
Impact of Small-Group Learning Strategy on Performance and Retention in Ecology among Senior Secondary School Students in Gusau, Zamfara State, Nigeria.

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ABSTRACT

This study investigated the Impact of Small-Group Learning Strategy (S-GLS) on students' retention and academic performance in ecology among Senior Secondary 2 (SS2) students in Gusau, Zamfara state. The study was guided by two objectives, two research questions and two null hypotheses. Sixty (60) SS2 students were selected using simple random sampling technique from a population of six hundred (600) SS2 students who offer biology. Pre-test, posttest and post-posttest quasi experimental research design involving two groups was adopted for the purpose of this research. One was tagged experimental and the other control. The students in the experimental group were taught ecology concept using the S-GLS while the control group were taught the same concept using lecture method. The Ecology Performance Test (EPT) was used for data collection. EPT was duly validated and had a reliability value of 0.88 when subjected to the Pearson Product Moment Correlation (PPMC). The research questions were answered using descriptive statistics while the hypotheses were tested at $p = 0.05$ level of significance using t-test. Result obtained from data analysis showed that students in experimental group performed significantly better than those in control group. Also, there was no significant difference between the performance among male and female students taught using S-GLS. Based on the findings of this study it was recommended that biology teachers should employ the use of S-GLS in teaching their students. In addition, the Female Education Board (FEB) and Zamfara State Science Teachers and Technical Board (ZSSTTSB) should conduct seminars and workshops for teachers of science-based subjects to sensitize and train them to use S-GLS.

Keywords: Small Group Learning, Retention, Academic Performance

INTRODUCTION

Science has been described as a dynamic field of human creation, it has been realized that the development of any country depends largely on the teaching and learning of science, consequently the country's educational policies and programmes are being directed toward the sciences which include biology. The economic strength of a nation is always assessed in term of its performance in science and technology (Oyarole, 2016; Umar, 2015 and Otuka, 2006). In view of its importance, the Federal Government of Nigeria emphasized the teaching of science and technology in all institutions as contained in the National Policy on Education (FRN, 2005).

As a science subject, biology serves as a prerequisite to the study of medicine, pharmacy, agriculture among others. Biology concepts according to Chew (2004) can sometimes be difficult particularly when describing ideas that are abstract or cannot be fully comprehended by learners for the first time. Research finding by Oyedokun (2002); West African Examination Council (2010) have also shown that a number of concepts in biology which include Ecology, Evolution and Genetics contains topics that pose difficulty for biology students to understand. Ecology is an aspect of the biology syllabus that senior secondary students at SS2 must study. However, it is considered as abstract in nature and difficult to

understand which has resulted in poor performance among students (Danmole & Ferni-Adeoye, 2004).

The problem of poor performance in science subjects including Biology has persisted over the years (Eguabor, 2001; Olalekan & Jerome, 2006; and Enesi, 2007). This observation has evoked much research efforts aimed at evolving means of re-addressing the situation. Science education researcher like Akibuilo, (2004) attributed the poor performance in science including Biology to problems such as low morale of students, poor preparation of teachers, overcrowded classroom, and inadequacy of laboratory, poor attitude of students to work, gross underfunding and inadequacy of rewards for excellence in science teaching and learning. However, with all the problems associated with poor performance, efforts are being made to find solutions to the recurring failure rate among science students. One of such efforts is on the issue of instructional methods which has attracted a lot of researchers such as Ibrahim (2008); Abdullahi, (2007); Olalekan and Jerome (2010). Studies revealed the use of poor teaching methods as a major cause of poor performance in science subjects. Adamu and Ahmad, (2000); Akibuilo (2004) viewed the use of inappropriate teaching methods as a major cause of students' poor performance in science examinations.

Teaching methods otherwise called instructional methods are many and varied. According to Nkeberem and Okon (2006), teaching method is described as interplay of activities whose combined effect enhances the accomplishment of specific instructional objectives. They enumerated some commonly used teaching methods as lecture, tutorial methods. All these methods aim at enhancing teaching and learning leading to the attainment of specific instructional objectives. Predominant instructional method used in teaching at all levels of education, is through the use of lecture method. Lecture method on the other hand has been reported by Okeke (2006) to be ineffective in science instruction. The use of lecture method entails a one-way flow of communication from the teacher to the students. It is teacher-centre or teacher dominated

approach. Most of the talking is carried out by the teacher while the students remain as passive listeners taking down notes. Hence is referred to as didactic approach or talk and chalk method. Though lecture method has its advantages as large amount of information can be presented to students within a limited time. Most teachers embrace the use of lecture method due to the fact that it enhances coverage of the syllabus. It can be used to teach large and small class sizes. The teacher may ask few or no question in the process. To this effect, the students are denied the opportunity of developing manipulative skills. Ausubel (1986) believed lecture method was only concerned with verbal presentation of concepts and ideas to the students. Science educators such as Danjuma (2005); Otuka, (2006) and Abdullahi (2007) reported that about 80-90% of the scientific information or principles students received from their teachers came through lecture method.

There are many methods adopted by the teachers in the classrooms. One of the methods recommended in teaching is the incorporation of Small-group (collaborative learning) (Kellough & Kellough, 2002) which provide settings where students from different background, classes, gender and ability level can learn to work in a mutually beneficial environment, which also allows students to share across their differences enriching their experience. According to Johnson and Johnson (1991) collaborative learning instruction could enhance performance; one of the elements of Small-group learning is positive interdependence, where students perceived that their success or failure lies within their working together as a group (Johnson & Johnson, 2002). From a motivational perspective, small-group goal structure creates a situation in which the only way group members can attain their personal goals, is if the group is successful (Slavin, 2000). Therefore, in order to attain their personal goals, students are likely to encourage members within the group to do whatever helps the group to succeed and to help one and another with a group task.

Small-group learning strategy can be very useful in the development and understanding of a new topic and as a follow-up approach by students on a new topic taught. In the Small-group learning strategy, the class is divided or rearranged into 4 or 5 equal groups, depending on the size of the class and the nature of the work to be done. The basis for this strategy is that the students will be actively involved in the learning process, and as the students are in free atmosphere, they are likely to learn effectively through the help of their mates rather than when the teacher does all the teaching (Johnson , Johnson & Holube , 2003) Students in a group interact with each other, share ideas and information, seek additional information, make decision about the results of their deliberations and present their findings to the entire class (Reese, 2009).

Retention of concept is an essential factor in determining students' performance in a given task or activities carried out. When concepts are taught, the wish of the teacher is that the concepts taught should be remembered. Retention as the name implies is the ability to keep what is learnt in memory and consequently remember them at a later time (Bichi 2002). When teaching is characterized by rote learning, meaningless memorization on verbalism, students make ineffective learning, and the facts thus learned are not long retained, nor do they seem to have much effect in changing behaviour (Akinbobola & Folashade, 2009).

Another important issue is that of the influence of gender and teaching strategies in science. Some studies (Ogunleye, 2001; Adesoji, 2008, and Bunkure, 2008) on the effects of instructional strategies on students' performance in science suggest that there is a relationship between gender and teaching approaches. Difference in the performance of both male and female students in science subjects when exposed to various instructional strategies are reported by Okeke (2001) to be insignificant. However, some research findings such as Ezeugo & Agwagah (2000); Mari, (2001) and Adepoju, (2009) revealed consistent differences between the performances of male and female

learners in performance tasks in science. Mari (2001) reported that students' performance in science was significantly high when taught by teachers of opposite sex. The reasons researcher attribute to gender-related differences in performance between male and female learners include the innovative nature of the instructional approach used, students' ability levels, psychological and socio-cultural factors, (Okeke 2006). It will therefore be interesting to find out if there may be link between S-GLS and gender differences in performance between male and female learners.

The theoretical backing guiding this study is the use of constructivism that is very relevant in S-GLS is that of Vygotsky, (1978) who believed that a child's cognitive development is a result of social interaction with adults. Through the process of internalization, children create mental structures from the social processes they have witnessed (Omrod, 2000). The theory of scaffolding and its zone of proximal development emphasizes on the role of active involvement in learning in relation to the child's environment. The teacher acts as a facilitator who encourages students to discover principles for themselves and to construct knowledge by working to solve realistic problems. This implies that the students must take some responsibility for learning. This is because they have to be actively involved in teaching and learning process.

Statement of the Problem

Annual report of examination results by West African Examination Council (2015) showed that students' performance in biology was very unsatisfying as contained in (Table 1). This is because Biology is not a core curriculum subject in the senior secondary but because of the stipulation that students must offer one of the basic science subjects, according to the new curriculum of 2013/2014 Hence, it is preferred by most students. The results obtained by candidates have been abysmal and do not justify the popularity as observed by researchers (Ajayelemi, 1990; Okoye & Okeke, 2007; Gyuse, 2009). The statistics of performance in Biology May/June Senior Secondary

Certificate Examination (SSCE) from 2008-2015 revealed a poor percentage score at credit level in

grade 1-6. The highlight of the performance is as indicated in Table 1

Table 1: Trends of Performance in Biology in the West African Senior School Certificate Examination May/June from 2008-2015

Year	Total Entry	Total Passed	% Passed with Credit &	
			above	% Failed
2008	745,439	207,232	27.8	72.2
2009	620,565	119,762	19.3	80.7
2010	917,041	278,122	30.3	69.7
2011	931,219	392,249	42.1	57.9
2012	838,945	253,483	30.2	69.8
2013	1,261,971	421,120	33.37	66.63
2014	1,285,048	436,145	33.94	66.06
2015	1,364,655	390,019	28.58	71.42

Source: WAEC Annual Report (2008-2015)

From the Table 1 the performance in biology within a period of 8 years have been abysmal. Despite the increasing number of candidates over the year under review, the percentages of candidates with credit pass and above is below 45% for the whole year under review. Consistent poor performance of students in Biology at SSCE leaves one in doubt about the effectiveness of the teaching method popularly used by biology teachers. The use of talk and chalks methods of teaching leads to memorization of facts and concept, which has not proven to be effective for all reasoning abilities. The use of Small-group strategy has been advocated by researchers, such as Abimbade, (1997); Njoku, (2004) and Adesoji & Ibrahim, (2009) that the use of Small-group learning strategy enhances academic performance and retention in science subjects at SS level. This study attempt to find out suitable ways in which learners will help their mates rather than when the teacher does all the teaching.

Objectives of the study

The objectives of this study are to:

1. Determine impact of S-GLS on performance among students in ecology concept.

2. Investigate the impact of S-GLS on academic performance and retention based on gender.

Research Questions

The following research questions were put across to guide this study:

1. What is the difference between of mean score between students taught ecology concept using S-GLS and those taught the same concept using lecture method?
2. What is the mean difference between the retention ability of male and female students taught ecology using S-GLS?

Research Hypotheses

The following hypotheses were formulated and tested at p 0.05 level of significances.

HO₁: There is no significant difference in the mean scores of students taught ecology concepts using S-GLS and those taught using lecture methods.

HO₂: There is no significant difference in the retention level of male and female students taught ecology concepts using S-GLS and those taught using lecture methods.

METHODOLOGY

This study adopted pretest, posttest and post-posttest quasi experimental-control group design as proposed by (Kerlinger, 1973). The study involved two groups; experimental and control groups consisting male and female students. The two groups were pre-tested to determine the equivalence in ability of the students, the subjects in the experimental group were treated using Small-group learning strategy while the control group were taught

the same concept using lecture method. At the end of the six weeks' treatment period, a posttest was administered to both groups of students to evaluate the effectiveness of the treatment in enhancing students' academic performance in Biology. The post-posttest was administered two weeks after the posttest to test for the student's retention ability as proposed by (Tuckman, 1975). The research design is presented in Figure 3

Where:

EG = Experimental Group

CG = Control Group

O₁ = Pre-Test

O₂ = Post- test

O₃ = Post- post-test

The population for this study constitutes all the public Senior Secondary Schools under Ministry of Science and Technical Education Gusau, Zamfara metropolis. There are six (6) public senior secondary

school in Zamfara. The total population of students in these schools was 600 as at 2016/2017 academic session. This is presented in Table 2

Table 2: Population for the Study

School	Location	Male	Female	Total
GDSS Gusau	Gusau	116	0	116
GGC T/Mafara	T/ Mafara	0	96	96
GSSS K/Koshi	K/Koshi	0	98	98
GSSS Shinkafi	Shinkafi	102	0	102
GTC K/Namoda	K/Namoda	90	0	90
GGc Tsafe	Tsafe	98	0	98
Total		406	194	600

Source: Zamfara State Science Teachers and Technical Board (STTB, 2017)

In selecting the sample used for the study, the names of the six schools in Gusau metropolis were written on a piece of paper and put in a hat, a boy of age 13 was asked to pick two pieces of paper by using simple random sampling once at a time. The content was reshuffled each time a piece of paper was picked to ensure equal chance of picking each of the paper. The two schools whose names

were coded on the pieces of paper picked were used as sample schools, hence, the total number of subjects in the two schools was 60 subjects. This is in accordance with central limit theorem Tuckman (1975) who proposed 30 as minimum sample size for an experimental study. Details of the sample selected are presented in Table 2

Table 3: Sample for the Study

School	Status	Male	Female	Total
GDSS Gusau	Experimental	12	20	30
GSSS K/Koshi	Control	18	10	30
Total		30	30	60

One instrument tagged Ecology Performance Test (EPT) which was developed by the researcher was used to collect data for the study. EPT is a multiple choice objective test with 5 distractors on ecology. The face and content validation of EPT was carried out by three professionals in sciences education department, with rank of senior lecturers and Ph.D., Ahmadu Bello University, Zaria. To ascertain the reliability of EPT,

test-retest method was used to statistically estimate the internally consistency of the instrument, Tuckman (1975), who proposed the minimum interval of two weeks or more interval. The result of the test was correlated using Pearson Product Moment Coefficient and reliability coefficient was found to be 0.88 which was considered reliable for the study to measure the academic performance of the subjects. Table 4 is the Table of specification for EPT.

Table 4: Test Blue Print EPT Construction Based on Bloom's Taxonomy in Cognitive Domain

Content	Weight	Knowledge	Comprehension	Application	Analysis	Syntheses	Evaluation	Total
	%	40%	17.5%	15%	0%	15%	12.5%	100
-Basic concept	37.5	4	3	3	-	3	2	15
-Major Biomes of the world	22.5	4	2	1	-	1	1	9
Population Studies	20.0	4	1	1	-	1	1	8
Ecological Factor	20.0	4	1	1	-	1	1	8
Total	100.0	16	7	6	-	6	5	40

Source: Adapted from Obeka (2012)

Research questions were answered using descriptive statistics; mean and standard deviation while research hypotheses were tested using independent t-test statistics at 0.05 level of significance.

RESULTS

Research question one: What is the mean difference between the retention ability of ecology

students taught using S-GLS and those taught using lecture method?

To answer the above research question, mean and standard deviation scores of the students was used.

Null Hypothesis One: There is no significant difference in the retention ability of ecology students taught in Small-group compared with those taught using lecture methods. To test the hypothesis, the

posttest performance means scores of experimental and control groups were analysed using independent

t-test statistics. The result of the t-test is shown in Table 5.

Table 5: Summary of t-test Analysis for performance of Experimental and Control Groups

Group	N	Mean	SD	Df	t-value	P-value	Remark
Experimental	30	23.5	4.65	58	3.92	0.03	S
Control	30	14.3	3.82				

*Significant at P 0.05

From Table 5, the mean score of students in the experimental group had mean score of (23.5) who were taught using S-GLS is higher than the mean score of students in the control group had mean score of (14.3) taught using lecture method. Hence, there is difference in performance between the groups in favour of the experimental group who were exposed to small-group learning strategy. In order to ascertain if the observed difference was significant or not, the scores of the groups were further analysed using the independent t-test statistics.

Table 5 shows the t-test relationship between the student academic performance in post-test score in both experimental and control group. It reveals that there is significant difference between the

performance of experimental group and control group as the calculated p-value of 0.03 is lower than the 0.05 alpha level of significance. Therefore, the null hypothesis which stated that: There is no significant difference in the retention ability of ecology students taught in Small-group compared with those taught using lecture method is therefore rejected.

Research Question Two: What is the mean difference between the retention ability of male and female students taught ecology in Small-group learning strategy?

The data collected for the purpose of answering question two was analysed using descriptive statistics i.e mean and standard deviation as shown in Table 6.

Table 7: Means and Standard Deviation of Post- posttest Scores for Male and Female in Experimental Group.

Gender	N	Pretest	Posttest	SD	Mean gain
Female	30	39.54	68.50	6.16	28.96
Male	30	38.72	63.54	9.45	24.82

The result in Table 7. shows the retention ability of female and male of the experimental and control group before treatment recorded mean score of 39.54 and 38.72, while after treatment the mean was 68.50 and 63.54 respectively with a mean gain of 4.96 indicating that the female score higher than the male counterparts. This means that there is difference in retention ability of male and female of the experimental group in favour of the females.

Hypothesis 2: There is no significant difference between retention of ecology concepts between male and female students taught using S-GLS.

The H₀₂: was analyzed using independence t-test at p 0.05 level of significance. The result is presented in Table7;

Table 8: Summary of t-test Analysis of Post-posttest Scores of Male and Female Students in the Experimental Group.

Group	N	Mean	SD	df	t-value	P-value	Remark
Experimental	30	68.5	6.16	58	2.28	0.26	**
Control	30	63.54	9.45				

*Significant at $P < 0.05$

Table 7. Revealed that there is no significant difference in retention of ecology concepts between male and female students in their academic scores after exposure to small-group learning strategy i.e treatment. They female and male recorded a mean of 68.50 and 63.54 respectively. The calculated p value of 0.26 is higher than the 0.05 alpha level of significance. Therefore, the null hypothesis which stated that there is no significant difference between male and female students exposed to small-group learning strategy is hereby retained.

DISCUSSIONS

The result from the research question and hypothesis one indicated that the experimental group who were taught using Small-group learning strategy achieved significantly better than those in the control group who were taught same using lecture method. The significant difficult in student performance is in favour of the students in the experimental group who suggested a greater impact of Small-group learning strategy over the lecture method of teaching. This finding of this study agrees with that of Ibrahim & Omar (2006) who also discovered that students using collaboratively together perform significantly better than those taught using lecture method. The performance of those in the Small-group using strategy might have been engendered by the opportunity the members had to interact together, share ideas and have better grasp of concept which enhanced their performance. The result in control group showed that lecture method is not very effective in increasing academic performance. As students in lecture method are engaged as passive learners.

Hypothesis two showed that there was no significant difference in the performance of male and female when exposed to small-group learning strategy. The result revealed no significant difference in the performance of male and female students as shown in table 7. This means that Small-group learning strategy is an instructional strategy that is gender friendly.

This finding agrees with the findings of Gaduno (2006) who reported no significant difference in the academic performance of boys than girls who were exposed to Small-group learning strategy. No significant difference between retention ability of ecology concept between male and female students exposed to Small-group learning strategy as revealed by the result of this study may be due to the fact that in Small-group learning strategy students of different ability came together to work on the same task share ideas and experiences freely. This equal opportunity for the students to learn together irrespective of their gender differences.

CONCLUSION

In conclusion, the findings of the study had shown that students taught ecology concepts achieved higher and had better retention when small-group strategy was used as a medium of instruction for senior secondary biology students. This study also revealed that small-group learning strategy is efficacious in eliminating gender related differences in science learning, indicating that the strategy is gender friendly.

RECOMMENDATIONS

The following recommendations were made:

1. S-GLS has been found to improve academic performance for both male and female students, therefore teachers should be advised to adopt the approach in teaching biology.
2. The Female Education Board (FDB) and Zamfara State Science Teachers and Technical Board (ZSSTTSB) should conduct seminars and workshops for teachers of science-based subjects to sensitize and train them to use S-GLS.

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