

EFFECT OF COOPERATIVE TEACHING STRATEGY ON SENIOR SECONDARY SCHOOL STUDENTS' ACHIEVEMENT IN CHEMISTRY

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Introduction

Chemistry is one of the important science subjects taught at the Senior Secondary School (SSS) level. It is one of the core science subjects that students are required to pass at credit level in order to qualify for admission into tertiary institutions to pursue science-based programmes. In spite of this central and important position of chemistry among others science and related disciplines, studies revealed that, academic achievement of students in chemistry at Senior Secondary School Certificate Examination (SSSCE) has consistently been very poor and unimpressive (Njoku, 2005). Many factors have been suggested as contributing to this poor performance of students in chemistry in particular and science in general. Some of these factors include: inadequate laboratory equipment in chemistry (Eniayeju, 2010); poor teaching methods (Ayogu, 2001); mathematical nature of chemistry among others. It is now being recognized that there are better ways to learn than through the traditional methods (Wood and Gentile, 2003). Educators are beginning to show an increased awareness of the importance of the way students learn. Many of our standard methods of conveying knowledge have been shown to be relatively ineffective in the students' ability to master and then retain important concepts. Learning through some methods of teaching is passive rather than active. The traditional methods (lecture, laboratory, recitation) do not tend to foster critical thinking, creative thinking, and problem-solving (Wood and Gentile, 2003).

Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. Class members are split into groups of 2–5 members after receiving instructions from the teacher. They then work through the assignment until all group members have successfully understood and completed it. Cooperative efforts result in participants striving for mutual benefit from one's efforts and recognizing that all group members share a common fate. They recognize that one's performance is mutually caused by oneself and one's colleague they feel proud of and jointly celebrate when a group member is recognized for achievement. There is a positive inter-dependence among students' goal attainments. Students perceive that they can reach their learning goals if and only if the other students in the learning group also reach their goals. Social skill learning and academic skills are the goals of cooperative learning. Cooperative

learning creates the atmosphere for students to increase their academic achievement as they learn social skills, such as resolving disputes on their own, helping newcomers feel welcome, taking turns, listening to others, contributing ideas, explaining oneself clearly, encouraging others, and criticizing ideas not people. The reason for improved academic achievement is that students are more active participants (Lord, 2001). They care about the class and they are more personally engaged. Other advantages include nurturing students, self-confidence, responsibility, growth of organizational skills, decision-making, experimenting, exploring, expressing feelings, empathizing, and motivation. These skills are very important in the classrooms and later in life because no matter what kind of work students later engage in life, they must work with others.

Also, the students like the subject and college better (Lord, 2001). They are more likely to make friends in class. They like and trust other students more than students who are learning individually (Lord, 2001) and have more self-esteem (Slavin, 1991). Motivated students are less likely to miss class and drop out. Cooperative learning is different from other group learning in that it is structured to include the five essential components that make group learning truly cooperative. These are positive interdependence, face-to-face promotion interaction, individual accountability, interpersonal and small group skills, and group processing. For a teacher to use it, he/she should start it early in the term, so that the necessary interpersonal skills needed for effective cooperative learning are developed. It can simply involve a five minute class exercise or a complex project that cuts across class periods. Generally, there are key steps for successful implementation.

These are pre-instructional planning, introducing the activity to students, monitoring and intervention, assessing and processing. Cooperative learning had been found effective to teach coping strategies, academic, social, and life skills to anti-social adolescents. It has been shown to substantially improve behavior and reduce recidivism rates (Brier, 1994). In addition to peer tutoring, cooperative learning is effective for reducing anti-social behavior in adolescents. Adequate peer role models are needed to enhance generalization of pro-social skills. Quinn (2002) in a study examined the effectiveness of using cooperative learning to increase appropriate behaviours of young boys identified as being at risk for the development of anti-social behavior patterns. The students received a six-week cooperative learning intervention using peer role models to teach interpersonal problem-solving skills through the combined use of cognitive and behavioral techniques. The results showed a significant increase in academic performance. White (2010) in his study found cooperative learning as effective teaching strategy for reducing anti-social behavior in schooling adolescents. The implementation of cooperative learning can involve varying the groups or pairs with emphasis on different content areas or behavior skills.

Abdullahi (1976) criticised the traditional lecture method and renewed the various calls for methods which would encourage the development of scientific attitudes in both students and the general public. This is in line with another recent call by Bellow (1987) which declared: "Knowledge divorced from life equals sickness". Okebukola (1985) investigated the relative effectiveness of cooperative, competitive and individualistic student-student interaction patterns on affective outcomes of science instruction. His results showed cooperative > competitive > individualistic > traditional method (control) model of effectiveness, in that order, this means that the cooperative method encourages scientific attitude more than the other teaching methods. On the other hand, Ajayi-Dopemu's (1986) investigation of the effects of competition on primary school pupils' language learning revealed that a competitive environment encourages learning better than a cooperative one, which clearly contradicts the findings of the studies cited earlier.

Sherman (1986) reviewed 46 experimental studies contrasting cooperative structures with individual and competitive goals. He found that cooperative learning methods that used task, specialization and group rewards increased student achievement more than competitive or traditional lecture method. Again, Sherman (1989) investigated achievement in individually competitive and cooperative reward-structures environments. This was in two high school biology classrooms. He found that neither treatment was superior to the other in leading to academic achievement. Sherman therefore advocated for further research so that other results can be got for this topic which relates to academic achievement and attitudes towards learning. The obvious disagreement among research result makes further and more specific investigation on science teaching methods inevitable. Achievement in learning is partly a function of good teachers and good teaching. For instance, commenting on the teaching of Biochemistry, Vella (1989) asserted:

There are no difficult subjects, only difficult teachers and difficult teaching methods... Learning based mainly on memorisation (usually for as long as required for examination purposes) is wasteful and inefficient (p.7).

Samuel & John (2004) examined how the cooperative class experiment (CCE) teaching methods affect students' achievement in Chemistry. They found that there was no significant difference in gender achievement between the experimental and control groups, but girls had a slightly higher mean score than boys did. More so, the girls taught through CCE method performed better than girls taught through the conventional teaching method in the post-test scores. Similarly, boys who were taught using CCE method performed significantly better than the boys in the control groups in the post-test scores. The researchers also pointed out that there was no significant difference in achievement between boys and girls exposed to CCE

method, both performed significantly better than those taught through conventional lecture method. Chemistry at the foundation level of senior secondary school should be taught using effective functional approach capable of arresting and maintaining high interest among students irrespective of sex. This research work sought to investigate the effects of cooperative learning on students' achievement in chemistry.

Statement of the Problem

Science educators, parents and other stakeholders in science education had been worried about the poor performance of students in SSCE and WASCE chemistry for quite some time now. In spite of the important position of chemistry among other science subject and related disciplines, literature have revealed that, students performance in chemistry at Senior Secondary School Certificate Examination (SSSCE) have been poor consistently, (Njoku 2005 and WAEC Chief Examiners' report 2007-2012).

The Objectives of the Study were

- To teach the experimental group through cooperative learning and control group through traditional teaching
- To compare the performance of male and female students in the experimental group.

Research Questions

1. Is there any significance difference in performance of SSS chemistry students taught using CL strategy and those taught using the traditional teaching strategy?
2. Is there any significance difference in the achievement of male and female students taught using the CL strategy?

Hypotheses of the Study

The following null hypotheses were tested in this study:

HO1: There is no statistically significant difference in achievement between students taught chemistry using cooperative learning and those taught using traditional methods.

Ho2: There is no significance difference in achievement between male and female students taught chemistry using the CL strategy and traditional method

Methodology

The research employed a quasi experimental control group design, involving pre and post test. Two intact classes were used. The research subjects were not randomized due to problems of rearrangement of intact classes. The study involves control and experimental groups consisting of both male and female study subjects. A pre test was administered to the groups, before the treatment, to determine the group comparability. The experimental group was taught the concept of balancing chemical equations using cooperative learning, and the control group was taught the same concept using traditional/lecture method for six weeks. After the treatment a Chemistry Achievement Test (CAT) was administered i.e. post test. The population of the study involve all senior secondary schools within Obio/Akpor. The instrument used for data collection was chemistry achievement test (CAT). CAT was validated by two experts in the department of chemistry education and Psychology in Ignatius Ajuru University of Education Port Harcourt. T-test unrelated sample was used to analyse the results from the test.

Research Question 1: Is there any significance difference in performance of SSS chemistry students taught using CL strategy and those taught using the traditional teaching strategy?

Table 4.1: Mean Scores of the Experimental and Control Group Based On the Achievement Test Scores

Group type	N	Mean(X) at Pre- test	Mean(X) at Post- test	SD Pre-test	SD post-test	Mean difference
Experimental group	50	16.80	41.74	4.61	4.95	24.9
Control group	53	15.30	27.41	5.73	4.67	12.1
Total	103					

Table 4.1 shows the pre and post-test in achievement of students exposed to experimental groups. It varied from 16.8 to 41.7 and 15.3 to 27.4 accordingly. The mean difference for groups 1 was 24.9 and that of group 2 was 12.1.

Research Question 2: Is there any significance difference in the achievement of male and female students taught using the CL strategy?

Table 4.2: Students' achievement mean scores and standard deviation of scores of male and female Students

Method	Gender	N	X	SD
Experimental	Male	22	42.50	5.48
	Female	28	41.14	4.50

The result in table 4.2 reveals that male students have a mean 42.5 while their female counterpart a mean 44.1. The result implies that male students performed better than female students when exposed to cooperative Learning.

Research Hypothesis 1: There is no statistically significant difference in achievement between students taught chemistry using cooperative learning and those taught using traditional methods.

Table 4.3: Analysis of Covariance (ANCOVA) Of Students Overall Scores in chemistry Achievement Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	22.981 ^a	18	1.277	39.036	.000
Intercept	11.274	1	11.274	344.711	.000
Pre	.169	1	.169	5.178	.025
Post	22.452	17	1.321	40.381	.000
Error	2.747	84	.033		
Total	262.000	103			
Corrected Total	25.728	102			

a. R Squared = .893 (Adjusted R Squared = .870)

Table 4.2 reveals that there is a significant difference in Achievement ($F_{17, 84} = 40.3$, $p < 0.05$). This means that students performed better when exposed to cooperative learning. Hence, hypothesis 1 is not supported.

Hypothesis 2: There is no significance difference in achievement between male and female students taught chemistry using the CL strategy and traditional method

Table 4.3: Summary of analysis of covariance (ANCOVA) for post CAT (achievement of mean scores with reference to method by gender)

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	438.736 ^a	2	219.368	3.056	.052
Intercept	7841.538	1	7841.538	109.225	.000
Pre	427.344	1	427.344	5.952	.016
Sex	16.145	1	16.145	.225	.636
Error	7179.245	100	71.792		
Total	129284.000	103			
Corrected Total	7617.981	102			

a. R Squared = .058 (Adjusted R Squared = .039)

Table 4.2 reveals that there is a significant difference in Achievement ($F_{1, 100} = 0.225$, $p > 0.05$). This means that there is no significant difference in the performance of male and female students in chemistry. This implies that gender does not have any significance effect on the academic performance of chemistry students. Hence, hypothesis 1 is retained.

Discussion

The analysis of results of the achievement presented in table 4.1 showed that the pre-test and post-test of the experimental and control group, are 16.80, 41.74 and 15.30, 27.41 respectively. The analysis of covariance presented in table 4.3, confirmed that there is a statistically significant difference between students taught with CL and those taught with lecture method. This is in line with the work of Sherman (1986) who reviewed 46 experimental studies contrasting co-operative structures with individual and competitive goals. He found that cooperative learning methods that used task, specialization and group rewards increased student achievement more than competitive or traditional lecture method. Table 4 shows that there is no significant difference on the basis of gender in respect of the two teaching strategies. This finding is in agreement with Samuel & John (2004) who found no significance differences in students' science achievement by gender.

Conclusions

It is hereby concluded in this study that co-operative learning method is more effective than conventional lecture method in improving students' achievement in

chemistry and that the use of the CL method is the solution to the dwindling performance of students in chemistry.

Recommendations

- In view of the effectiveness of cooperative learning in the teaching of chemistry it may be tried out in other subjects and levels.
- Further study may be conducted to examine locality differences in the use of different teaching methods.

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Reference to this paper should be made as follows: Ogologo, Gift Allen and Gideon A. Wokocho (2015), Effect of Cooperative Teaching Strategy on Senior Secondary School Students' Achievement in Chemistry. *J. of Education and Leadership Development Vol. 7, No. 1, Pp. 63 – 71*.
