



Comparative Effect of Cooperative Learning Strategy and Lecture Method on the Academic Achievement of N.C.E Students in Electrolysis

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Abstract: *The study on the comparative effect of cooperative learning strategy and lecture method on the academic achievement of Nigeria Certificate in Education (NCE) 100 Level students in electrolysis; was a pretest posttest quasi-experimental-control group design. The population of the study comprised 243 students from physics and chemistry departments of Federal College of Education (Technical), Gombe, and from the population, 87 students were used as sample using purposive sampling technique. Electrolysis Achievement Test (EAT) was the instrument used for the study and data collection. Two research questions and two corresponding research hypotheses were raised. Descriptive statistic was used to answer the research questions while t-test was used to test the research hypothesis at 0.05 level of significance. The study showed significant difference in academic achievement between the two groups in favour of those taught using cooperative learning strategy and also revealed no significant difference on gender when taught using cooperative learning strategy. It was recommended that teachers should employ the use of cooperative learning strategy since it has been established to enhance students' academic achievement especially when they are allowed to interact freely with one another and in groups.*

Keywords: *Cooperative learning, Lecture Method, Academic Achievement, N.C.E. Students, Electrolysis*

Introduction

To overcome the challenges of the 21st century especially in the area of science and technology, there is the need to foster students centered approach to teaching and learning. Many teaching methods/strategies to teaching have been innovated by educators and stake holders alike, however, to select the best, appropriate and suitable method/strategy to teach a particular subject, topic or even concept has been a source of concern. Metha and Kulshrestha (2014) asserted that the teaching and learning process has become an issue of rational consideration

and on critical query on all fronts, and there have been debates on the instructional materials and methods to provide to students at various levels world wide. There are growing researches within the scientific community and other areas on pedagogy that support new teaching approach with a view to ensuring quality of instructions. Effective teaching is based on several factors such as positive reinforcements, advance organizers, cues and feedback, higher questioning technique, positive classroom environment and cooperative learning (Najmonnisa, Amin and Saád 2016). Therefore, the 21st century teacher needs to be equipped with modern teaching strategies in order to produce better results. According to Wolfensberger and Canella (2015), many teaching methods and strategies have been identified and practiced and have produced encouraging results, and among these is cooperative learning.

Najmonnisa et al (2016) define cooperative learning as a teaching method that helps students learn together in groups to maximise their learning with interest and motivation. Hence cooperative learning can be regarded as a method/strategy of teaching that provides the learners with the opportunity to learn together in pairs or small groups. <http://courses.coe.asu.edu> (n.d) identified various strategies that exist in cooperative learning, these are:

- (i) Think-pair-share: - this is a method that allows students to engage in individual and small group thinking before they are asked to answer questions in front of the whole class.
- (ii) Three-Step-Interview: - this is a strategy that is effective when students are solving problems that have no specific right answers.
- (iii) Round table or rally table: - this is a type of cooperative learning structure that covers much content, builds team spirit and involves much writing.
- (iv) Group investigations: - these are structured to emphasise higher order thinking skills such as analysis and evaluation. Here, students work to produce group project which they themselves choose to work on.
- (v) Students Team Achievement Division (STAD):- this involves students with varying academic abilities being assigned to 4 or 5 member teams to study what was initially taught by the teacher and to help each student attain his or her highest level of academic achievement. Each member of the group earns certificate or recognition based on the degree to which all the team members over their past record.
- (vi) Jigsaw II:- Here, each member is responsible for learning a specific topic, and after meeting with other group members who are expert in that area, this person returns back to the group to present the topic or findings. All team members are required to also present their findings.
- (vii) Round Robin Brainstorming or Rally Robin: - this is a strategy in which the class is divided into a group of 5 or 6 students per group with one group member as a recorder. Here, the question is asked by the teacher with many possible answers and the students are given time to think. After the think time, members share responses with one another and the recorder writes all the responses.

- (viii) Three-Minute Review:- this is used when the teacher stop any time during lecture or discussion to allow students three minutes to review what was taught.

It is in this regard that the study on the comparative effect of cooperative learning and lecture method will be carried out among students in Colleges of Education students in Nigeria.

The lecture method in science is a method of teaching that emphasizes “talk - chalk” in the teaching of science subjects. More than 80% of scientific information, ideas, concepts, generalization and facts are verbally presented to students by the teacher (Abdullahi, 1982). The teacher does much of the activity in form of talking while the students are either passive or slightly involved. Olarenwaju (1994) sees lecture method as pure teacher centered approach where students are not given opportunity to ask questions or give feedback to the teacher. Here, the teacher talks and writes notes on the board while the students listen and copy down notes. The lecture method does not promote academic performance in science as observed by Abdullahi (1982).

Kuar (2011) in a study, described lecture as a model of teaching that is frequently criticized, but it is a fact that it has managed to survive so long in pace of technological developments and is still often used to teach organised bodies of knowledge which is an important part of the school curriculum at all levels, and they have continued as a primary form of instruction in colleges and universities; the same study also concluded that lecture method remain popular for several reasons which include among others:

- (i) They are efficient, planning time is devoted to organizing the context and less attention is devoted to teaching strategy;
- (ii) They are flexible and can be adapted to a wide range of subjects;
- (iii) Most people can learn to lecture well enough to survive in a classroom as they are easier to learn than most instructional strategies;
- (iv) They are easier for the teacher due to simply “telling” students about the subject and topic.

Therefore, lecture method can be considered as a popular teaching model in different fields of study such as in sciences, engineering, social sciences, medicine and arts in colleges and universities throughout the world.

Hence, this study compared the academic achievement of students taught electrolysis using the two discussed teaching methods.

Statement of the Problem

Nigeria is facing problems in the teaching of physics at both secondary and tertiary levels of education. It has been observed that the teaching of Physics suffers due to limited resources, equipment and latest physics books (Oladejo, Olusunde, Ojebisi and Ishola, 2011). According to Ogunleye and Babajide, (2011), Nigeria has witnessed persistent poor students’ performance in Physics at the Senior School Certificate level. This has been linked to the adoption of instructional strategies which did not give enough consideration to learners’ previous knowledge and how they reasoned in order for learners to construct their knowledge based on

these. According to Adeyemi (2010), problems in teaching physics can be minimized by selecting suitable teaching methods.

Cooperative learning is one of those teaching strategies and is a pedagogical practice that has attracted much attention over the last decades because of a large body of research that indicates students gain both academically and socially when they have opportunities and when they interact with others to accomplish shared goals (Gilles and Boyle, 2009).

The study therefore taught an introductory physics course (electrolysis) at the Nigeria Certificate in Education (NCE) level and compared cooperative learning strategy and lecture method and its effects on the academic performance of Nigeria Certificate in Education (NCE) 100 Level students in Federal College of Education (Technical), Gombe.

Justification of the Study

In spite of the great emphasis on physics teaching and because of its central role in technological advancement, students are observed to do poorly in the subject. Many factors have been attributed to this ugly situation. These factors include poor teaching methods, lack of instructional materials, lack of functional laboratories, poor students' technological attitude and lack of qualified physics teachers. Many research studies have been carried out on other factors mentioned, however, the researcher has not been able to find similar studies among N.C.E students especially on the topic "electrolysis" and hence this study intends to make its contribution in this area.

Objectives of the Study

The purpose of this study investigated the effects of cooperative learning and lecture teaching methods on the academic achievement of NCE 100 level students in physics and the specific objectives of the study were:

- (i) To investigate the effects of cooperative learning and lecture teaching methods on the academic achievement of NCE 100 level students on the topic "electrolysis" in Federal College of Education (Technical), Gombe.
- (ii) To find out the effect of cooperative learning on gender among NCE 100 level students on the topic "electrolysis" in Federal College of Education (Technical), Gombe.

Research Questions

The following research questions were made for the study:

- i) Is there any significant difference in the mean score of NCE 100 level students taught electrolysis using cooperative learning and those taught the same topic using lecture method?
- ii) What is the difference in the mean score of male and female NCE 100 level students taught electrolysis using cooperative learning teaching strategy in Federal College of Education (Technical), Gombe?

Null Hypotheses

The following null hypotheses were tested at $p \leq 0.05$ level of significance.

H₀₁: There is no significant difference in the academic achievement of NCE 100 level students taught electrolysis using cooperative learning and those taught the same topic using lecture method?

H₀₂: There is no significant difference in the academic achievement of NCE 100 students taught electrolysis using cooperative learning strategy on the basis of gender.

Scope of the Study

The study was delimited to only NCE I students studying Physics and Chemistry in Federal Colleges of Education (Technical), Gombe in North- Eastern Nigeria. The topic electrolysis selected for the study was based on the contents and objectives of the requirements in the curriculum of Nigerian Certificate in Education (NCE). The methods of instruction used in this study were cooperative learning and lecture methods of teaching.

Research design

The design for this study was a quasi-experimental-control groups design consisting of pretest and posttests. Pretest and posttest was administered to the experimental and control groups as recommended by Akuezilo, (1993) and Musa (2000). An Electrolysis Achievement Test (EAT) was administered to both groups during the pretest in order to determine their knowledge of electrolysis, the groups equivalence and their ability before treatment and at the end of the treatment, posttest using (EAT) was again administered to the two groups to determine the significant difference if any in their mean academic performance in electrolysis.

Population and Sample of the Study

The study comprises all NCE students from Physics and Chemistry Departments of Federal College of Education (Technical), Gombe. There are 234 students in NCE I, II and III in both departments with 143 male and 91 female. The sampling technique was a purposive technique since the topic used for the study (electrolysis) is common to both groups at the NCE 100 level. The students sample was purposive too since the number of NCE 100 level students from both departments stands as 87, with 46 male and 41 female, hence an intact class was chosen for the study. Simple random sampling technique was used to divide the students into the control and experimental groups so that 40 students were selected for the control while 47 were selected for the experimental group before the treatment.

Instrument, Validity and Reliability

The instrument used for data collection in this study was Electrolysis Achievement Test (EAT), it was constructed by the researchers and is comprised of forty multiple choice items with options A-E from the topic electrolysis as contained in the NCE minimum standard. The instrument was validated by senior lecturers in the department of physics and chemistry for clarity and relevance. A pretest was conducted before treatment in order to find out its

reliability. A reliability coefficient of 0.88 was obtained using the split-half method which made the instrument reliable for the study.

Treatment and Administration of Instrument

Both the experimental and control groups were treated using cooperative learning and lecture method respectively for six (6) weeks. During this period, the topic electrolysis was taught by the researchers and each contact lasted for two hours. After the treatment both groups were posttested using EAT. During the treatment, the experimental group was divided into four (4) groups and the topics under electrolysis were assigned to each of the groups to deliberate in groups and were then presented as group presentation during each contact. Hence the group investigations strategy of cooperative learning was adopted in the treatment of the experimental group. This is structured to emphasise higher order thinking skills such as analysis and evaluation, which implies students work to produce group project which they themselves choose to work on under the guidance of the teacher. For this study, the group distribution is shown in table 1.

Table 1 Showing Students groups Distribution in Cooperative Learning

Group(s)	Topic(s) Distribution	Number students
A	Dynamics of charged particles (ions)	12
B	Examples of Electrolysis	12
C	Faraday's laws of Electrolysis and quantitative examples	11
D	Applications of Electrolysis	12

Data Analysis

The students' scores from the posttests served as the source of data for the study. Descriptive statistic was used in answering the research questions while t-test was used to test the research hypotheses at $P \leq 0.05$ served as the tools for the data analysis.

Analysis and Results Presentation

The analysis and presentation of the results were conducted using descriptive statistics in responding to the research questions and t-test was used to answer the research hypotheses.

Research question one

- i) Is there any significant difference in the mean score of NCE 100 level students taught electrolysis using cooperative learning and those taught the same topic using lecture method?

To answer research question one, the mean score between the two groups was determined using descriptive statistics and the result is presented in Table 2

Table 2 Descriptive Statistics Results of Difference in Academic Achievements Between Students in the Control and Experimental groups

Group	N	Mean	Std Dev.	Mean Score Difference
control group	40	14.125	4.26	8.94
Experimental group	47	23.064	5.32	

The results in Table 2 showed that the control group has a mean of 14.125 while the experimental group has a mean of 23.064; the difference in mean was observed to be 8.94 and to test whether the difference is significant or not, null hypothesis one was formulated and tested using independent t-test statistic, the hypothesis reads:

Ho₁: There is no significant difference in the academic achievement of NCE 100 level students taught electrolysis using cooperative learning and those taught the same topic using lecture method?

Table 3: Comparison of the Academic Achievement between the Students in the Control and Experimental groups

Group	N	Mean	Std Dev	S.E	Df	t _{cal}	t _{crit}	Decision
Control Group	40	14.125	4.26	1.045	85	8.55	1.67	Rejected
Experimental Group	47	23.064	5.318	1.027				

$$p \leq 0.05$$

The results shown in table 3 revealed that t-calculated has a value of 8.55, while t-critical has a value of 1.67 for df = 85 at P ≤ 0.05 and since t_{crit} is less than t-calculated, the null hypothesis is therefore rejected, this signifies that there is significant difference in the academic achievement of students taught electrolysis using lecture method and those taught the same topic using cooperative learning strategy.

Research question two

- ii. What is the difference in the mean score of male and female NCE 100 level students taught electrolysis using cooperative learning teaching strategy in Federal College of Education (Technical), Gombe?

Table 4: Descriptive Statistics Results of Difference in Academic Achievements

Between male and female Students in the Experimental group

Group	N	Mean	Std Dev.	Mean Score Difference
Male	22	24.091	5.23	1.93
Female	25	22.160	5.34	

The results in Table 4 showed that male group has a mean of 24.091 while the female group has a mean of 22.160; the difference in mean was observed to be 1.93 and to test whether the difference is significant or not, null hypothesis two was formulated and tested using independent t-test statistic, the hypothesis reads:

H₀₂ There is no significant difference in the academic achievement of NCE 100 level students taught electrolysis using cooperative learning strategy on the basis of gender.

Table 5: Comparison of the Academic Achievement between the Male and Female

Students in the Experimental group

Group	N	Mean	Std Dev	S.E	Df	t _{cal}	t _{crit}	Decision
Male Group	22	24.091	5.23	1.114	45	1.25	1.67	Accepted
Female Group	25	22.160	5.34	1.067				

$$p \leq 0.05$$

The results shown in table 5 revealed that t-calculated has a value of 1.25, while t-critical has a value of 1.67 for df = 45 at $P \leq 0.05$ and since t_{crit} is greater than t-calculated, the null hypothesis is therefore accepted, this signifies that there is no significant difference in the academic achievement of male and female students taught electrolysis using cooperative learning strategy.

Discussion of Results

The results in Table 3 indicated that there is significant difference in the academic achievement of those taught electrolysis using lecture method and those taught the same topic using cooperative learning strategy of teaching. This finding is in agreement with the results obtained by Ikechuwu, (2011), which maintained that cooperative learning enhances students’ academic achievement and interest in chemistry and that it has no effect on gender when it compared with peer-teaching. In the same vain, Njoroge and Githua (2013) in a study on the effect of

cooperative learning in mathematics on gender revealed that there was no statistical difference in academic achievement in mathematics. Jimoh, Idris and Olatunji (2016) also in a study on the effects of Jigsaw cooperative learning strategy and gender on students academic achievement in cost accounting in Colleges of Education in Ogun state revealed that students taught cost accounting jigsaw cooperative learning strategy performed better than those taught using lecture method and that cooperative has no effect on gender.

Summary and conclusion

The study was an investigation into the comparative effects of lecture method and cooperative learning strategy of teaching on the academic achievement on NCE 100 level students in electrolysis. The study was a pretest-posttest experimental-control group design. The population of the study comprised of all NCE 100 level students from physics and chemistry departments of Federal College of Education (Tech) Gombe. 87 students from the two departments were purposively used as sample for the study. Electrolysis Achievement Test (EAT) was the instrument used for the collection of data which was constructed by the researchers. It consists of forty (40) multiple choice questions based on the topic electrolysis with a reliability coefficient of 0.88. Descriptive statistic was used to answer the research questions while t-statistic was used to test the two hypotheses raised at 0.05 level of significance. It was concluded that there is significant difference in the academic achievement of those taught electrolysis using lecture method and those taught the same topic using cooperative learning strategy of teaching in favour of those taught using cooperative learning strategy. In the same vein, the study revealed that there is no significant difference in the academic achievement of male and female students taught electrolysis using cooperative learning strategy.

Recommendations

The study recommended that

- (1) In large classes, students should be grouped into smaller groups so that they can engage themselves in discussions and later present their discussions in class.
- (2) Teachers should employ the use of cooperative learning strategy since it has been established to enhance students' academic achievement especially when they are allowed to interact freely with one another and in groups.
- (3) Students should also be allowed to make their own notes during self study.
- (4) Teachers/Lecturers when teaching electrolysis should divide the topics into sections and distribute according to the sub-groupings.

References

- Abdullahi, A. (1982). Science Teaching in Nigeria. Atoto Press Limited, Ilorin Nigeria
- Adeyemo, S.A. (2010). Teaching/ Learning Physics in Nigerian Secondary School: The Curriculum Transformation, Issues, Problems and Prospects. *International Journal of Educational Research and Technology*, 1(1), 99-111.
- Akuezuilo, E.O. (1993). Research Methodology and Statistics. Nuel Centi (Nigeria) Publishers.
- Gillies, R.U. and Boyle, M. (2009). Teachers' Reflection on Cooperative Learning (CL): a Two-year

- follow-up. *Teach. Educ.* (1) 63 – 78.
- Kaur, G. (2011). Study and Analysis of Lecture Model of Teaching. *International Journal of Educational Administration* (1)19 – 13.
- Ikechukwu, I.B. (2011). Effects of Cooperative Learning and Peer-Teaching on Academic Achievement and Interest in some difficult Chemistry Concepts. A Thesis Submitted to the Faculty of Education, University of Nigeria Nsukka for the Award of Degree of Master of Science Education, Unpublished.
- Jimoh, A.G., Idris, L.O., Olatunji, B.A. (2016). Effect of Jigsaw Cooperative Learning Strategy and Gender on Students' Academic Achievement in Colleges of Education in Ogun State, Nigeria. *International Journal of Academic Research in Education and Review* 4 (5) 150 – 157.
- Metha, S. and Kulshrestha, A.K. (2014). Implementation of Cooperative Learning in Science: A Developmental-Cum-Experimental Study. Hndawi Publishing Cooperation Educational Research International, 2014. ID 431542 1-7.
- Musa, B. (2000). The Relative of Efficiency of Laboratory Teaching Method for Enhancing Academic Performance in Chemistry Among Senior Secondary School Students. Unpublished Master's Degree in Science Education Thesis, Ahmadu Bello University, Zaria.
- Najmonnisa, M.A and Saad, I. (2016). Impact of Cooperative Learning Teaching Methods On 7th Grade Students Academic Achievement, an Experimental Study. *Journal of Elementary Education* 25(2), 89 – 112.
- Njoroge, J.N & Githua, B.N. (2013). Effect of Cooperative Learning/Teaching Strategy on Learners Mathematics Achievement by Gender. *Asian Journal of Social Science and Humanities* 2(2) 257-267.
- Oladije, M.A., Olusundo, G.R., Ojebisi, A.O. & Isola, O.M. (2011). Instructional Materials and Students Academic Achievement in Physics. Some Policy Implications. *European Journal of Humanities and Social Sciences*. 2(1) 112-126.
- Ogunleye, B.O. & Babajide, V.F.T (2011). Generative Instructional Strategy Enhances Senior Secondary Schools Students Achievement in Physics. *European Journal of Educational Studies* 3(3) 453-463.
- Olarenwaju, A.O. (1994). New Approaches to Teaching Integrated Science. Ibadan Alafas PUBLISHING Company.
- Wolfenberg, B. and Canella, C. (2015). Cooperative Learning about Nature of Science with a Case from History of Science. *International Journal of Environmental Science Education* 10 (6) 865 – 889.