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EFFECTS OF STAD COOPERATIVE LEARNING STRATEGY ON THE ACADEMIC ACHIEVEMENT OF SENIOR SECONDARY SCHOOL STUDENTS IN BIOLOGY IN BAUCHI METROPOLIS

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ABSTRACT

This study investigated on the Effects of STAD Cooperative Learning Strategy on the Academic Achievement of Senior Secondary School Students in Biology in Bauchi Metropolis. A post-test-control group design quasi experimental design was adopted. A sample of 83 students participated in the study were selected randomly from two schools in Bauchi Metropolis. An essay, Biology Achievement Test (BAT) used as an instrument for data collection. The instrument was analyzed using mean, standard deviation and independent sampled-test. The reliability of the instrument obtained using Pearson Product Correlation was 0. 842. Two hypotheses was formulated and tested at 0.05 level of significances. The study found that there was a significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught with lecture method. Moreover, the study shows that there was no significant difference between the mean achievement scores of male and female students taught with STAD cooperative learning. The study recommends that government should encourage secondary schools' teachers to adopt STAD cooperative strategy as an instructional approach for teaching Biology in secondary Schools to improve students' achievement.

Keywords: Academic Achievement, Biology, STAD Cooperative Learning Strategy.

INTRODUCTION

The system of Education around the world has developed from a teacher-centered learning transforming into a student centered learning that teaches students how to take responsibility for their own learning and become more independent. Ideally education is not only focused to the past and present, but it should be a process that anticipates and discusses the future. Good education is education that not only prepares students for a profession or position, but to solve the problems they face in daily life organized by educational institutions (Trianto 2007).

Education should look far ahead and think about what students will face in the future. Many teachers still follow traditional practices such as direct lecturing, strict use of textbook as the

only reference, and rarely extend their teaching to make it relevant to real-life scenarios. As stated by Yore (2001), this does not place any importance on the development of critical thinking skills and whole concepts that are important to science literacy. On the other hand, Cobb, McClain, de Silva Lamberg and Dean (2003) state that: "Design experiments have both a pragmatic bent and a theoretical orientation developing domain-specific theories by systematically studying those forms of learning and the means of supporting them."

Based on the results of research analysis on the low learning outcomes of students, this is due to the learning process that is dominated by traditional learning, in traditional learning the atmosphere of the classroom tends to be teacher-centered so that students become passive. In this case, students are not taught learning strategies that can understand how to learn, think and motivate themselves. This problem is often found in teaching and learning activities in the classroom (Trianto 2007). This fact applies to all subjects

The learning model that can be applied to overcome the biology learning conditions above is the STAD type cooperative learning model. In this study, researchers used cooperative learning type Student Team Achievement Division (STAD) with the consideration that the STAD type is the simplest type of cooperative learning and involves many students so that students who have difficulty will be helped and difficult material will be easily understood.

According to Slavin (2014) Cooperative Learning is a learning method in which students work together in small groups to help one another learn. Studies have shown several reasons why teachers use Cooperative Learning strategy (Udu, 2018a; Gamabri & Yusuf, 2016; Gambari, Yusuf and Thomas, 2015;Alabekee, Samuel and Ossat, 2015; Gambari and Yusuf, 2015; Satyaprakasha, 2015;Bertucci, Conte, Johnson and Johnson, 2010 and Johnson and Johnson, 2005).

Firstly, Cooperative Learning improves students' academic achievement. Gambari, Yusuf and Thomas (2015) found that the performances of students improve when taught physics with Student Teams Achievement Division-Cooperative Learning Strategy as compared to those taught with conventional method of teaching. Also, several studies conducted by researchers, for example, a study by Gambariand Yusuf (2015) on the Effects of Computer-Assisted STAD, LTM and ICI Cooperative Learning Strategies on Nigerian Secondary School Students' Achievement, Gender and Motivation in Physics found that students taught with STAD Cooperative learning perform better than those taught with conventional method. Another studies by Alabekee, Samueland Ossat (2015) on the Effect of Cooperative Learning Strategy on Students Learning Experience and Achievements in Mathematics found that students taught with Cooperative learning perform better than those taught with conventional method.

Secondly, students taught with Cooperative Learning have high academic self-esteem. Johnson and Johnson (2005) found that students taught with Cooperative Learning tend to result in higher self-esteem than those working alone. Similarly, Bertucci, Conte, Johnson and Johnson (2010) found that students working in cooperative pairs had higher self-esteem than students working alone.

Thirdly, Cooperative Learning improves social relation among group members. For instance, when students of the same group interact often with their group members, such interaction tends to improve social relationship among students within the same group. A review of studies

conducted by Satyaprakasha (2015) found that cooperative learning has positive effect on students relating with their peers and become friendlier among themselves.

Learning Biology, it is very necessary appropriate learning models that can involve students optimally both intellectually and emotionally, because Biology teaching emphasizes process skills (Yusuf 2008). Therefore, it is necessary to apply a learning model that can help students to understand teaching material and improve learning outcomes.

From the foregoing, STAD Cooperative Learning results in higher achievement and higher retention than lecture method. It is based on this assertion that the researcher wants to determine the effect of STAD Cooperative Learning on academic achievement in Biology.

Purpose of the Study

The purpose of the study is to determine the effects of STAD Cooperative Learning strategy on the Academic Achievement of Senior Secondary School Students in biology. Specifically, this study sought to achieve the following objectives.

i. Find out the mean achievement scores of students taught with STAD Cooperative Learning and those taught with lecture method.
ii. Find out the mean achievement scores between male and female students taught with STAD Cooperative Learning.

RESEARCH QUESTIONS

The following research questions guided this study

i. What is the mean achievement scores of Students taught biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method?
ii. What is the difference in mean achievement scores between male and female students taught with STAD Cooperative Learning?

Research Hypotheses

The following hypotheses was tested at 0.05level of significance

i. There is no significant difference in the mean achievement scores between Students taught biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method.
ii. There is no significant difference in the mean achievement scores between male and female students taught with STAD Cooperative Learning.

Significance of the Study

The findings of this study will hopefully, uplift the standard of biology education through the students, teachers, curriculum planners, administrators and policy makers:

To Students this study will help to develop cooperative learning skills and will also help student to be more resourceful during lessons. To teachers they will be better informed on better ways of implementation of various cooperative learning strategies when delivery lessons in the classroom.

To curriculum planners the study will further provide insight during the review of content of the existing curriculum they will make a special provision suggesting the appropriate cooperative learning strategies and how they could be effectively applying such strategies during teaching and learning process. Also produce textual materials that will guide teachers to improve the instructional process.

To administrators such as Ministry of Education, the findings of this study will enable them to carryout periodic seminars and workshops for teachers on the implementation of various cooperative learning strategies.

To policy makers, the findings from this study will enable them to make policies that will promote the use cooperative learning strategies in the classroom

Scope of the Study

This research work cover only the aspect of investigating the effects of STAD cooperative learning on the academic achievement of senior secondary school students in Biology in Bauchi Metropolis. Specifically, it will cover the senior secondary school students two (SSII) of public secondary school in Bauchi Metropolis.

LITERATURE REVIEW

Theoretical Framework

This study is based on Social Interdependence Theory. Social Interdependence theory states that the accomplishment of each student's goal is affected by the actions of others (Deutsch, 1949, 1962, Johnson & Johnson, 1989).

Furthermore, Social Interdependence Theory was formally conceptualized by Deutsch (1949). Johnson, Johnson and Holubec (1998) argue that for a situation to be true cooperative it must have five elements. These elements include: positive interdependence, individual accountability, the appropriate use of social skill, face-to-face promotive interaction and group processing. According to social interdependence theory, there are two types of interdependence, they are positive and negative interdependence. Positive interdependence lead to cooperation among students while negative interdependence lead to competition among students. This study will concentrate on the positive interdependence. It entails each student believing that they have role to play in the group. Each Student must perform his /her specific role so as to complete their group task. Positive interdependence results in promotive interaction (i.e., students encourage and facilitate each other's efforts to complete tasks in order to reach the group's goals).

Individual accountability is when the performance of each student test is assessed and the result given to the group. To foster effective cooperation among group members, students need to appropriately use some social skills, for example: communicating accurately and unambiguously and ability to resolve conflict. Johnson and Johnson (2005) stated that not only do social skill promote higher achievement but contribute to building more positive relation among group members.

Furthermore, group members need to examine the students who are contributing to achieve the group's goal. Group processing as a variable of social interdependence is therefore necessary for successful cooperation among group members. According to Johnson and Johnson (2005) group processing occurs when group's members reflect on which student actions were helpful and unhelpful and also make decisions about which actions to continue or change. Similarly, the purpose of group processing is to clarify and improve the effectiveness of the group with which student carry out to achieve the group goals (Johnson & Johnson, 2005).

Positive interdependence is established in this study by the researcher assigning roles to each student within a group. Likewise, individual accountability is established by researcher

assessing the performance of each student test within a group and the result presented to both the student and the group. Furthermore, promotive interaction is established by the researcher monitoring the interaction among students on a regular basis. This is highly important, as will leads to the success of the group members to achieve their goal goals.

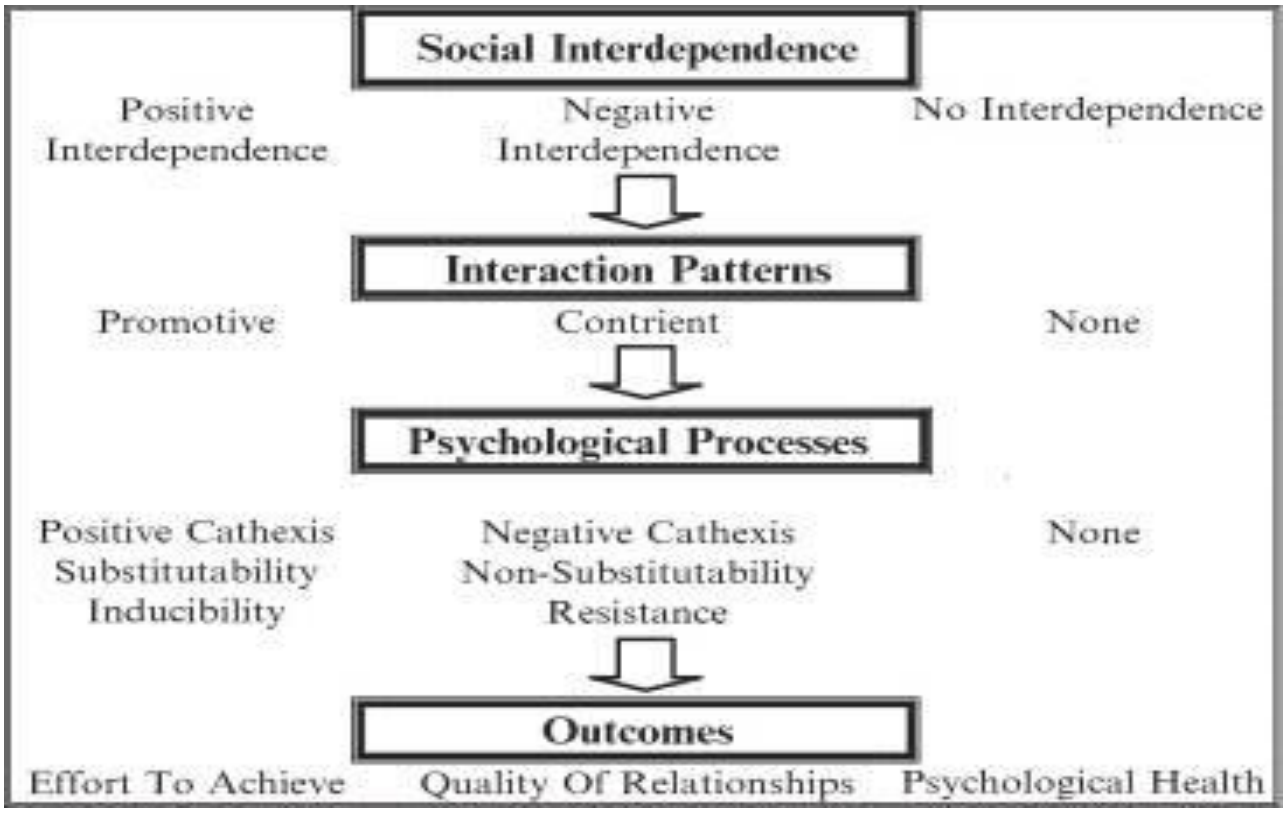

Figure 1:Overview of Social Interdependence theory (Johnson & Johnson, 2005).

Figure 1: Overview of Social Interdependence theory (Johnson & Johnson, 2005).

Overview of Cooperative Learning

Slavin (2011) see Cooperative Learning as a set of instructional strategies in which students work together in small groups to help each other learn academic content. Various cooperative learning strategies have been developed by researchers (Slavin, 1980). Among them includes students team learning developed by Robert Slavin & his colleagues. The student team learning consists of Students Teams Achievement Divisions, Teams-Games Tournament, Team Accelerated instruction and Cooperative Integrated Reading and Composition and other strategies include Learning Together Method developed by Johnson and Johnson in mid 1960s, Jigsaw II developed by Aronson & his colleagues in the 1976. The Group-Investigation method developed by Sharan and Sharan in 1976.This study will adopted the STAD method because it is most appropriate for teaching well-defined objectives, such as mathematical computations and sciences.Any lesson in any subject area for different ages of students can be done cooperatively.

There are four types of cooperative learning. They are formal,informal, cooperative base groups and cooperative structure.

Formal Cooperative Learning

In formal cooperative learning, students work together from one class period to several weeks, to achieve shared learning goals by ensuring that their group-matessuccessfully complete the learning task assigned (Johnson, Johnson & Holubec, 2002).According to Johnson and Johnson (2002) teachers do the following in formal cooperative learning:

i. Make a number of pre-instructional decisions such as deciding on the objectives of the lessons (these objectivescan be academicor social skill in nature), size of the group, the method of assigning students to groups, the role students will be assigned, the materials needed to conduct the lesson and the way the room will be arranged.
ii. Explain the task to the student and structuring positive interdependence: A teacher needs to clearly define the task student should do and specifies the positive and individual accountability, gives criteria for success and explain the targeted social skills students are to engage in.
iii. Monitor students learning and intervene in groups to provide task assistance or to increase students' interpersonal skill and group skills. A teacher needs to observe and collects data on each group as it works. When it is needed, the teacher intervenes to assist students in completing the task accurately and working together effectively.
iv. Assess students' learning and help them process how well their groups functioned. Students' learning should be carefully assessed by the teacher. The teacher needs to help members of the learning groups to process how effectively they have been working together.

Informal Cooperative Learning

In informal cooperative learning, students work together to achieve a joint learning goal in temporary ad-hoc groups that last from a few minutes to one class period, alongside with the teacher giving lectures, demonstrations, showing films and video tape on a particular topic to the students. According to Johnson and Johnson (2002),the purposes of informal cooperative learning are to focus student's attention on the material to be learned, create an expectation set and mood conductive for learning, help organise in advanced the material to be covered in a class session, ensure that students cognitively process the material be taught, and provide closure to an instructional session.

Cooperative Base Groups

Johnson, Johnson and Holubec (2002) see Cooperative base groups as long-term, heterogeneous cooperative learning groups with stable membership that last for at least a year and perhaps until all members are graduated. These groups provide students with permanent, committed relationships that allow group members to give each other the needed support, help, encouragement and assistances to consistently work hard in school.

Cooperative Structure

In order to use cooperative learning majority of time, the teacher must identify and cooperative structure generic lessons and repetitive course routine. This is achieved by using cooperative learning scripts. Cooperative learning scripts are standard, content free cooperative procedures, which prescribe student actions steps-by-steps for either conducting generic, repetitive lessons (such as writing reports or giving presentations) or managing classroom routines (such as checking homework and reviewing tests) (Johnson & Johnson, 2002).

Essential Component of Cooperative Learning

Johnson, Johnson and Holubec (1998) had pointed out five essential components in order for any lessons to be truly cooperative. Johnson and Jonson (2002) argue that cooperation often goes due to the absence of these components. The components include positive independence, individual accountability, and face-to-face promotion interaction, social skills, and group processing.

Positive Interdependence

Positive interdependence exists when students perceive that they are linked with group-mates in way that makes it impossible for anyone to succeed and they must coordinate their efforts coordinate their efforts with their group-mates to complete a task (Johnson, Johnson & Holubec, 2002). There are various types of positive interdependence.They include goal, role, reward, resource, and identity (Johnson, 2002). The ways teacher structure the various types of positive interdependence are enumerated below.

i. The goal interdependence is structured by informing students that, they can accomplish their goal if and only others members of their group accomplish their goals.
ii. Role interdependence is structured by assigning each group member a specific role to play in the group. Examples of such roles may include reader, checker for understanding, encourager of participation, summarizers etc.
iii. Resource interdependence is structured by dividing the materials into parts, assigning one part to each member, and having each group member teach their part to the other members of the group.
iv. Reward Interdependence is structured by indicating that if the group goal is achieved, each member will get bonus points on the assignment.
v. Identify interdependence can be established by asking each group to come up with a group name, flag or symbols.

Individual Accountability

Individual accountability exists when the performance of each individual student is assessed and the results are given back to the group and the individual. Johnson, Johnson and Holubec (2002) opined that the result given to the group, help the group in identifying which member need explanation on the content not clear to him. Common ways to structure individual accountability include giving an individual test to each student and randomly selecting one student to represent the entire group, or having each student explain what they have learned to a classmate.

Face-to-Face Promotive Interaction

Individuals promote each other's success by helping, assisting, supporting, encouraging, and praising each other's efforts to achieve the expected goals. Certain cognitive activities and interpersonal dynamics only occur when students are involved in promoting one another's learning. These include orally explaining how to solve problems, discussing the nature of the concepts being learned, teaching one's knowledge to classmates, and connecting present with past learning. (Johnson, 2002).

Social Skills

Contributing to the success of a cooperative effort requires interpersonal and small group skills. Placing socially unskilled individuals in a group and telling them to cooperate do not guarantee that they will be able to do so effectively. Persons must be taught the leadership, decision-making, trust-building, communication, and conflict-management skills just as purposefully and precisely as academic skills.

Group Processing

Group processing exists when group members discuss how well they are achieving their goals and maintaining effective working relationships. Groups need to describe what member actions are helpful and unhelpful, and make decisions about what behaviours to continue or change. When difficulties in relating to one another arise, students must engage in group processing and identify, define, and solve the problems they are having working together.

Implementation of Cooperative Learning

It is not enough to place students in group and expect cooperative learning to take place. The essentials components of cooperative learning, which are positive interdependence, individual accountability, face-face promotive interaction, social skills and groups processing must be carefully structured by teacher. According to Johnson, Johnson and Holubec (2003) theyare six steps when implementing cooperative learning. These steps include: specifying the objectives of the lessons, making pre-instructional decisions about learning group, explaining the task and goal structure to the students, settings the cooperative lessons in motion, monitoring the effectiveness of the cooperative learning groups and intervening as necessary, and evaluating students' achievement and helping them discuss how well they collaborated with each other. These steps are discussed accordingly.

Firstly, specifying the instructional objectives, the teacher must specify the two types of objectives, which are academic objectives and social skills objectives. The academic objectives need to be specified at the correct level for the students. The social skills objective must be detail the interpersonal and small-group skills that will be emphasized during the lesson.

Secondly, making pre-instructional decisions, the pre-instructional decision consist of: deciding the size of the group, assigning student to group, arranging the room, and assigning roles to ensure interdependence. The size of cooperative learning group should range from two to four students (Johnson, Johnson and Holubec, 2002; Slavin, 1990). A common way to determine the size of the group, is to divide the total number of students in class by 4. For instance, if there are 35 students in class, diving 35 students by 4 will amount to 8 remainder 3, so there are 9 cooperative learning group (8 group, the remainder '3' will be made to form their own group). After the size of the group has be determined, the next step is to assign students to a particular group. Slavin (1990) suggest that each group should be heterogeneous in nature (that is consisting of male and female students, a combination of high, medium, and low scoring students within the same group). Johnson, Johnson and Holubec (2002) also recommend that the cooperative learning group should heterogeneous in nature.After students, have assigned to their respective group. The next step is to arrange the room to promote cooperative learning. Johnson, Johnson and Holubec (1990, 2002) recommend that members of

a learning group close enough, preferably in cyclic manner so that they can share materials, maintain eye contact with each other, and communicate effectively without disrupting the learning group. After the room has been arranged, the next step is to assign roles to ensure interdependence. According to Johnson, Johnson and Holubec, (2002) roles such as summarizer, a checker of understanding, an accuracy coach, an elaborator, a research runner, a recorder, an encourage of participation, and observer may be assign each member with a particular group.

Thirdly, explaining the task and goal structure. The teacher need explainwhat procedures students follow in completing the assignment. Clear and specific instructions are crucial in warding off students' frustration. The teacher, also needs explain the objectives of the lessons and relates the concepts and information to be studied by the students. Once the procedures and objectives are clear, direct teaching of concepts, principles and strategies may take place.

Fourthly, setting the cooperative lesson in motion, the teacher needs to select a particular cooperative learning strategy to be used in teaching the class. Such strategies include learning together method (Johnson and Johnson, 1994), Jigsaw (Aronson, 1978), Teams-Games-Tournament (TGT) (De Veries & Edward, 1974), Student-Team-Achievement-Divisions Learning (STAD) (Slavin, 1980) etc.

Fifthly, monitoring the effectiveness of cooperative learning groups and intervening is necessary. Whether the lesson is loosely or tightly structured cooperatively, the teacher's role is to monitor student's interaction in the learning groups and intervene to help students learn and interact more skillfully. The teacher observes the interaction among group members to assess their academic progress and appropriate use of interpersonal and small-group skill. While, monitoring the group as they work, teachers need to clarify instructions, review important procedures, and teach task that are necessary. Also, while monitoring learning groups, teachers may find students without the necessary social skills to be effective group members. in this case the teacher needs to intervene and suggest to the group more effective procedures for working and specific social skills to use.

Finally, evaluating students' achievement and helping them discus how well they collaborated with each other. Teacher need to evaluate student's achievement by assessing both the individual's achievement test and collaborative behaviour.

Student Teams-Achievement Division

Student Teams-Achievement Division (STAD) is one of the student team learning developed by Slavin and colleagues in 1980. According to Slavin (1991) STAD is the simplest type of the Student Team Learning Methods; students are assigned to four or five-members learning teams. Each team is a microcosm of the entire class, made up of high, average and low-performing students. STAD is made of five components. These components include class presentations, team's quizzes, individual's improvements score and team recognition.

i. Class presentation: According to Slavin (1991) the teacher initially introduces the material in a class presentation. Students are required to pay attention during the presentation because it will help them do well on the quizzes and their quiz scores determine their team score

ii. Teams: Teams are composed of four or five students who represent a cross-section of the class in academic performance, sex and race or ethnicity. The major functions of the team are to prepare its members to do well on the quizzes. After the teacher presents the material, the individual team meets to study the materials.

iii. Quizzes: After one to two periods of the teacher's presentation and one to two periods of the team's practice, students take individuals quizzes composed of the course-content relevant questions. The quizzes are designed to test the knowledge the students have gained from class presentation and team practice.

iv. Individual improvements score: The ideal behind the individual improvement scores is to give each student a performance goal that he or she can reach but by only working harder than in the past

v. Team recognition: This is achieved by the teacher rewarding best teams and the best students for their performance. The teacher will have to place the best students and best team on the notice on a weekly basis.

RESEARCH METHODOLOGY

Research Design

The study adopted a post-test non-equivalent control group quasi-experimental research design.Jonson and Christensen (2017) see post-test non-equivalent control group quasi-experimental research as a design that administers a post-test to two selected groups of participants in which one of the group has been administered the experimental treatment condition. The choice for the design was considered appropriate for the study because intact classes were used to avoid disruption of normal class lessons. The researcher assigned the intact classes into to experimental and control group. This design is presented diagrammatically:

Figure 2: Diagrammatic Representation of the Research Design

Groups	Treatment	Post-Test
Experiment (Group1)	X_1	T_1
Control (Group 2)	X_0	T_1

Adapted from (Gambari,Yusuf and Thomas, 2015)

Where

X_1 = Treatment (STAD)

X_0 = Treatment (lecture method)

T_1 = Post-test

Area of Study

This study was carried out in Bauchi Metropolis of Bauchi State, Nigeria. Bauchi is located inthe north-eastern Nigeria. It shares boundaries to the east with Adamawa, Yobe and Gombe State, Plateau and Taraba states to the south while Kano and Jigawa Sates to the north and Kaduna Stateto the west respectively..

Population of the Study

The population for the study comprises ninety thousand and sixty-two (9062) Senior Public Secondary two (SS2) Biology students in all the twenty-two public secondary schools in Bauchi Metropolis of Bauchi State in the 2020/2021 academic session. The choice of SS2 is as a result of the experience and its position in the senior secondary school Biology curriculum.

Sample and Sampling Technique

The sample for this study consisted of 83 Senior Secondary School Students two (SSS2) from two intact classes randomly selected from two public co-educational schools in Bauchi Metropolis. Simple random sampling was also used to assign two schools into experimental and control group. Creswell (2015) sees simple random sampling as sampling technique where the researcher selects participants for the sample so that any individual has an equal probability of being selected from the population. Simple Random Technique was used as follow:

Firstly, it was used to select twenty two senior public senior secondary schools in Bauchi metropolis. The researcher cut twenty-two pieces of papers with the name of the schools written on the papers and place the paper into container and the researcher shake the container, after which the researcher pick two papers, one after the other at random. Once, the schools were selected at random.

Secondly, it was also used to assigned the schools into experimental and control group. The researcher tosses a coin, of which the head represented the experimental group while the tail represented the control group. From the Table 1 below, School A represented the experimental group while School B represented the control group.

Table 1: Sample for the Study in 2020/2021Academic Session

Schools	Gender Number		Total
	Male	Female	
School A	12	27	39
School B	21	23	44
Total	33	50	83

Instrument for Data Collection

The instrument for data collection was Biology Achievement Test (BAT) which consists of five essay questions that tested student's knowledge on Biology. The s tudents are required to answer all the questions. The items were allotted 10 marks each, culminating in the total of 50marks.The researcher adapts Biology past questions from West Africa Senior School Certificate Examination (WASSCE, 2014 -2020).

Validation of the Instrument

The instrument for data collection was face and content validated by an expert in the Department science Education , Abubakar Tafawa Balewa University, and two Biology lecturers from Bilyaminu Othman College of Education Dass, Bauchi State espectively. The experts validated the instrument to ensure that the items were constructed based on: the objectives of the study, the suitability of each item in terms of clarity and language usage. Thereafter, the corrections were made and the comments made were effected for the final draft of the instrument.

Reliability of Instrument

The reliability was established by using test-re-test method. National Open University of Nigeria (NOUN) 2006see test-retest method as way of estimating reliability which requires the same test to be administered twice to the same group of learners with a given time interval

between the two administrations. The resulting test scores are correlated and the correlation coefficient provides a measure of stability. The instrument was administered two times on the same group of 20 Students that are not part of the sample. The time interval was two weeks. The data collected was analyzed using the Pearson Product Moment Correlation Co-efficient (PPMCC) which yielded an index of 0.842 The instrument was reliable since the Co-efficient was above 0.50 (Human Resource Guide, 2009)

Method of Data Collection

The researcher was assign to teach Experimental group by using STAD cooperative learning strategy while the research assistant (Biology teacher with B.Tech Biology Education with five years' experience) was assigned to teach the Control group using the lecture method.
Experimental: In the experimental groups, the students were taught using STAD Cooperative Learning strategy for four weeks. 44 students were assigned to four-member learning teams consisting of 11 teams which was microcosm of the entire class, comprising: high, average, and low performing students (this was determined using their previous class performances). Formative test was administered to the students at the end of each topic. At the end of the treatment, a post-test was administered.

Control

In the control group, 39 students were taught. The researcher assistant delivered the lessons and ensures that students listen and copy notes. Assignments were given to the students. At the end of the exercise, the post-test was administered.
Methods of Data Analysis
The data collected was analysed by using IBM Statistical Package for Social Science (SPSS) Version 26 as follow:
Mean and Standard Deviation was used to answer the research questions.
Independent sample t-test was used to test the research hypotheses at 0.05 level of significance

RESULT AND DISCUSSIONS

The results were presented according to the research questions and hypotheses formulated as stated in chapter one.

Research Question One

What is the mean achievement scores of Students taught Biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method?

Table 2: Mean Achievement Scores of STAD and Lecture Method

Variable	N	$\bar{x}$	SD	Mean difference
STAD	39	25.41	8.165	
				11.27
Lecture Method	44	14.14	6.795	

To answer research question 1, the result from Table 1 shows that the mean achievement score of students taught Biology with STAD cooperative learning is 25.41while the mean achievement

score of students taught with lecture is14.41. The mean difference is 11.27 in favour of the students who were taught with STAD cooperative learning.

Research Question two

What is the difference in mean achievement scores between male and female students taught with STAD Cooperative Learning?

Table 3: Mean Achievement Scores of Male and Female Students' in STAD Cooperative Learning

Variable	N	$\bar{x}$	SD	Mean difference
Male	33	19.03	8.918	
				0.67
Female	50	19.70	9.681	

To answer research question 2, the result from Table 3 shows that the mean achievement scores of female students is 19.70while the mean achievement score of male students is 19.03.The mean difference is 0.67 in favour of the female students who were taught with STAD cooperative learning

Research Hypothesis One

There is no significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method.

Table 4: Independent analysis of t-test on Mean Achievement scores of Students taught Biology using STAD Cooperative learning strategy and those taught the same Concept with Lecture Method

PVariable	N	$\bar{X}$	SD	df	Tcal	p	Decision
STAD	39	25.41	8.165				
				81	6.863	0.00	Rejected
Lecture Method	44	14.14	6.795				

Significant at $p < 0.05$

The result in Table 4 shows that t-value of 6.863 and the p-value of 0.00 was observed at df =81. Since the p-value is less than 0.05 level of significance. It means therefore that the difference in the achievement of students taught Biology with STAD cooperative learning and those taught with lecture was significant in favour of the experiment group. Therefore, the null hypothesis which states that there is no significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method was rejected.

Research Hypothesis two

There is no significant difference in the mean achievement scores between of male and female students taught with STAD Cooperative Learning.

Table 5: Independent Sampled t-test on the Mean Achievement scores of Male and Female Students taught with STAD Cooperative Learning.

Variable	N	$\bar{X}$	SD	df	Tcal	p	Decision
Male	33	19.03	8.918				
				81	-3.18	0.751	Accepted
Female	50	19.70	9.681				

Significant at $p< 0.05$

The result in Table 5 shows that the t-value of -3.18 and p-value of 0.751 was observed at df =81. Since the p-value is greater than 0.05 level of significance. It means therefore that the difference in the achievement of students taught Biology with STAD cooperative learning and those taught with lecture was not significant. Therefore, the null hypothesis which states that there is no significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught the same concept with lecture method was accepted.

Summary of Key Findings

The study showed the following findings:

i. There was a significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught with lecture method.
ii. There was no significant difference in the mean achievement scores of male and female students taught Biology with STAD Cooperative Learning.

Discussions of Findings

Based on the findings, the result of this study was discussed accordingly.

The study was carried to determine the effect of STAD Cooperative Learning on academic achievement Biology.

The result of the study as presented in Table 2 shows that students taught Biology with STAD cooperative learning achieved higher than those taught with lecture method. The result from the test of hypothesis one showed there was a statistically significant difference ($p <0.05$) in the mean achievement scores of students taught Biology with STAD cooperative learning strategy over students taught with lecture method. This result confirms with findings of Adu and Galloway (2015); Gambari and Yusuf (2015), Gambari, Yusuf, and Thomas (2015);Gamabri and Yusuf (2017); Inuwa, Abdullahi and Hassan (2017); Udu (2018)also found in their separate studies that students taught with STAD cooperative learning have higher achievement than those taught with lecture.

The result of the study as presented in Table 3 showed that male and female students in the STAD group had mean achievement scores of 19.03 and 19.70 respectively. The mean difference is low (0.67). The result from the test of hypothesis two showed that there was no significant difference between the mean achievement scores of male and female students taught with STAD Cooperative Learning ($p>0.05$). This means that gender was not significant factor in determining student's achievement in biology. This result agrees with findings of Gambari and Yusuf (2015); Bot and Eze (2016) who found that there were no significant differences between the achievement of males and female taught with STAD cooperative learning.

CONCLUSION

The study investigated on The Effects of STAD cooperative learning on the Academic Achievement of Senior Secondary School in Biology in Bauchi Metropolis. Using mean, standard deviation and t-test, Based on the findings of the study it was concluded that there was a significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught with lecture method and it also shows there was no significant difference in the mean achievement scores of male and female students taught Biology with STAD Cooperative Learning.

RECOMMENDATIONS

In line with the findings of this study, the following recommendations are made.

i. Since it was it was found that there was a significant difference in the mean achievement scores between Students taught Biology using STAD Cooperative Learning strategy and those taught with lecture method there is need for teacher to attend seminars, work-shops, conferences on STAD cooperative learning so that they update on several strategies of cooperative learning.

ii. Since it was found that there was no significant difference in the mean achievement scores of male and female students taught Biology with STAD Cooperative Learning then there is need for Biology teaching and evaluation strategies free from gender bias. This will make males and females to see themselves as equal, capable of collaborating in school activities.

SUGGESTION FOR FURTHER STUDIES

Based on the findings of this study, the areas/topics have been suggested for further research:

i. A similar research could be conducted in other aspects of learning outcomes such as attitude

ii. A similar research could be conducted in other branches of science education.

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