

Effect of Cooperative Teaching Strategy on Academic Performance of Low Achievers in Biology among Senior Secondary School Students in Zaria LGA, Kaduna State, Nigeria

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This study examines the use of Cooperative teaching strategy in the teaching and learning of biology to low achievers among senior secondary schools in Zaria LGA. Cooperative teaching is a successful teaching strategy in which small teams, each with students of different schools of ability, use a variety of learning activities to improve their understanding of a subject. This study seeks to determine the effectiveness of Cooperative teaching strategy and conventional learning strategy on the academic performance low achievers in senior secondary school II students taught Biology concepts. These included two instructional groups (cooperative and conventional classroom groups), ability (high and low), and repeated testing (pretest and posttest). The population of study was made up of 947 SS II students from where a sample of 120 students was randomly selected. The instrument used for the collection of data was Biology Performance Test (BPT). All the data collected were analyzed with analysis of co-variance statistic. Two hypotheses were tested at 0.05 level of significance and the major findings of the study included: a significant higher achievement test scores of students in cooperative learning group than those in conventional classroom; a significant higher achievement test scores of all students of varying abilities in cooperative learning group than those in traditional classroom. The research into cooperative learning does not show that having students work together in a cooperative manner is a magic device that will solve all classroom problems. What it does say is that those problems probably have a better chance of being solved in cooperative than in competitive or an individualistic setting.

Keywords: Cooperative Teaching Strategy, Low achievers, Pre-test and Post-test, Biology

1.1 Introduction

Biology is a core science subject offered by secondary school students who intend to further their education in science related courses at the tertiary institution. However research evidence by Ivowi (1997) suggests that students perform poorly in the sciences and biology in particular as a result of the teaching method used. Owing to the study carried out by Ajaja (2002) which is a follow-up of an earlier study on the state of resource materials for teaching and learning science, was in part necessitated by a protracted period of poor performance and attitude of science students. The conventional method of teaching therefore, could also be regarded as the hitherto existing traditional methods of instruction in the normal classroom setting. Salawu (1999) also noted that there existed several methods of such conventional methods of instruction which has permeated our educational system over the years. Among

such conventional methods of instruction are lecture method, dramatization method, inquiry method, project and field trip among others. According to Ajaja (2002) WAEC (2004, 2005, 2006, 2007), it was observed that there has been a protracted long period of poor performance of science students in the sciences and biology in particular. Prominent among the factors which have been identified as contributing to the persistent low interest and poor levels of achievement in Biology are: teacher characteristics, memory skills and lack of organized strategies for concept formation, (Falade 2001). There is, therefore, the need to search for more effective strategies that will be suitable and efficient for promoting secondary school biology achievement beyond contemporary limits and to the satisfaction of the current biology curriculum requirements.

Definition of Cooperative Learning Strategy

The way we teach and learn in modern educational environments has been transformed through the advent of cooperative learning (Johnson & Johnson, 2009). Different researchers have different definitions of cooperative learning. For example, Slavin (2011) refers to cooperative learning as “instructional methods in which teachers organize students into small groups, which then work together to help one another learn academic content” (p.344). Although researchers have not used the same official definition of this term, all of them refer to cooperative learning as a “set of methods in which students work together in small groups and help one another to achieve learning objectives” (Johnson & Johnson, 2009, p.69). There are three main types of cooperative learning groups, namely informal cooperative learning groups, formal cooperative learning groups, and cooperative based groups (Johnson & Johnson, 2008). Informal cooperative learning, lasting from a few minutes to one class period, are short-term and ad-hoc groups in which students are required to work together to achieve a shared learning goal. Informal cooperative learning may be used to help students engage in the learning task, and focus their attention on the material they are to learn through focused-pair discussions before and after a lecture. Cooperative based groups usually last a semester or an academic year, or even several years. They are long-term and heterogeneous learning groups with committed relationships, in which students support one another to complete assignments and make academic progress. Formal cooperative learning groups last from one class period to several weeks. These are cooperative learning groups in which students work together to complete the learning tasks assigned and achieve shared learning goals.

Basic Elements of Cooperative Learning Strategy

Conducting cooperative learning does not mean that we simply let students sit next to each other at the same desk and ask them to do their own tasks (Gillies, 2003). A cooperative learning environment will exist if groups are structured in such a way that group members coordinate activities to facilitate one another’s learning (Ballantine & Larres, 2007). In order to engage students in learning, five elements: positive interdependence, face-to-face

interaction, individual accountability, interpersonal & social skills, and group processing, must be present in the cooperative classroom (Johnson & Johnson, 2008).

Positive Interdependence

Positive interdependence is the first essential element of cooperative learning. Learning situations are not cooperative if students are arranged into groups without positive interdependence (Johnson & Johnson, 2009). Positive interdependence means that in cooperative learning situations, students are required to work together as a cohesive group to achieve shared learning objectives (Jensen, Moore & Hatch, 2002). In the process, students must be responsible for their own learning and for the success of other group members' learning (Slavin, 2011). In other words, students must ensure that other members in their group complete the tasks and achieve the academic outcomes. The lesson will not be cooperative if students do not "swim together" in the group learning activities (Johnson & Johnson, 2008). Hence, positive interdependence needs to be constructed in cooperative learning groups to help students work and learn together.

Face-to-face Promotive Interaction

The second element of cooperative learning is face-to-face promotive interaction. Positive interdependence results in reciprocal interaction among individuals, which promotes each group member's productivity and achievement. Promotive interaction occurs as individuals encourage and facilitate each other's efforts to accomplish the group's goals. In cooperative learning groups, students are required to interact verbally with one another on learning tasks (Johnson & Johnson, 2008). As part of the cooperative learning condition, students are required to interact verbally with one another on learning tasks (Johnson & Johnson, 2008), exchange opinions, explain things, teach others and present their understanding (Ballantine & Larres, 2007). Hence, groups should be small when students begin learning together to help them develop cooperative learning skills. Moreover, the quality of group interaction depends on the academic level of all members in the group. The learning ability of all members in the group should be identified to help them to give feedback to and support one another in their learning. In addition, the quality of group interaction depends on the learning environment. If a positive learning environment is established, students in the cooperative group work and learn together effectively (Slavin, 2011).

Individual Accountability

The third essential element of cooperative learning is individual accountability. Individual responsibility means that students ask for assistance, do their best work, present their ideas, learn as much as possible, take their tasks seriously, help the group operate well, and take care of one another (Johnson, 2009). Positive interdependence is recognized to create "responsibility forces" that increase the individual accountability of group members for accomplishing shared work and facilitating other group members' work (Johnson & Johnson, 2008). Individual accountability is considered as the degree to which the achievement of the

group is dependent on the individual learning of all group members. If there is no individual accountability, one or two group members may do all the work while others do nothing. When group accountability and individual accountability exist in the group, the responsibility forces increase (Johnson & Johnson, 2008). Group accountability exists when the overall performance of the group is assessed and the results are given back to all group members to compare against a standard of performance. Similarly, individual accountability exists when the performance of each individual member is assessed, the results are given back to the individual and the group to compare against a standard of performance, and the member is held responsible by group-mates for contributing his or her fair share to the group's success.

Interpersonal and Social Skills

Interpersonal and social skills are the fourth essential element of cooperative learning. In reality, students cannot work effectively if socially unskilled students are arranged into one group (Johnson & Johnson, 2006). Cooperative learning, compared with individualistic or competitive learning, is more complex because it requires students to engage in learning tasks and work together (Ballantine & Larres, 2007). Therefore, social and interpersonal skills, such as listening attentively, questioning cooperatively and negotiating respectfully need to be taught, to help students cooperate effectively in the group (Killen, 2007). In addition, each group member should know how to manage the group, how to make decisions and how to solve conflicts that arise among group members.

Interpersonal and social skills can be taught using techniques such as role playing, and modeling in group activities (Slavin, 2011). Group members must have, or be taught, the interpersonal and small group skills needed for high quality cooperation, and be motivated to use them. To coordinate efforts to achieve mutual goals, participants must: (a) get to know and trust each other; (b) communicate accurately and unambiguously; (c) accept and support each other; and (d) resolve conflicts constructively (Johnson & Johnson, 2009). Thus, the more socially skillful participants are, the more social skills are taught and rewarded, and the more individual feedback participants receive on their use of the skills, the higher the achievement and productivity of the cooperative groups tends to be. Not only do social skills promote higher achievement, they contribute to building more positive relationships among group members.

Group Processing

The fifth essential element of cooperative learning is group processing. Group processing helps improve the effectiveness of the members in contributing to the shared efforts to achieve the group's goals via reflection on the learning process (Yamarik, 2007). In other words, the purpose of group processing is to clarify and improve the effectiveness of the members in contributing to the joint efforts to achieve the group's goals.

According to Ronsini, (2000) cooperative teaching is a successful teaching strategy in which small teams, each with students of different school ability, use a variety of learning activities to improve their understanding of a subject. Ronsini (2000) went on to describe that each

member of a team is responsible not only for learning what is taught but also for helping team mates to learn, thus creating an atmosphere of achievement. Arbab (2003) conducted a research to probe the effects of cooperative teaching strategy on general science achievement of 9th class students. In the experiment of two weeks duration, she found on the basis of pre-test and posttest scores that cooperative teaching strategy had more effect on students general science achievement as compared to usual method of teaching general sciences.

Reddy and Ramar (2003) observed that, low achievers are those whose ability is not quite so limited but nevertheless who have more difficulty in learning than average students. Their attainment is not in tune with their capability. While the high achievers are those who exhibited high capabilities towards learning. It is likely that every teacher has known at least one student who failed to perform at the level of his or her ability. These were the students who came to class unprepared, appeared not to study, and were not affected by parents and teachers' pleas to perform. These students have been commonly known as underachievers (McCoach & Siegle, 2001). Underachievement was most commonly defined as a "discrepancy between potential and performance" (Reis & McCoach, 2000, p. 154). Factors commonly associated with underachievement included low self-concept, low self-efficacy, low self-motivation, low goal valuation, and a negative attitude toward school and teachers (McCoach & Siegle 2001).

1.2 Statement of the Problem

There have been a lot of comments in books, particularly those written in Europe and America, which confirmed cooperative learning to be an effective way to structure learning activities. But there is surprisingly very little research effort, particularly in Nigeria, that emphasized cooperative interaction in science and even less that focused on Biology at the senior secondary school level. Furthermore, no studies to our knowledge had investigated the effect of cooperative learning and its interaction ability on Biology achievement among senior secondary school students in Nigeria. The purpose of this study, therefore, was to specifically determine, among others, the effects of cooperative learning on students' achievement in Biology particularly for low ability students. The statement of the problem, therefore, is; will the application of cooperative learning strategy in the teaching Biology produce differential achievement scores among senior secondary school students generally and specifically among students of varying abilities?

1.3 Objectives of the Study

The following objectives of this study are to determine if there is a difference.

1. in the academic performance of students taught Biology using cooperative teaching strategies and those taught using traditional learning strategy; and
2. on the academic performance of low achievers taught Biology using cooperative teaching strategy and those taught using traditional learning strategy.

1.4 Research Questions

This study was guided by the following research questions

- a. What is the difference between the academic performance of students taught Biology using cooperative teaching strategy and those taught using conventional learning strategy?
- b. What is the difference in academic performance of low achievers taught Biology using cooperative teaching strategy and those taught using conventional learning strategy?

1.5 Hypotheses

The following null hypotheses were formulated for this study

1. There is no significant difference between the mean scores of the students taught using cooperative teaching strategy and those taught using conventional methods.
2. There is no significant difference between the mean scores of low achievers taught biology using cooperative teaching strategy and those taught using conventional learning strategy.

Research Methodology

2.1 Research Design

The study was based on a quasi-experimental pre-test, post-test research design. The choice of this experimental design was borne out of the fact that the research involved selecting groups, upon which a variable was tested, without any random pre-selection processes.

2.2 Population of the Study

The population of the study comprised all the senior secondary II students in government secondary schools within Zaria division of Kaduna State Nigeria which are forty three (43) in number.

2.3 Sample and Sampling Technique

The sample consisted of senior secondary II students in two (2) selected government secondary schools under Zaria division. The schools were selected randomly and are listed as shown in Table 2.1. The two schools used are Barewa College and Alhudahuda Secondary School all in Zaria Division Kaduna State. Barewa College and Alhudahuda Secondary School each provided data for both the experimental and control groups used by the researcher for the study. The low achievers were determined from the class records obtained on permission from the Head teacher.

Table 2.1 Selected Secondary School under Zaria Division

Population of the

S/No	School	students offering biology in SS 11	Sample
1	Barewa College	417	60
2	Alhudaduda Sec Sch	530	60
Total	947	120	

2.4 Instrumentation

The researcher used one instrument in the course of data collection as; BAT which is an acronym for Biology Performance Test. All the test subjects were pre-tested before treatment. The Biology Performance Test which consisted of 25 multiple choice items covered all the topics under “Membrane Transport Systems”. The Biology Performance Test used for this study was constructed by the researcher and validated by content and face validity methods. The reliability index of the instrument was found to be 0.81 using the kuder-richardson 21 formula. Johnson and Christensen (2000) and Borich (2004) indicated that reliability has to do with accuracy and precision of a measurement procedure. a high reliability value of 0.70 or higher shows that the test is reliable (accurately), measuring the characteristics it was designed to measure. At the end of every week's instruction, post performance test was administered to both the experimental and control groups. Also at the end of every week's instruction. At the end of the sixth week of instruction, the performance test of the subjects in the experimental and control groups were averaged to arrive at the individual student's post-test scores.

2.5 Data Analysis

Raw scores obtained from the BAT pre-test and post-test were presented in tabular form for the purpose of interpretation. For the manipulation of data, the means, standard deviation, standard error, degree of freedom, t-cal and t-crit were computed for each group. Significance of difference between the mean scores of both the experimental and control groups on the variable of the BAT pre-test scores, post-test scores were tested at 0.05 level by applying ttest.

3.1 Results

Question 1: What is the difference between the academic performance of students taught Biology using cooperative teaching strategy and those taught using conventional learning strategy?

HO₁. There is no significant difference between the mean scores of the students taught using cooperative teaching strategy and those taught using conventional methods.

Pre-test Mean scores of the experimental and control group

In Table 3.1 the result shows that the pre-test mean score of the experimental group taught using cooperative teaching strategy was 26.23 while the control was 29.63 which indicates that the difference between the mean score of the experimental group and control groups on

pretest was found to be not significant at 0.05 levels given that the t-cal is less than the t-crit. Hence, both the groups were found to be almost equal.

Table 3.1: Pre-test Mean scores of the experimental and control group

	N	M	SD	SE	T. DF	CAL	T.CRIT
Experimental Group	60	26.23	7.05			0.42	
				1.28	118		1.98
Control Group	60	26.93	7.02				

Post- Test Mean score of the experimental and control group.

In Table 3.2 the mean score was found to be 58.11 for the experimental group and 38.62 for the control group showing that the difference between the mean score of the experimental and the control groups on post-test was significant at 0.05 levels. Based on this we will reject the null hypothesis.

Table 3.2: Post- Test Mean score of the experimental and control group. T.

	N	M	SD	SE	DF	CAL	T.CRIT
Experimental Group	60	58.11	9.60			5.87	
				1.82	118		1.98
Control Group	60	38.62	10.34				

Question 2: What is the difference in academic performance of low achievers taught Biology using cooperative teaching strategy and those taught using traditional learning strategy?

HO₂ There is no significant difference between the mean scores of low achievers taught using cooperative teaching strategy and those taught using traditional learning strategy.

Pre-test Mean score of low achievers of the experimental and control group

According to Table 3.3.it shows that the mean score for the experimental and control group were 22.20 and 22.19 respectively which shows that there was no significant difference between the performance of low achievers of the experimental group and low achievers of the control group on the pre-test given that the t-cal is less than t-crit.

Table 3.3 Pre-test Mean score of low achievers of the experimental and control group

	N	M	SD	SE	DF	T. CAL	T.CRIT
Experimental Group	45	22.20	5.92				
				0.98	73	0.01	1.98
Control Group	30	22.19	4.83				

Post-test Mean score of low achievers of experimental and control group The data in Table 3.4 indicated that the mean scores for the experimental and control groups were 43.40 and 31.00 respectively which showed that there was a significant difference between the mean scores of low achievers of the experiment and the control groups on post-test.

Table 3.4: Post-test Mean score of low achievers of experimental and control group

	N	M	SD	SE	DF	T. CAL	T.CRIT
Experimental Group	45	43.40	3.80				
				0.92	73	7.56	1.98
Control Group	30	31.00	6.30				

4.3 Discussion

One of the major findings of this study (Table 2) is that students taught using the cooperative learning approach scored higher marks in science achievement test than those taught using the traditional classroom teaching method. This may have been achieved by the high level of students' participation in learning activities. The students in the cooperative group performed specific roles in solving problems which are presented in the classroom to the benefit of all members of the group. When learners are confronted with problems which they must solve, they are forced to reason and think critically in order to solve the problems. This agrees with the investigations by Whicker et al (1997) who investigated the effects of cooperative teaching on students' achievement and attitude in a secondary Biology classroom, it was discovered that students in the cooperative teaching group had significantly higher test scores than students in the comparison group. This coincided with the results obtained in the study which showed that cooperative teaching strategy was beneficial in the teaching and learning of Biology.

Ajaja and Eravwoke (2010) studied the effects of Cooperative Learning Strategy on Senior Secondary School Students Achievement in Biology and found that students taught using the cooperative learning approach scored higher marks in Biology achievement test than those taught using the traditional classroom teaching method.

Comparison of mean scores of low achievers of the experimental and the control groups of both schools (table 3.4) showed significant difference. Thus, cooperative teaching approach promises to be more effective for low achievers. This means that the hypotheses is rejected. This coincided with the findings of Hampton and Grudnitski (1996) who reported that low achieving undergraduate business students benefited the most from cooperative teaching. Given that student-student interaction constitutes the majority of time and activity during cooperative learning, it is generally believed by researchers that an essential ingredient of cooperative learning is each learner's desire to facilitate the task performance of fellow group members.

The researcher therefore sums it up as follows:

- The students enjoyed working in groups.
- The students liked to share their ideas and information with others.
- The students learned better when a classmate explained something to them.
- Working in groups helped the students to complete their task faster.
- Working in groups helps the students to pass their examination.
- The students gained a lot of knowledge and new experiences using cooperative teaching strategy.
- Cooperative teaching releases students' tension and stress.

- The students did not get bored easily when learning Biology using cooperative teaching.
- By using Cooperative teaching strategy, a teacher can vary his or her teaching strategy.

5.3 Conclusion

The research into cooperative learning does not show that having students work together in a cooperative manner is a magic device that will solve all classroom problems. What it does say is that those problems probably have a better chance of being solved in cooperative than in competitive or an individualistic setting. The major purpose of teacher-student interaction during cooperative learning is to promote independent thinking. The exchanges between the teacher and students in the cooperative classroom focus on getting learners to think for themselves, independently of the text. This implies that Biology teachers must model their instructions to enforce collaboration with students since cooperative learning occurs in groups that share a common purpose and task, it, again, implies that the Biology teacher must broaden interactions to fit the zone of maximum response opportunity that is common to most group members in his classroom.

5.4 Recommendations

The pattern of teacher-student interaction during cooperative learning has implications for the teaching and learning of science in schools. The major purpose of teacher-student interaction during cooperative learning is to promote independent thinking. The exchanges between the teacher and students in the cooperative classroom focus on getting learners to think for themselves, independently of the text. This implies that science teachers must model their instructions to enforce collaboration with students since cooperative learning occurs in groups that share a common purpose and task, it, again, implies that the science teacher must broaden interactions to fit the zone of maximum response opportunity that is common to most group members in his classroom.

The interaction among students in cooperative learning groups is intense and prolonged. In cooperative learning groups, students gradually take responsibility for each other's learning. During cooperative learning, the feedback, reinforcement, and support come from student peers in the group. This implies that science teachers dividing their students into groups of four or five, working together in physical closeness promoted by a common task, will encourage collaboration, support and feedback from the closest and most immediate sourceone's peers. The implication of this in teaching and learning of science is that science teachers should model their instructions to enforce student – student interaction.

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