

## EFFECT OF COLLABORATIVE INSTRUCTIONAL STRATEGY ON ACADEMIC PERFORMANCE AND RETENTION AMONG SENIOR SECONDARY SCHOOL STUDENTS IN DUTSINMA EDUCATION ZONAL QUALITY ASSURANCE, KATSINA STATE, NIGERIA

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### ABSTRACT

This study investigated the effect of Collaborative Teaching Strategy on Academic performance and Retention among Senior Secondary school students in Dutsinma Education Zonal Quality Assurance, Katsina State, Nigeria. The study was guided by four objectives among which is, 'to Determine the difference between academic performance of Biology students taught using Collaborative teaching strategy and those taught using chalk/talk method', from which four research questions were generated, among which is, 'What is the difference between the mean academic performance scores of biology students taught using Collaborative Teaching and those taught using Chalk/Talk method'? And four null Hypotheses were generated and analyzed, of the hypothesis is, 'there is no significant difference between the mean academic performance scores of biology students taught using Collaborative Teaching and those taught using chalk/talk method'. A quasi-experimental research design using the pre-test, post-test, and post-post-test control group was adopted. The population of the study comprised 3,761 SS II students. Two intact classes containing 158 students (Experimental group = 81 and Control group = 77) were used in this study. A 30-item multiple-choice Biology Performance Test with reliability (Pearson Product Moment Correlation  $r=0.720$ ) was used to collect data. The treatment and data collection process lasted for eight weeks. The data collected were analyzed using mean, standard deviation, and independent t-tests. The result of the findings shows that there is a significant difference in the academic performance of the experimental and control groups ( $p=0.00<0.05$ ), and there is a significant difference in the retention between the experimental and control groups ( $p=0.00<0.05$ ) in favor of the experimental group. The study also showed that there is no significant difference in the performance scores ( $p=0.50>0.05$ ) and retention scores ( $p=0.32>0.05$ ) of male and female students in the experimental group. It was therefore concluded that collaborative teaching strategies have a more significant effect on students' performance in biology than the traditional chalk/talk method. On the basis of findings from the study, it was recommended among others that, teachers of biology should adopt the use of collaborative teaching strategy to improve academic performance and retention ability among students regardless of gender.

**Keywords:** Collaborative, Teaching, Performance, Retention, Students

### 1.0 INTRODUCTION

Biology is one of the important science subjects taught at the Senior Secondary School (SSS) level. The Federal Republic of Nigeria in its National Policy on Education, (FRN, 2014), stated that 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 programs. In spite of this central and important position of Biology among other science and related disciplines, studies revealed that the academic performance of students in Science subjects at the Senior Secondary Certificate Examination (SSCE) has consistently been very poor and highly unimpressive (Njoku, 2005). Many factors have been suggested as contributing to this poor performance of students in Biology in particular and science in general. Some of these factors include inadequate laboratory equipment in Biology (Eniayeju, 2010); poor teaching methods (Ayogu, 2010) that are basically not learners centered.

However, a collaborative teaching strategy is a teaching approach that is learner-centered in which small groups, each with learners of diverse levels of capability, use a range of educational activities to enhance their comprehension of a topic (Dyson & Casey, 2012). Its advantages included an increase in communicative competence, language knowledge and skills, as well as a higher level of enthusiasm and Collaborative within the class. Furthermore, advanced students were able to help those students whose fluency was less developed. Collaborative teaching can be employed in any type of task that can be assigned to students in learning classes, project-based courses, or laboratories (Maceirasa et al., 2011). Furthermore, collaborative teaching connects students to the knowledge-sharing process by enabling them to motivate each other, depend upon each other and engage in active social communication in a group context. Thus, collaborative teaching is mainly based on the ability to use a social interface rather than being a mechanical process without interaction or dynamic behaviour or thinking.

According to Aronson (2014), stated that student's performances excel when collaborative teaching strategies, including jigsaw, are implemented. It affirms that teacher-centered classroom does not effectively equip the students with enough resources to broaden their level of understanding. Moreover, collaborative teaching has been proven to equip the students with ability to derive deeper understanding of subjects (Molly, Dingel, & Aminul 2014). Compared to chalk/talk method, collaborative teaching improves interaction in groups, promotes individual responsibility for learning, and met cognitive awareness (Dallmer, 2007). The benefits of collaborative teaching also include increased cooperation and more well-developed social skills, motivation, and retention of knowledge (Davidson & Major, 2014). Therefore, against this background therefore, the study investigated the effect of collaborative teaching on performance and retention among senior secondary school students in Dutsin-ma Education Zonal Quality Assurance.

## 2.0 STATEMENT OF THE PROBLEM

The academic performance of students in science subjects in general and Biology in particular in Nigerian secondary schools has not been very good. The concern of every Nigerian is what the causes of this poor performance in schools are. However, among the causes of this poor performance is the teachers' method of teaching (Wanbugu, Changeiywo & Ndritu, 2013; Oladejo, Olosunde, Ojebisi & Isola, 2011). Based on this, it is important to review the different type of teaching methods in science education, their disadvantages and the need for a shift of

paradigm. According to WASSCE Chief Examiner's Report 2018, the observed weakness include; Poor spelling of some technical terms, Poor drawing of some diagrams Poor expressions in questions requiring explanations, Inability to compare Biological processes appropriately, inability to use technical terms to describe concepts. The teaching of Photosynthesis in Nigerian secondary schools has been with the use of traditional method of instruction. However, the performance of students in the topic, (specifically on the concept and process of photosynthesis) especially at SSCE level has consistently remained unimpressive. This implies that student's academic performance from the use of this method of teaching is not supportive and encouraging. Moreover, many teachers handling the science subjects in most of our secondary schools specialized in science, not in science education (Omosewo, 2015). As such find it difficult to teach the subject very well. Therefore, these teachers lacked appropriate instructional strategies for teaching and often used chalk/talk method. Science education in Nigerian schools is faced with many challenges; one of such challenges is the out-of-field teaching. This is when a teacher is assigned to teach subjects for which he or she has not got adequate training and qualification (Ingersoll, 2012). These categories of teachers need a change of teaching method as most of them teach by the chalk/talk based instruction. This method has been criticized for lack of effective interactive approach. This study therefore, determined the effect of introducing collaborative teaching strategy on Secondary Schools students understanding of the concept of photosynthesis among senior secondary schools in Dutsin-ma zonal education quality assurance, Katsina State.

## **2.1 Objectives of the Study**

Specifically has the following objectives; to;

1. Find out the effect of Collaborative strategy on academic performance in biology among senior secondary school students in Dutsin-ma Zonal education quality assurance.
2. Investigate the effect of Collaborative teaching strategy on retention of Biological concepts among secondary school students in Dutsin-ma Zonal education quality assurance
3. Determine the difference between retention ability of Biology students taught using Collaborative teaching strategy and those taught using chalk/talk method.
4. Compare the difference between retention ability of male and female Biology students taught using collaborative teaching strategy.

## **2.2 Research Questions**

The following research questions guided the study:

1. What is the difference between the mean academic performance scores of Biology students taught using Collaborative strategy and those taught using chalk/talk method?
2. What is the mean difference between the mean retention ability scores of Biology students taught using Collaborative strategy and those taught using chalk/talk method?

3. What is the difference between the mean academic performance scores of male and female Biology students taught using collaborative strategy?
4. What is the difference between the mean retention scores of male and female Biology students taught using collaborative strategy?

### 2.3 Research Hypotheses

The study formulated the following null hypotheses;

**H01.** There is no significant difference between the mean academic performance scores of Biology students taught using Collaborative strategy and those taught using chalk/talk method.

**H02.** There is no significant difference between the retention scores of Biology students taught using Collaborative strategy and those taught using chalk/talk.

**H03:** There is no significant difference between the mean academic performance scores of male and female Biology students taught using collaborative strategy.

**H04.** There is no significant difference between the mean retention scores of male and female Biology students taught using collaborative strategy.

### 3.0 METHOD

This study employed a quasi-experimental research design using the pre-test, post-test, post posttest control group. This design was considered suitable for this study because the variables under study can be manipulated. The two groups (Experimental and Control Groups) were given a pretest (O1) by administering the Biology Performance (BAT) before the treatment. The experimental group (EG) was treated for four weeks using collaborative learning approaches (X1) while the control group was taught for similar number of weeks using chalk and talk method (O1). After the treatment, the BAT was administered to the groups as posttest (O2) to determine the effect of the treatment. After two weeks of the posttest, a post posttest (O3) was conducted to determine the retention level of the two groups.

The population for this study comprises of all the public Secondary School Students offering biology in Dutsin-ma Zonal Education Quality Assurance. There are sixteen (16) Government secondary schools with a total population of 3761 students grouped into 1,706 male and 2,055 female students. To obtain adequate sample for this study, a purposive sampling technique was adopted. Two co-educational secondary schools were purposively sampled. The choice for co-educational schools is to enable male and female students to participate in the study. The two schools were far apart enough which avoided possible effect of interference with the treatment. From each of the schools selected, an intact class of SSII students was selected which were randomly assigned as experimental and control groups.

An instrument titled Biology Performance Test (BPT) and instructional tools were used in this study. BAT is a 30-item multiple choice objective questions adapted from Senior School Certificate Examination conducted by the West African Examination Council and National Examination Council. The topics from which BPT was developed were on Photosynthesis. Each item was scored one mark, making a minimum of 1mark and maximum of 30 marks

respectively. The instructional tools consist of lesson plans developed in two versions. The versions of the lesson plans were structured to guide the application of treatment to the experimental group as well as control groups respectively. The Collaborative Learning Package was developed to foster collaborative learning among the experimental group based on the content of the treatment to the group. The reliability coefficient of the instrument was determined using Pearson Product Moment Correlation (PPMC) method with the aid of statistical package for social science (SPSS) of estimating internal consistency. From the result obtained, reliability of the instrument is found to be 0.720. Hence, the instrument is reliable and consistent for the study.

A pretest was conducted by administering the BPT to the students in the first week to determine the entry level of students' knowledge in the topic selected. The experimental group was treated using collaborative teaching approach while the control group was treated using traditional chalk/talk method. The application of treatment lasted for four weeks (week 2 – week 5). A posttest was conducted for the two groups on the sixth weeks by administration of BAT to determine the effect of the treatment on performance. After two weeks of the posttest, a post posttest (retention test) was conducted using the disguised version of BAT to determine the retention level of the two groups. Thus, the data collection process lasted for a period of eight weeks.

The data collected were analyzed using SPSS version 23, based on the research questions and null hypotheses of this study. The research questions were answered using mean and standard deviations while the null hypotheses were tested using an independent t-test at 0.05 level of significance. The choice for the independent t-test is because, independent t-test reveals (if any) existence of significant difference between the categorical groups (experimental and control) as well as gender.

#### 4.0 RESULTS

**Research Question 1:** What is the difference between the mean performance scores of biology students taught using Collaborative Teaching and those taught using Chalk/Talk method?

**Table 1: Mean and Standard Deviation of Posttest Performance of Experimental and Control Group**

Group	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Experimental	81	34.77	9.90	1.10	11.39
Control	77	23.38	4.11	0.46	

The Table 1 shows that experimental group has a mean score of 34.77 and Standard Deviation of 9.90 while control group has a mean of 23.38 and standard deviation of 4.11 with a mean difference of 11.39. The mean score of experimental group is greater than the mean of control group. This answered the research question number one which sought to established difference between the mean academic performance scores of students taught Biology using Collaborative

Teaching and those taught using chalk/talk method. Students taught using Collaborative Teaching has the highest mean score than control group.

**H01:** There is no significant difference between the mean performance scores of biology students taught using Collaborative Teaching and those taught using chalk/talk method.

**Table 2: t-test analysis of Posttest Students' Performance in Experimental and Control Groups**

Group	N	Mean	SD	t-value	DF	P-Value	remark
Experimental	81	34.77	9.90	9.35	156	0.00	*Sig.
Control	77	23.38	4.11				

The Table 2 presents t-test analysis of Posttest students' performance in Experimental and Control Groups. Result shows that the t-value calculated was found to be 9.35 and p-value obtained was 0.00 which is less than 0.05. Therefore, there is significant difference between the mean academic performances of students after treatment. This established significant difference in the mean academic performance scores of students taught Biology using Collaborative Teaching and those taught the same concept using chalk/talk method, in favour of experimental group. The hypothesis is rejected.

**Research Question 2:** What is the difference between the mean retention ability scores of biology students taught using Collaborative Teaching and those taught using Chalk/talk method?

**Table 3: Mean and Standard Deviation of Post-Posttest Retention Ability of Experimental and Control Groups**

Group	N	Mean	Std. Deviation	SE	Mean Difference
Experimental	81	33.40	9.50	1.056	14.47
Control	77	18.93	2.53	0.28	

The Table 3 presents Mean and Standard Deviation of post-posttest Retention Ability of experimental and control groups. From the results, experimental group taught using Collaborative Teaching has a mean score of 33.40 and standard deviation of 9.50 while control group has a mean of 18.93 and standard deviation of 2.53. The mean retention score of experimental group is greater than the mean of control group. This answered the research question number two which sought to established difference between the mean retention scores of students taught Biology using Collaborative Teaching and those taught using conventional method. Students taught using Collaborative Teaching has the highest mean score than control group.

**H02.** There is no significant difference between the mean retention ability scores of biology students taught using Collaborative Teaching and those taught using chalk/talk method.

**Table 4: t-test Analysis of Post-Posttest Students' Retention in Experimental and Control Groups**

Group	N	Mean	SD	t-value	DF	P-Value	remark
Experimental	81	33.40	9.50				
				12.92	156	0.00	*Sig.
Control	77	18.93	2.53				

The Table 4 shows t-test analysis of Post Posttest students' retention in Experimental and Control Groups. Result shows that the t-value calculated was found to be 12.92 and p-value obtained was 0.00 which is less than 0.05. Therefore, there is significant difference between the mean retention score of students. This established no significant difference between the mean retention scores of students taught Biology using Collaborative Teaching and those taught the same concept using chalk/talk method. The hypothesis is rejected.

**Research Question 3:** What is the difference between the mean performance scores of male and female biology students taught using Collaborative Teaching?

**Table 5: Mean and Standard Deviation of Posttest Performance of Male and Female Students in Experimental Group**

Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Male	48	35.39	9.136	1.31	
					1.57
Female	33	33.87	11.01	1.91	

Table 5 presents Mean and Standard Deviation of posttest performance of male and female students in experimental group. From the results, male students in the experimental group taught using Collaborative Teaching has a mean score of 35.39 and standard deviation of 9.13 while female students in the same group has a mean score of 33.87 and standard deviation of 11.01. The mean score of male students is greater than the mean of female students with mean difference of 1.57. This answered the research question number three which sought to establish difference between the mean academic performance scores of male and female students taught Biology using Collaborative Teaching. Male students taught using Collaborative Teaching has slightly higher mean score than female students.

**H03:** There is no significant difference between the mean performance scores of male and female biology students taught using Collaborative Teaching.

**Table 6: t-test Analysis of Posttest performance of Male and Female Students in Experimental Group**

Gender	N	Mean	SD	t-value	DF	P-Value	remark
Male	48	35.39	9.13	0.675	79	0.50	**Not Sig.
Female	33	33.87	11.01				

The Table 6 presented t-test analysis of Posttest of Male and female students' performance in Experimental Group. Result shows that the t-value calculated was found to be 0.67 and p-value obtained was 0.50 which is greater than 0.05. Therefore, there is no significant difference between the mean academic performance of male and female students after treatment. This shows that there is no significant difference between the mean academic performance scores of Male and female students taught Biology using Collaborative Teaching. The hypothesis is retained.

**Research Question 4:** What is the difference between the mean retention scores of male and female biology students taught using Collaborative Teaching?

**Table 7: Mean Retention Scores of Male and Female Students in the Experimental Group**

Gender	N	Mean	Std. Deviation	Std. Error Mean	Mean Difference
Male	48	34.27	8.60	1.24	2.12
Female	33	32.15	10.70	1.86	

Table 7 presents Mean and Standard Deviation of post-posttest retention of male and female students in experimental group. From the results, male students in the experimental group taught using Collaborative Teaching has a mean score of 34.27 and standard deviation of 8.60 while female students in the same group has a mean score of 32.15 and standard deviation of 10.70. The mean score of male students is greater than the mean of female students. This answered the research question three which sought to establish difference between the mean retention scores of male and female students taught Biology using Collaborative Teaching. Male students taught using Collaborative Teaching has slightly higher mean retention score than female students (mean difference =2.12).

**H04.** There is no significant difference between the mean retention scores of male and female biology students taught using Collaborative Teaching.

**Table 8: t-test Analysis of Posttest Performance of Male and Female Students in Experimental Group**

Gender	N	Mean	SD	t-value	DF	P-Value	remark
Male	48	34.2708	8.60	0.98	79	0.33	**Not Sig.
Female	33	32.1515	10.70				



The Table 8 presents t-test analysis of Posttest of Male and female students' retention in Experimental Group. Result shows that the t-value calculated was found to be 0.98 and p-value obtained was 0.32 which is greater than 0.05. Therefore, there is no significant difference between the mean retention of male and female students after treatment. This shows that there is no significant difference between the mean retention scores of Male and female students taught Biology using Collaborative Teaching. The hypothesis is retained.

## **5.0 DISCUSSION OF FINDINGS**

This study revealed that, there is significant effect of collaborative teaching strategy on students' academic performance in biology. This finding corresponds with other previous findings on collaborative teaching. For instance, Oyarole (2016 and Williams and Akpan 2017) revealed that collaborative learning was more effective on students' performance in Biology. Collaborative learning strategy has also been found to have significant effect on students' performance in other science subjects (Ishaq 2015; Iji et al 2017; Anthony et a 2018 Bika and Sule 2019). The finding of this study is therefore not surprising because, collaborative teaching which has its root from the Positive Interdependence Theory which simply stated that students in collaborative teaching/learning group impacts one another through mutual work and motivation and ensure that, every member in the group succeed and achieve a common goal (Johnson, et al, 2014). This is contrary to what happens in the traditional teaching/learning method by lecture/chalk talk where the teacher dominates the lesson. The collaborative effort of every students in the group accounted for the effectiveness of collaborative teaching/learning.

The second finding of this study is that there is significant effect of collaborative teaching on students' retention of biology concepts learned. This finding agrees with the findings of some previous researches in biology as well as in other fields. For instance, Chianson et al, 2011, Korkmaz and Tay 2016 and Bika and Sule 2019 revealed the effectiveness of Collaborative instructional strategy on student's retention of concepts learned. Oyarole (2016) also revealed that, there is significant effect of collaborative instructional strategy on student's retention in ecology. Collaborative learning has been supported by the Vygotskian Principle which view a child's learning, memory and concept formation as a function of inter-psychological (collaboration) at the first learning stage and intra-psychological (individual) as the second learning stage (Vygotsky, 1978; cited in Graduate Student Instructor, 2019). This is contrary as what takes place in the Traditional learning (lecture) method where students are assumed to be recorder of information without involvement and the teacher do more of the classwork rather than the students. The recipient of help, motivation and support by students with low aptitude (at Zone of Proximal Development) from their peers and the teacher scaffolds is thought to give more advantage to the collaborative learning group than the traditional learning (lecture) group. This reason may account for the effectiveness of collaborative learning on students' retention of biology concepts.

The third finding emanated from this study further revealed that, there is no significant difference between the scores of male and female students in the experimental group before and after treatment was applied. This indicated that, the treatment was equally effective to both male and female students. This finding further proves the effectiveness of collaborative learning without gender bias. Similar finding has been revealed in previous studies on

collaborative learning. For instance, Iji, et al, (2017) Male and female students do not significantly differ in their performance in chemistry. Specifically, on biology, Oyarole (2016) revealed that, both male and female students taught using collaborative learning performed equally. Williams and Akpan (2017) emphatically stated that, students' gender has no effect on the effectiveness of collaborative teaching and learning strategy.

Fourth finding revealed that, both male and female students equally retain the biology concept learned. This finding agrees also with the finding of Oyarole (2016) who revealed that, both male and female students taught ecology using collaborative learning strategy equally retain the concepts learned. In a recent study where the interaction effect of collaborative learning and gender was investigated, Bika and Sule (2019) revealed that, there was no significant interaction effect of gender on students' retention. In other word, the effectiveness of collaborative learning does not depend on students' gender. Gender is not fostered by the environment as in the case of learning. Rather, it is a product of the nature of gene inherited by an individual. For this reason, effectiveness of learning strategies may not be influenced by gender except the learning strategy was not implemented properly. Collaborative learning which foster positive interdependence Johnson, et al, (2014), create an avenue where learning takes place by interaction irrespective of students' ability and/or gender. This reason may account for the equal effectiveness of collaborative learning across gender.

## 6.0 CONCLUSION

Students' performance in biology has been at dismay. Based on the finding of this study, the problem is attributive to poor teaching methods adopted by biology teachers in schools. This study provides an empirical evidence to support the efficacy of collaborative learning as credible enough to improve students' performance in biology. Collaborative learning strategy facilitates students' performance better than the traditional lecture methods. Remarkably as this learning strategy is, gender do not affect students' performance when it is used. It is hereby concluded that, collaborative learning strategy have significant effect on the students' performance in biology than the traditional lecture method without gender interference.

## 7.0 RECOMMENDATIONS

**Based on the findings of this study, the following are hereby recommended:**

- i. Teachers of biology should adopt the use of collaborative teaching and learning strategy to encourage social interaction and active engagement and positive interdependence among their students. that will help students to improve their performance in Biology
- ii. Both male and female students and Students with low or high self-concept should be grouped heterogeneously in order to learn collectively and perform equally
- iii. Teachers should be encouraged or mandated to attend workshops and conferences to familiarize themselves with skills to use collaborative learning strategies in their classrooms.
- iv. School principals and other heads of educational institutions should encourage and supervise the implementation of collaborative teaching and learning strategy in their institutions.

- v. Curriculum planners should structure biology curriculum that encourage teachers to use collaborative learning strategy to fully implement biology curriculum.
- vi. Textbook writers should provide students manuals and/or activity worksheets that will encourage students to learn through collaboration.

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