coefficient of 0.75. Data were analyzed using mean and standard deviation to answer the research questions while t-test was used to analyze the hypotheses. The result of the study reveals that co-operative learning strategy enhanced students' academic achievement in Biology in both unisex and mixed schools. There was significant difference (P>0.05) between the mean achievement scores of experimental and control groups in favour of experimental group. The researchers recommend among others that co-operative learning strategy be used in teaching and learning of Biology in schools.

Interaction is one major factor that enhances learning. In the school system, students learn more and improve their knowledge and skills through interaction. There are the student-student interaction, student-teacher interaction and teacher-head teacher interaction patterns, e.t.c in the school. All these interaction patterns involve sharing of ideas among participants in order to solve a common problem.

One of the interaction patterns in the school is the co-operative learning which is student-student/learner-learner interaction pattern or peer discourse/peer-led learning (Lee, 2000; Viiri & Saari, 2006). The co-operative learning strategy is a collaborative learning method of teaching and learning in which students or learners team together and share ideas in order to solve a common problem assigned to them by the teacher (Banu, 1992; Johnson, 1995). During co-operative or collaborative learning, students work together in a mixed ability small groups of 4 or 5 students per group on a given task which they normally do after the teachers teaching with the participation for a trained peer-leader in each group (Johnson, 1995; Okebukola, 2004). Students contribute ideas to the assignment or task given to them until every member had understood the solution of the assignment (Banu, 1992, Muodomogu, 2005).

In contrast, students exposed to conventional lecture method (CLM) are devoid of interaction among themselves. There is no sharing of ideas on a common problem. After teaching the students taught with CLM, study individually to solve the problem on their own (Okebukola, 2004). Lee (2000) found out that only 11 out of 42 learners spoke during a question and answer discussion in the

teacher fronted discussion while 46 out of 46 learners spoke during a group discussion among students which showed the effectiveness of learner-teacher interaction. According to Hogan, Nastasi and Pressley (1999), Peer discussion tended to be more generative and explorative, which enables students to find out facts for discussion. Okebukola (2004) found out that mixed ability co-operative group out performed all other four groups namely highly, medium, lowland control groups in Biology (Science of life). The control group taught with traditional method performed least. The mixed ability group performed best due to peer tutoring, active participation of group members which promoted achievement in Biology.

The result of a study by Banu (1992) revealed that there was significant difference between the control group and experimental group in the single-sex school in favour of experimental group but in mixed schools there was no significant difference between the experimental and control groups. The co-operative learning proved more effective than the conventional method in single – sex schools but not in mixed schools. The experimental group did better than the control group because when boys and girls were taught separately in their schools, members of the group pooled their resources together to solve a common problem, members worked harder on the task given to them in order to succeed, those who knew better than others improved on their knowledge and skills for coaching others.

(1) Muodomogu (2005) found out that the experimental co-operative group used for experiment performed significantly better than the control group (individual group) due to interaction among experimental group.
(2) However, in the experimental group in mixed schools should have problems and male dominance in science activities which frustrate their effort in doing well (Njoku 2001). The reason may be that girls seem to perceive science difficult and generally under estimate their ability and show less confidence in their competence, Ologunju (2001), Abubakar, (2004), Okeke, (2007).
(3) In this regard, Udeani (1992) asserted that science achievement is not innate but are rather due to imbalances of both sexes while growing up.
(4) The problem of this study put in a question form is: What would be the effect of co-operative learning strategy on academic achievement of Senior Secondary School Biology Students in Yola Educational Zone of Adamawa State?

The general purpose of this study was to investigate the effect of co-operative learning on academic achievement of senior secondary school Biology Students in Yola educational zone of Adamawa State. The specific purposes of the study were to determine:

1. The effect of co-operative learning on academic achievement of Biology students in Unisex secondary schools in Yola educational zone of Adamawa State.
2. The effect of co-operative learning on academic achievement of Biology students in mixed secondary schools in Yola educational zone of Adamawa State.

Research Questions

The following research questions were posed to guide the study:

i. What is the mean pre-test scores of students in the experimental and control groups in unisex and mixed schools used for the study?
ii. What is the effect of co-operative learning strategy on academic achievement of male and female biology students (experimental group) and male and female control groups taught with the conventional lecture method in unisex schools?
iii. What is the effect of co-operative learning strategy on academic achievement of Biology students in the experimental group and students in the control group taught with conventional lecture method in mixed schools?

Hypothesis

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

H_{O1}: There is no significant difference in the mean achievement scores of male biology students (experimental group) taught with the co-operative learning strategy and male control groups taught with the conventional lecture method in unisex schools.

H_{O2}: Same as H_{o1} above but put female in place of males

H_{O2}: There is no significant difference in the mean achievement scores of biology students in the experimental group taught with the co-operative learning strategy and students in the control group taught with the conventional lecture method in mixed schools.

Methodology

The research design for this study was the quasi-experimental of non equivalent control group design. This design was adopted because subjects were not randomly assigned to groups instead intact classes were randomly assigned to experimental groups. The area of this study was Yola educational zone of Adamawa State.

The population of this study consisted of all the 20 senior secondary schools in Yola educational zone of Adamawa State. Two senior secondary schools were unisex secondary schools, one for boys and the other for girls. Therefore 18 senior secondary schools were mixed schools.

Senior secondary two (SS II) Biology students participated in the study with a population of 6348 students. The population of the two unisex schools was 768 while that of the 18 mixed schools was 5,580 students. SS II students were used because they were not final year (SS III) students who might not pay attention to the study due to nearness of their examination. The breakdown of the population is as follows: the Unisex school: was made up of six classes in each school, totaling 12 classes so each class has 64 students. In the mixed schools, there were five classes in each school, totaling 90 classes, so each class had 62 students.

The researcher studied the two unisex schools due to small size of being only two schools while six schools randomly selected were studied out of the 18 mixed schools. Simple random sampling by ballot system was used to select samples for the study. In the two unisex/single-sex schools, boys or girls school, two intact classes were randomly selected for study from each of the two single-sex schools. The two intact classes from the boys' school gave a sample of 128 students so 64 boys were used as experimental group while 64 were used as control group. This sample size applied to the girls school too i.e 62 girls for experimental and 62 girls for control, randomly selected from two intact classes.

In the 18 mixed schools, six schools were studied and also selected by ballot. From three schools out of the six schools, one intact class from each school was randomly selected by ballot for the study which gave a sample of 186 students which were used as experimental group. The next three schools were used as control group where a sample of 186 students from three intact classes were selected as in the experimental group.

The instrument for data collection was a Biology Achievement Test (BAT) constructed by the researcher on food shortage and overcrowding from the National curriculum on Biology year two (2008). The BAT consisted of 60 multiple-choice objective test items on the two Biology topics with options lettered A – D. The 50 items measured the six objectives in the cognitive domain of Bloom's taxonomy of educational objectives. The draft BAT and table of specification used in constructing the test were given to two specialists in science education (Biology) and two specialists in educational measurement and evaluation for face and content validation. The experts were requested to asses the instruments for clarity of expression, suitability of items and content coverage. They were also asked to make suggestions and amendments where necessary. At the end, 50 items were returned as good items while 10 items were reported as ambiguous and out of syllabus items which were dropped. For content validity of the items, the validated table of specification used for constructing BAT and

suggestions from the validators ensured content validity. The table of specification ensured adequate sampling of content taught, so adequate number of questions were drawn to reflect the various levels of bloom's taxonomy of educational objectives in the cognitive domain.

The 50 items that remained after face validation were trial tested on 30 students in a school outside the ones used for the study but the two schools were of similar characteristics. The result of the study was used to calculate item analysis (item difficulty and item discrimination) indices which were computed for each item by using 27% cut off for upper and lower class of testees that scored the items right Ugodulunwa & Ugwuanyi (1999). Item difficulty index between 0.28 and 0.82 and an item discrimination index of +0.23 and above were used for the selection of tests items respectively. After the computations and selection of items, 40 objective items met the cut-off point and they were selected and used for the study while 10 items were rejected because they did not meet the cut-off points in each case. Lesson plans were prepared for teaching the topics which were validated by the experts that validated the BAT items.

The reliability coefficient of Bat was determined with Kuder-Richardson formula 20 (K – R20) method which was used to estimate the internal consistency of the BAT items that gave 0.78. The scores obtained from trial testing with 30 students in a school outside the one used for the study was used to compute the coefficient of internal consistency of BAT items.

Treatment was done with the validated lesson plans. The researcher trained six research assistants, comprising one regular Biology teacher in each school used for the study that helped him to teach the students. Teaching lasted for four weeks and each lesson took 40 minutes. On the first day of the experiment the BAT was administered as pre-test on the experimental and control groups. Thereafter, each group was taught the Biology topics using the lesson plans by the research assistants. The experimental group was taught with co-operative learning strategy while the control group was taught with the Conventional Lecture Method (CLM).

After teaching, the groups were divided into small groups of five students per groups to further teach themselves led by a peer leader in each group. Experimental group shared ideas on the taught lesson which enabled them to discuss the taught lesson the more which enabled them to learn from each other. The control group studied individually without sharing ideas on the problem. The last period in the fourth week was used for administering post-test. Both the pre-test and post-test scores were recorded and used for data analysis. The researcher coordinated the exercise using a time-table.

Data were analyzed using mean and standard deviation to answer the research questions while t-test was used to test the hypothesis at 0.05 level of significance. The grand mean of the scores of each of the two groups (experimental and control groups) were used for data analysis.

Results

The results of this study are presented in the following tables as shown below:

Table I: Mean pre-test results of experimental and control groups in the unisex schools (boys) used for the study.

Groups	**N**	$\bar{x}$	**SD**
Experimental group	64	19.8	0.71
Control group	64	19.6	0.68

Data in table I show the mean pre-test results of experimental and control groups in unisex school (boys) used for the study. The result indicated that the mean scores of experimental group was 19.8 while that of control group was 19.6 which showed small difference of 0.2. The result revealed equal academic background of the two groups.

Table 2: Mean pre-test results of experimental and control groups in the unisex school (girls) used for the study.

Groups	N	$\bar{x}$	SD
Experimental group	64	18.7	0.69
Control group	64	17.4	0.58

The table 2 above shows the mean pretest results of the experimental and control groups in unisex schools (girls) used for the study. The result revealed that the mean scores of the groups were 18.7 for the experimental group and 17.4 in the control group which showed small gap of 0.3. The result revealed equal academic background of the two groups.

Table 3: Mean Pretest Results of Experimental and Control Groups in Mixed Schools Used for this Study.

Groups	N	$\bar{x}$	SD
Experimental group	186	17.4	0.59
Control group	186	16.0	0.56

The above result in table 3 indicated that the mean pretest scores of students in the mixed schools used for the study was 17.4 and 16.0 for experimental and control groups respectively. The result further revealed that the two groups are of equal academic background because the difference between the two mean scores (0.4) is small.

Ho1: There is no significant difference in the mean achievement scores of male biology students (experimental group) taught with the cooperative learning strategy and male control groups taught with the conventional lecture method in unisex school (boys).

Table 4: T-Test Analysis of Mean Scores of Unisex (Boys) Taught With Cooperative Learning Strategy and Those Taught With CLM (Control).

Groups	$G\bar{X}$	SD	N	DF	t-cal	t-crit	Decision
Experimental group (Boys)	37.6	0.56	64	126	5.70	1.96	* sig
Control group (Boys)	10.4	0.52	64				

$G\bar{X}$ = Grand mean
t-cal = t-calculated
t-crit = t- critical
* Sig. = Significant at 0.05 level of significance

The result in table 4 indicated that there is significant difference between the mean scores of experimental group taught with cooperative learning strategy and control group taught with the conventional lecture method. This is because the t-test result of the ground mean of the two groups showed significant difference at 0.05 level of significance. Therefore H_{o1} is rejected because the t-calculated is greater than (P>0.05) t-critical at 0.005 level of significance.

Ho2: There is no significant difference in the mean achievement scores of female biology students (experimental group) taught with the co-operative learning strategy and female control groups taught with the conventional lecture method in Unisex school (Girs).

Table 5: T-Test Analysis of Scores of Unisex School (Girls) Taught With Co-Operative Learning Strategy and Those Taught With CLM (Control).

Groups	$G\bar{X}$	SD	N	DF	t-cal	t-crit	Decision
Experimental group (Girls)	36.6	0.48	64	126	5.33	1.96	* sig
Control group (Girls)	19.8	0.46	64				

* Sig. = Significant at 0.05 level of significance

Table 5 showed that the t-test result of mean scores of experimental and control groups of unisex school (girls) was significant at 0.05 level of significance. The reason is that t-calculated was greater than ($P<0.05$) t-critical at 0.05 level of significance. Therefore Ho2 is not accepted.

H03: There is no significant difference in the mean achievement scores of Biology students in the experimental group taught with the co-operative learning strategy and students in the control group taught with the conventional lecture method in mixed schools.

Table 6: T-Test Analysis of Scores of Students in the Mixed Schools Taught With Co-Operative Learning Strategy and Those Taught With CLM (Control).

Groups	$G\bar{X}$	SD	N	DF	t-cal	t-crit	Decision
Experimental group (Girls)	28.8	0.72	186	370	2.96	1.96	* sig
Control group (Girls)	22.0	0.69	186				

* Sig. = Significant at 0.05 level of significance

Data in table 6 indicated that t-test result of mean scores of experimental and control groups in the mixed schools used for the study was significant at 0.05 level of significance. The reason being that t-calculated is greater than ($P>0.05$) t-critical at 0.05 level of significance, and so the H03 is rejected.

Findings from the Study

The following findings resulted from the study:

1. The experimental and control groups in both unisex and mixed schools used for the study do not differ much in their academic background due to small gap in their mean pre-test scores (Tables 1,2 &3).
2. The difference between the mean post-test and pre-test scores was wide (tables 1 – 6). The difference in the mean post-test and pre-test scores was due to treatment effect in favour of post –test whose mean scores were higher than those of pre-test mean scores.
3. There was significant difference between the performance of experimental groups taught with co-operative learning strategy and the control groups taught with the conventional lecture method in both unisex and mixed schools used for the study.
4. The co-operative learning strategy produced positive effect on students' academic achievement in the schools used for the study.

Discussion

The results in table (4 – 6) indicate that students in Unisex school (boys) and unisex schools (girls) taught with co-operative learning strategy performed better than the students taught with conventional lecture method (control group). Specifically, experimental group (boys0 and control group (boys) did not perform equally in the achievement test given to them. Similarly, experimental group (girls) and control group (girls) did not perform equally too. The performances were in favour of the experimental group in each case. This finding is in line with the findings of Banu 91992) and

Muodumogu, (2005) who conducted similar studies and found out that the experimental group taught with cooperative learning strategy performed better than the control group taught with conventional lecture method.

Therefore co-operative learning strategy was more effective in enhancing academic achievement in students be it in unisex boys. Schools or in unisex girls school. The cooperative experimental group performed better than the control group due to peer –tutoring among the co-operating group than the control group that did no cooperate to solve problems during the experiment and so interaction existed among the group. Furthermore, and according to Banu (1992), the experimental group did better than the control group because when boys and girls were taught separately in their schools members of the group pooled their resources together to solve a common problem, members worked harder on the task given to them in order to succeed and those who knew better than others improved on their knowledge and skills for coaching others. The implications is that the inter learning that existed between the experimental group as they shared ideas in the team work enabled the group to out-perform the control group who were either taught with CLM or they studied individually without interaction.

In the mixed school, the story is the same as in the unisex school where in mixed school, the experimental group performed better than the control group. There was significant difference between the mean achievement scores of the experimental group and the control group in favour of the experimental group. This finding contradicts the findings of Banu (1992) who found out that there is no significant difference in the mean achievement scores of the experimental group taught with cooperative learning strategy and the control group taught wise CLM in mixed school implying that the two groups performed equally.

It can be argued that the experimental group in the mixed school performed better than the control group in this study not withstanding the effect of male dominance in science activities which could be a factor affecting female active and equal participation with males in science activities (Njoku, 2001). The reason could be that it is possible that the girls had improved on their knowledge and mustered courage that enabled them to catch up with the dominating males, for both of them to team up and perform better than the control group in this study. In addition male dominance may not be continuous because science achievement is not innate but is rather due to imbalances of both sexes while growing up (Udeani, 1992). Therefore, male dominance may not be reliable. As a result of this observation, it is not a miracle that significant difference was obtained in this study in mixed school but could be attributed to hard work, sharing of ideas and effective interaction among the experimental group in the mixed school.

Conclusion

Co-operative learning strategy proved effective in enhancing students academic achievement in Biology in the unisex and mixed schools used for the study. The experimental group in both unisex and mixed schools performed better than the control groups which proved the effectiveness of the strategy. The skills of co-operative learning strategy like peer-tutoring, sharing of ideas, teamwork, active participation of members, e.t.c made it possible for the co-operating members to learn from each other that enabled the group to perform better than the non-cooperating group (control group). It is clear then that co-operative learning enabled the experimental group to improve on their knowledge and skills to be able to participate well in the experiment hence their better performance than the control group in both unisex and mixed schools.

Recommendations: the following recommendations resulted from this study

1. Cooperative learning strategy should be encouraged in both unisex and mixed schools for the strategy enhanced academic achievement of situations both schools in both schools in Biology.
2. The use of lecture method in teaching and learning of Biology should be reduced because the method did not enhance academic achievement in the subject.

3. The use of unisex and mixed schools for cooperative learning should be encouraged because the use of the schools enhanced interaction and sharing of ideas among students in order to solve a common problem not withstanding some limitations found in mixed schools in science activities as revealed by literature.
4. Teachers are encouraged to embrace the skills of organizing cooperative learning and use the skills to teach Biology in our schools.

References

Abubakar, B. Y. (2004): Enrolment Trends and Academic Achievement of Female Science Students at Federal College of Education, *Zaria*, Zaria *Journal of Educational Studies*, 6 (1 & 2): 115 – 120.

Banu, D.P. (1992): The effect of co-operative learning on students' Achievement in Biology, *Dougirel Journal of Education*, 2: 48 – 51.

Hogan, K. Nastasi, & Pressley, M. (1999): Discourse Patterns and Collaborative Scientific Resonine in Peer and Teacher-guided Discussions, *Cognition and Instruction*, 17(4): 379 – 432.

Johnson, D.W. & Johnson, R.T. (1995): Positive Interdependence, key to Effective Co-operation in *Hertz-Lazarowitz, R & Miller, N (eds) Interaction in co-operative groups: the theoretical anatomy of group learning*, Cambridge: Cambridge University Press.

Lee, J.F. (2000): *Tasks and communicating in language classrooms*, New York: McGraw- Hill Publishers, Ltd.

Muodumogu, C.A. (2005): A Comparison of the Effects of Individual and Co-operative Learning Methods on Students' Cloze Performance, *Journal of World Council for Curriculum and Instruction (W.C.C.I), Nigeria Chapter forum*, 2(5): 25 – 35.

Njoku, Z.C. (2001): Enrolment of females in Science and Technology Education in Nigerian Higher Institutions. Trends and Implications for female empowerment, *Journal of the Science Teachers Association of Nigeria*, 36 (1 & 2): 87 – 93.

Okebukola, P. A. (1984): Tackling the problem of large classes in Biology: An investigation into the effects of a co-operative learning technique, *Journal of the Science Teachers Association of Nigeria*, 22 (2): 73 – 76.

Okeke, E.A.C. (2007): Making science Education accessible to all, *an Inaugural lecture*, University of Nigeria, Nsukka, August, 9

Olagunju, A.M. (2001): *Increasing Girls interest, participation and achievement in science*, proceeding of 42nd Annual Conference of Science Teachers' Association of Nigeria, Heinemann Educational Books (Nig) Plc.

Udeani, U.N. (1992). *Learning outcomes in integrated science as related to Teacher and Student Characteristics and Classroom interaction pattern*, Unpublished Ph.D Thesis University of Nigeira, Nsukka.

Ugodulunwa C.A & Ugwuanyi, C.L. (1999): *Understanding Educational Evaluation*, Jos: Fab Arieh (Nig) Ltd.

Viiri, J. & Saari, H. (2006): Teacher talk patterns in science Lessons: use in Science Education, *Journal of Science Teacher Education*, 17: 347 – 365.