COMPARATIVE STUDY OF DISCUSSION AND LECTURE METHODS ON ACHIEVEMENT AND ANXIETY AMONG SECONDARY BIOLOGY STUDENTS IN GASHUA, YOBE STATE, NIGERIA.

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DECEMBER, 2014.

DECLARATION

I declare that the work in this thesis entitled **Comparative Study of Discussion and Lecture Methods on Achievement and Anxiety Among Secondary Biology Students in Gashua, Yobe State, Nigeria** has been carried out by me in the Department of Science Education. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other institution.

Dawuda Danladi MOHAMMED ....

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CERTIFICATION

This thesis entitled COMPARATIVE STUDY OF DISCUSSION AND LECTURE METHODS ON ACHIEVEMENT AND ANXIETY AMONG SECONDARY BIOLOGY STUDENTS IN GASHUA, YOBE STATE, NIGERIA by Dawuda Danladi MOHAMMED meets the requirements governing the award of Masters Degree in Science Education of Ahmadu Bello University, Zaria and it is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This research work is dedicated to my late Father Muhammad Muhammad Snr. and Mother Rahmah Muhammad, my foster parents; A.D. Madaki and Fatima Muhammad, my loving wife Nafisa Mohammed and my children; Rahmah Ummi Mohammed and Mohammed B. Mohammed.

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OPERATIONAL DEFINITION OF TERMS

Achievement:	The outcome of students' performance in a test or examination.
Anxiety:	Apprehensive condition of students which prevent them from responding to test/examination questions properly.
Gender:	Description of sex type, i.e. male or female/ boy or girl.
Instructional Technique:	The methods or strategies teachers used in teaching students.
Phenomena	Common features appearing naturally and can be perceived by the senses.
Pollution	The release of harmful substances into the environment.

ABBREVIATIONS

BAT: Biology Achievement Test

BSAT: Biology Students Anxiety Test

FME: Federal Ministry of Education

FERDC: Federal Educational Research Development Council

MDG: Millennium Development Goals

YBMOE Yobe State Ministry of Education

WAEC West African Examination Council

NECO National Examination Council

SSCE Senior Secondary Certificate Examination

NTA Nigerian Television Authority

ABSTRACT

The purpose of this study was to compare the Effects of Discussion and Lecture Methods on the Achievement and Anxiety among Secondary Biology Students in Gashua, Yobe State, Nigeria. The study used a population of 532 students (363 boys and 169 girls) and a sample of 71 students (49 boys and 22 girls). A pretest posttest Experimental and Control group design was used. Simple random sampling was used to select the two (2) schools out of the four (4) co-educational secondary schools in Gashua educational Zone of Yobe State. The selected schools were randomly assigned to experimental and control groups. The experimental group was taught for six (6) weeks using discussion method and control group was taught using lecture method for the same period. The instruments used for data collection were Biology Achievement Test (BAT) and Biology Students Anxiety Test (BSAT) with reliability coefficient of 0.80 and 0.70 respectively. Four (4) Null hypotheses were tested at P=0.05 level of significance using t-test statistic. The major findings in the study indicated that; there was significant difference between the mean academic achievement scores of the experimental and control groups in favour of experimental group. There was no significant difference between the academic achievement scores of boys and girls of the experimental group. There was no significant difference between the anxiety levels of boys and girls of the experimental group. There was significant difference between the anxiety levels of boys and girls of the control group in favour of boys. Based on the findings of the research, a number of recommendations were made, among which were: (i) teachers should adopt discussion method which is learner-centred in their day-to-day classroom instruction and encourage students to actively participate, as this enhances the understanding of instructional content, improves academic achievement and reduces anxiety. (ii) Biology teachers should be trained through workshops and seminars on how to effectively use discussion teaching method to teach in secondary schools.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Science and Technology Education is the bedrock of scientific and technological development of any nation. Science and technology have predominantly shaped the world; it also constitutes the major determinant of both national and international development as well as economic and human empowerment (Uyoata, 2006).

Science has been defined by various authors. Shaibu (2008) refers to science as a complex human activity that culminates in the production of a body of universal statements which serve to explain the physical behaviour of the universe and parts of it which in themselves have predictive characteristics. Geddes and Grosset (2007) view science as a knowledge gained by systematic experimentation and analysis, and the formulation of general principles. Abdullahi (1982) defines science as the activities culminating into a testable, falsifiable and verifiable body of knowledge. Lasisi and Daniel (2009) view science as a systematic study of the nature and behaviour of the material and physical universe through observation, experimentation, measurement and recording. Eyetsemitan (2002) defines science as rationally structured knowledge about nature, which embraces systematic methods of positive attitudes for its acquisition, teaching, learning and application. Despite the importance to development, some educational administrators believed that science has not been properly taught in many nations' primary and secondary schools, including Nigeria (Heather, Vogel & Collins, 2010; Weekend File; NTA Network Programme 10:30 p.m 06/08/2011).

Over the last century, the importance of science, mathematics and technology education has become much more noticeable. Aliyu(2008) observed that the need for education in these areas (science, mathematics and technology) will become even more

important to individual learner(s) and the society in general in the 21st century. This calls for the need to investigate the factors that may affect students' achievement in science, mathematics and technology education. The high rate of failure among secondary school students in science subjects including biology is attributed to the fact that to date a large proportion of science teachers still resort to the use of the ineffective 'talk-chalk' or the traditional method rather than the student-centred strategies advocated for (FME, 1995; 1998; 2004; Bonet, 2007 & Miller, 2009).

Biology as a science subject requires all students wishing to study the course to develop some basic scientific skills such as the ability to observe and investigate (finding out) which involves systematic collection, analysis, organization and interpreting data. The students' active participation in these processes and their interaction with instructional materials would serve as effective means of reducing test-anxiety among biology students (Hollandsworth, 1999).

It is the concern of teachers to monitor the academic progress of their students. This is with the view to identifying their areas of problems, the causes of the problems and find ways to solve them. In this study, the aim is to investigate the effects of Discussion and Lecture Methods on Academic Achievement and Anxiety among Secondary School Biology Students in Gashua Educational Zone, Yobe State.

The major problems affecting teaching in general and biology teaching in particular could be attributed to the inappropriate usage of some instructional techniques by teachers(NTA Network News, 9:00p.m; 14/10/2011). The use of lecture method alone by teachers create a lot of tension among students because often little or no room is given to students to express their areas of difficulties either by way of asking questions or contributing to the progress of the lesson. This situation leads to

restlessness, frustration and anxiety which impair students learning (Hollandsworth, 1999; Geddes & Grossel, 2007).

O'Hair and McIntyre (1996) observed that many students especially at secondary school level develop some form of fear, apprehension and nervousness whenever they are faced with test or examination situation. This situation is referred to as anxiety, and this invariably lead to students' low academic achievement. (Menucha,2006; Wikipedia, 2010). The anxiety in schools has a negative effect on students' achievement in the classroom especially in test or examination situation or both. Anxiety has an influence on the degree of achievement (Frandsen, 1961; 1981). Odebunmi (1988) and Menucha (2006) also asserted that; many reasons have been attributed to the possible causes of students' poor achievement in science subjects such as biology; one of which is anxiety. This disturbing situation needs to be investigated so as to come up with possible solution(s).

The type of teaching methods used which are teacher-centred (example lecture method) as observed by Bonet (2007) are capable of causing high anxiety in students because the students are given little or no opportunity to contribute or ask questions. Similarly, despite several reform attempts to make a shift from the teacher-centred methods to student-centred methods, the teaching and learning of science is still characterized by the ineffective chalk and talk method (Bakinde, 2000). In this study, discussion and lecture methods were used to determine their effects on biology students' achievement in secondary schools.

Science teaching in Nigeria has undergone several transformations and syntheses to get to its present state of basic science (in primary school level), basic science and technology (in junior secondary school level), single science (in senior secondary level) and applied science (in tertiary institutions), all in an attempt to

improve the teaching and learning of science. With all these efforts, results still show lower achievement by students in Senior Secondary Certificate Examination (SSCE) (Aliyu, 1982; NTA Network News, 9:00p.m; 14/10/2011). For instance, the West African Examination Council (WAEC) Chief Examiners' Reports revealed with empathy that students performed poorly in some science subjects, biology inclusive (WAEC, 2003; 2005; 2006; 2013; 2014). Recent media report revealed that National Examination Council (NECO) recorded mass failure in its May/June, 2011 results, in which Science subjects such as Mathematics, Chemistry, Physics and Biology recorded less than 30% pass, respectively. Commenting over this, NECO registrar emphasized that; better results would largely depend on good teaching and learning in secondary schools (Weekend File; NTA Network Programme 10:30 p.m 06/08/2011). Similarly, the Nigeria's Minister of Education in a public address on secondary education, decries mass failure in public examinations such as WAEC and NECO and promised to double effort to arrest the situation (NTA Network News 9 p.m 14/09/2011) The researcher also observed poor achievements by students in biology in two secondary schools (for three (3) consecutive years) in the study area (WAEC, 2007; 2008; 2009). This is shown in Tables 1.1 and 1.2 respectively.

Table 1.1: Government Science and Technical College Gashua, Biology Result Statistics (WAEC) 2007 – 2009.

Year	Number registered	Number passed (A-E)	Number Failed	Percentage Passed (A-E)	Percentage Failed
2007	215	09	206	4.2	95.8
2008	380	05	375	1.3	98.7
2009	240	02	238	0.8	99.2
Total	835	16	819	1.92	98.08

Source: Yobe State Ministry of Education (2010)

Table 1.2: Government Day Secondary School Gashua, Biology Result Statistics (WAEC) 2007 – 2009.

Year	Number registered	Number passed (A-E)	Number Failed	Percentage Passed (A-E)	Percentage Failed
2007	460	72	388	15.7	84.3
2008	500	150	350	30	70
2009	500	300	200	60	40
Total	1460	520	940	35.62	64.38

Source: Yobe State Ministry of Education (2010)

In many studies such as that of Heather, Vogel and Collins (2010) showed that some factors such as poor methods of teaching are some of the reasons why the academic achievement of some children and youths fall below what might ordinarily be expected of individuals of similar intellectual capability and may lead to fear or anxiety.

Geddes and Grosset (2007) defined anxiety as a condition of being worried, uneasy, and eagerly wishing or distressed towards anticipated task(s). Gender discrimination in Nigeria is a common phenomenon that cuts across various human endeavours. The belief that males are superior to female has affected women/girls in quite a number of ways in both socio-cultural and educational aspects (Nuru, 2009). He further observed that the achievement of women right from past decades have always been hindered as a result of many cultural beliefs that women are the weaker sex and incapable of doing many things often regarded as rigorous and may be seen as men's vocation. For instance, one of the primary concerns of science educators is to train qualified and competent science teachers (in both appropriate science teaching technique and learning) so that the problem of gender will not arise (Aliyu, 2008). It is against this background that the researcher investigated whether anxiety affects the academic achievement of boys and girls at Senior Secondary Biology Level, and also compared whether Discussion and Lecture methods have the same effect on the academic achievement and anxiety of such boys and girls or not

1.1.1 Theoretical Framework

This study was based on the constructivists' theory, which is one of the theories of learning science. This theory emphasizes active participation of learner(s) in the process of finding out information through organizing and reconstructing knowledge (Piaget, 1947; Ausubel, 1978; Oyedokun, 1998; Azdina, Azura, Razali & Hassan, 2003; Bichi, 2006). Learning according to constructivism, places more emphasis on the student (learner) rather than the teacher. Teachers are seen as facilitators or coaches who assist students to construct their conceptualizations and find solutions to problems. The learner interacts with objects and events, and thereby gains an understanding of the feature held by such objects or events (Ausubel, Novak, & Haneisian, 1978; Hund &

Teagust, 1989; Bichi, 2006). Learning in science is an active, interactive process of interaction between the learner's mental schemes, his learning environment and the teacher (Driver, 1986). Learning is primarily entails an active involvement of the learner in the process of learning (Driver & Bell, 1986). Learning should focus on the experience and active involvement of learners in a dialogical process (Vygoski, 1979;1998). Bruner(1966;1996) believes that teaching should address the learners'involvement towards learning in a way that instruction can be readily grasped by the learner. Driver(1978) believes that learning is an active, constructive process in which the learner is an active constructor of information.

Discussion also portrays the principle of learner-centred form of learning where the learner is actively involved in the process of learning in which the teacher serves as a guide or moderator (Bonet, 2007; Atadoga & Onaolapo, 2008). This research was therefore based on the framework of constructivism.

1.2 Statement of the Problem

Several reports and studies showed that there is persistent failure in the Senior Secondary School Students' academic achievement in biology which may be as a result of poor teaching methods such as lecture (teacher-centred) which is concerned with giving factual information (WAEC Chief Examiner's Reports, 2003; 2005; 2006; WAEC(YBMOE),2007; 2008; 2009). The findings of Hassan and Okatahi (1990), Syncamore, (1999) and Okatahi (2006) showed that teaching methods which are teacher-centred leads to anxiety while learner-centred methods have been found to reduce test-anxiety.

Research studies have also shown that several factors such as anxiety, poor methods of teaching, family background, school/classroom environment, peer group among others were found to be some of the reasons why the academic achievement of

Senior Secondary School students (including biology students) falls below what might ordinarily be expected of individuals of similar intellectual capacities (Vogel & Collins, 2010; Zieder, 1998; Borg & Gall, 1999; Hassan & Okatahi, 2006). The type of teaching method used which is teacher-centred example lecture method, as observed by FME, 1985; Usman (2000); Bonet (2007); Atadoga & Onaolapo (2008) is one of the many factors responsible for poor academic achievement among science students, including biology students. Sarason (1980) and Okatahi (2006) noted that achievement oriented instructions (teacher-centred methods) lead to high test-anxiety. Discussion method give students the opportunity to interact among themselves and with the teacher, thus making learning more effective (Hoxby, 2000; Ngada, 2008; Atadoga & Onaolapo, 2008).

This study therefore compared the effects of discussion and lecture methods on SS II biology students' academic achievement. Also, the study investigated the effects of discussion and lecture methods on students' anxiety level and gender.

1.3 Objectives of the Study

The objectives of the study are to:

- compare the effects of discussion and lecture methods on academic achievement of students on the concept of pollution.
- compare the anxiety of students exposed to discussion method, and those exposed to lecture method.
- compare the effect of discussion and lecture methods on academic achievement in relation to gender among Senior Secondary School Biology Students.

1.4 Research Questions

The study seeks to answer the following questions:

- What is the difference between the academic achievements of students exposed to Discussion method and those exposed to lecture method on pollution concept?
- Is there any difference between the academic achievement of boys and girls exposed to discussion method?
- What is the effect of Discussion method on the anxiety exhibited by boys and girls of Senior Secondary Biology level exposed the method?
- Does lecture method have the same effect on the anxiety exhibited by boys and girls exposed to the method?

1.5 Null Hypotheses

Based on the research questions stated, the following null hypotheses were formulated and tested at $P \leq 0.05$:

Ho_1: There is no significant difference between the mean academic scores of subjects exposed to discussion method and those taught using lecture method

Ho_2: There is no significant difference between the academic achievement of boys and girls taught using discussion method.

Ho_3: There is no significant difference between the anxiety level of boys and girls exposed to discussion method.

Ho_4: There is no significant difference between the anxiety level of boys and girls exposed to lecture method.

1.6 Significance of the Study:

This research study aims at comparing the effects of discussion and lecture methods on anxiety and academic achievement of Senior Secondary School biology students. It is hoped that the findings would be:

- useful to biology teachers to adopt for the teaching and learning of biology.

- able to enhance students' academic achievement, improve their learning abilities and interest of finding out facts for themselves, and also reduce their anxiety level to test and examination situations.
- of great benefit to both education planners and planners of science curriculum such as Federal Ministry of Education (FME) and Federal Educational Research and Development Council (FERDC) to emphasize the importance of Discussion method in the teaching and learning of science due to its interactive nature. It would also assist curriculum planners to adjust the curriculum to incorporate Discussion strategy where appropriate.
- of benefit to fellow researchers because it would form a foundation for further studies in the use of Discussion as it affects academic achievement and anxiety and also add to recent literature.
- useful to text books publishers to emphasize Discussion as another method of teaching science in their publications (Texts).

1.7 Scope of the Study

The study compared the Effects of Discussion and Lecture Methods on the achievement and anxiety among Secondary Biology Students in Gashua, Yobe State, Nigeria. The study is delimitated to two (2) secondary schools out of the four (4) public co-educational schools in the educational zone. The researcher taught the concept of pollution in biology. This is because the topic is in the SS II syllabus.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Introduction

This study aims at comparing the effects of Discussion and Lecture Methods on the Achievement and Anxiety among Secondary School Biology Students. In this chapter, the review of related literature is presented in the following sub- headings:

2.2 Teaching Biology at Secondary School Level

2.3 Science Teaching Methods

2.4 Lecture Method in Science

2.5 Discussion Method in Science

2.5.1 Models for Discussion Method

2.5.2 Discussion Method and Academic Achievement in Science

2.5.3 Gender and Academic Achievement in Science

2.5.4 Factors Affecting Academic Achievement

2.6 Concepts and Theories of Anxiety in Science Teaching

2.6.1 Anxiety and Academic Achievement in Science

2.6.2 Gender and Anxiety in Science Teaching

2.6.3 Causes of Anxiety

2.6.4 Strategies to Overcome Anxiety

2.7 Overview of Related Studies

2.8 Implication of Literature Reviewed on the Present Study

2.2 Teaching Biology at Secondary School Level

Biology is a general subject which is offered by all secondary school students. It is a science subject that is supposed to develop the scientific literacy of students, so as to be able to cope with the latest scientific and technological advancement. The teaching

of biology therefore, should be such that will assist the students to develop scientific attitude like ability to observe, measure, collect data, organize and interpret the data, carry out experiment, to mention a few.

An important component to effective learning of science especially biology is the quality of teachers, which also depend on the appropriate methodology adopted by the teacher(s). Miller (2009) asserts that any teaching method that will help students to develop scientific skills will also help the students to achieve high in science. This is the reason why the researcher used Discussion and Lecture Methods among SS II Biology Students in the study area, in order to compare the effects of these methods on their anxiety levels, academic achievement and gender.

2.3 Science Teaching Methods

Science according to Lasisi and Daniel (2009) is a systematic study of the nature and behaviour of the material and physical universe through observation, experimentation, measurement and recording. Geddes and Grosset (2007) view science as a knowledge gained by systematic experimentation and analysis, and the formulation of general principles. Teaching on the other hand can be referred to as a process of facilitating learning for the learners or to show learners how to do (Bonet, 2007).

Methodology in terms of teaching refers to study of the various methods of teaching (Bonet, 2007; Getso,2008). It is also a process of dissemination, transmission and imparting of ideas, facts, information, culture social ethos and ethics through a designed process of communication. It is also a process of giving, exchanging or sharing of facts, information, ideas, skills, behaviour and attitudes that ultimately lead to noticeable and desirable behavioural changes in the individual (Shaibu, 2008).

There are several methods of teaching as there are teachers, and one of the important qualities that make a good teacher is his possession and application of appropriate teaching method(s) used to deliver the curriculum effectively (Bonet, 2007; Jack, 2012). Some of the many teaching methods include; Lecture, Discussion, Demonstration, Storey-telling, Play-way, Project, Assignment, etc. Of all these methods, many teachers especially science teachers often utilize the lecture method, despite its limitation by emphasizing learning by hearing through a one-way traffic of information (Bonet, 2007). Lecture method still appears indispensable under some specific situations, especially in the teaching of science subjects, where the teacher has to present many abstract concepts (Brown, Oke & Brown, 1982; Ortese, 2004; Okoye & Ovri, 2008).

2.4 Lecture Method in Science:

Lecture method is a one-way traffic of information from the teacher to the learner. The method is based on the premise that the learner knows little or nothing and so needs to be told (Ngada, 2008). This method therefore, is not popular when it comes to teaching to ensure meaningful learning. This accounts for some of the reasons for students' poor academic achievement. Supporting this assertion, Usman (2000) observed that the total reliance on lecture method for teaching science in secondary schools is considered to account for one of the many factors responsible for poor academic achievement among students. Atadoga and Onaolapo (2008) observed that students under lecture method have limited opportunities to explain their problems, conflicts and needs. It is also difficult to know if students understand the teacher's presentation. Okoye and Ovri (2008) define lecture method as talk and chalk and teacher-centred, where lesson is delivered to the learners without the use of instructional materials. Lecture method according to Wikipedia (2009) is a one way transaction in

which the teacher delivers the instructional contents by way of talking throughout, giving little or no room to students to participate by way of asking questions or contribution.

Students under lecture method become alienated, since there is little chance of addressing their misgivings and less opportunity to voice out their areas of problems during the lesson, as such the students are likely to develop anxiety. Bonet (2007) observed that; because it is a one-way flow of information and appeals to sense of hearing only, lecture method does not ensure meaningful learning. Udo (2006) believes that science teaching methods should be that de-emphasis the memorization and regurgitation of facts as emphasised by lecture method (FME, 2004; NCCE, 2008). Ortese (2004) pointed out that the lecture method is one of the methods mostly practiced in science teaching. He however suggested that the teaching of science should be child-centred and participatory approaches. It is against this background that the researcher utilized discussion and lecture methods to compare their effects on the academic achievement and anxiety among senior secondary school biology students.

Advantages

- It enables the teacher to handle a very large class.
- It enables the teacher to cover a large portion of the instructional content within a short time.
- It helps the teacher to develop his communication skills.
- It helps the teacher to develop and improve their listening skills.
- It helps the learners to develop the skill of taking note.
- It motivates students to read widely since not all what the teacher says that could be captured by the students.
- It is a suitable method for motivation and appreciation talk.

Disadvantages

- It render the learners passive
- There is little or no room for pupil-pupil and pupil-material interaction.
- Learners are not provided with enough room to develop their communication skills.
- It is very difficult to monitor the understanding of the whole class.
- Except with good speakers, the attention span of the learners is shortened.
- Regurgitation of facts may be mistaken for meaningful learning on the part of the learners.
- Learning is basically informative.
- It does not cater for individual differences of the students

2.5 Discussion Method in Science:

Discussion method facilitates students' scientific attitude in approaching the discussion topic by sharing ideas with one another, arguing over points, suggesting solutions and alternative opinions, drawing conclusions or making generalizations (Gersten, 2002). Discussion method is therefore good in the teaching and learning of science and many other subjects (Ngada, 2008). Discussion method is a student-centred method of teaching in which students participate actively in the discussion process over a subject matter or topic from various points of views, while the teacher acts as a moderator or guide. This method facilitates effective flow of information from the teacher to the students, from students back to the teacher and from one student to another (Haas, 2002).

The teacher is to ensure that the topic of discussion should be the type that is familiar to the students or that the students should have pre-knowledge of the topic

before the time of discussion. This will enable them to prepare well on the topic, collect relevant points and make up their minds about what to present during the discussion (Ngada, 2008). Discussion method can be carried out involving the whole class or small group of students. In order for discussion method to be effective, the teacher should direct and guide the discussion so that both brilliant and weak students, vocal and quiet ones should have equal opportunities to explain their viewpoints, ask questions and also answer questions. The teacher should be the one to initiate the interaction and allow the students to pursue the discussion towards the realisation of the set objectives, making sure that no person monopolizes the discussion. Each student should be encouraged to develop his own pattern of presentation (Gersten, 2002).

2.5.1 Models for Discussion Method:

Many researchers such as Haas (2002); Brown (2005); Carpenter (2006) have proven that discussion teaching strategy leads to favourable students' achievement outcomes on the principles of language learning and teaching. The works of Gersten (2002); Hunt, Haidet, Corverdale and Richards (2003); Yoder and Hochevar (2005) found that students' achievement when taught using discussion method yielded positive learning outcomes when compared to traditional lecture-based methods in reading comprehension. Also, the findings of the study by Carprariis, Barman and Magee (2001) and Sanabria (2005) showed that discussion method produces higher level comprehension among students in computer simulations. Three (3) models for discussion method were examined in this study, they are:

1. The Socratic Model for discussion method is also known as 'Method of elenchus, elenctic method' or 'Socratic debate', named after the classical Greek Philosopher Socrates. It is a form of discussion based on asking and answering questions between individuals to stimulate critical thinking and to illuminate ideas. It is

a dialectical method, often involving a discussion in which the defence of one point of view is questioned, thus strengthening the inquirer's point(s). The basis is a series of questions formulated as test of logic and fact intended to a person or group to discover their beliefs about some topics or help them to further their understanding of a concept (Gregory, 1983; Benson, 2000; 2011).

2. The Kelly Mellisa Model is a whole group discussion in which the focus is shared between the teacher and the students for information transfer. The teacher will stand before a class present instruction to the students and the students will also participate by asking and answering questions and providing examples. The major role of the teacher is to set up and enforce ground rules for students at the onset of the discussion. If these rules are not enforced, then there is a possibility that the discussion could quickly go off-topic. This model has the following benefits:

- Whole group discussion encourages greater interaction between the teacher and students.
- Teachers maintain a greater control over what is being taught because they are able to steer the discussion.
- Teachers can check what the students are retaining through questions asked during the course of the discussion.
- Students have the tendency to stay focused on the lessons because they might be called on to answer questions.
- Students may feel more comfortable by asking and answering questions during whole class discussion (Kelly, 2014).

3. Brookfield Et'al's Model. Students under this process feel that discussion invites them to develop and express their ideas in an unpressured way, then the discussion leader (teacher) must find a way to teach that is neither too dominant nor too reserved. It

is also the responsibility of the teacher to provide a checklist of questions to maintain the balance between saying too much and saying too little (Brookfield, Stephen & Stephen, 1999).

The researcher adopted the Socratic discussion model to find out its effects on academic achievement, anxiety and gender among SS II biology students.

2.5.2 Discussion Method and Academic Achievement in Science:

Discussion teaching method is a two way interaction between the teacher and students in which the instructional content is discussed in the classroom (Callahan & Clark, 1979; Ngada, 2007). Discussion according to Aliyu (1982) and Brown (2005) means talking over subjects from various points of view with the teacher acting as the moderator. Atadoga and Onaolopo (2008) viewed discussion method as student - centered focusing on the fact that knowledge arises from within the person and not from external source (Wikianswer, 2011; Olajide, 2002). The authors further elaborated that "when discussion method is employed, it is mandatory that students have been adequately prepared because it will be ridiculous for a teacher to ask students to discuss a subject or topic or concept about which they know nothing". Discussion method has imparted positively on the academic achievement of students in sciences due to the following advantages:

- Motivation of students' interest at the beginning of the lesson.
- Develop self confidence through frequent exchange of ideas between the students and the teacher, thereby improving academic achievement.
- Help students to prepare vigorously before partaking in the discussion process, thus broadening their knowledge and understanding of the instructional content.

- It fosters the development of interpersonal relationship in the class, because the students interact with the teacher and with one another..
- It creates a forum to solve some difficult problems or questions which require a variety of ideas and ways to resolve them among the students.
- It contributes to character development and training for the posts of leadership and responsibility in dealing with people as it encourages the students to accept and tolerate other students' ideas and views.
- It provides opportunities for students to practice and develop oral communication skills.
- It gives students training in searching for facts on their own.
- It encourages students to cultivate scientific attitudes and skills, ie listening skills, thinking, analysing and evaluating points made during discussions.

The overall benefit of this method is that it leads students to achieve high academically, because the teacher helps in encouraging other students who would normally not contribute by taking part in the discussion process (Callahan and Clark (1974; 1979); Aliyu (1982); Atadoga & Onaulapo (2008)). Kochchar (2012) posits that the learner become skilled only when he begins to participate actively in the learning process. For instance, the nature of discussion method is such that it gives the students opportunity to interact among themselves and with the teacher, thus making learning more effective (Hoxby, 2000; Atadoga & Onaolapo, 2008). Despite the huge advantages of this method as revealed by many researchers, the classroom practice is often not put in place by many teachers. This could be one of the factors for the poor achievement in science. It is against this background that the researcher utilized Discussion and Lecture methods to compare their effects on the academic achievement, anxiety and gender among SS II biology students.

2.5.3 Gender and Academic Achievement in Science:

The academic achievements of boys and girls in science, technology and mathematics have been perceived differently, where boys are rated higher than girls. Some researchers in science education such as Bichi (2002), Bello (2002), Linver, Davis-Kean, and Eccles (2002), etc have expressed concern on gender related issues with the view to improving science teaching and learning. Jimoh (2001) observed that the position of females in science, mathematics and vocational education is below average when compared to males. Fansto – Sterling (1992) opined that the difference is in socialization and not biological. Aliyu (2000) and Ibe (2006) believe that gender discrimination in science in Nigeria is the practice of the day, because people always think that science is only for males while languages are for females. Fannema (1979) believes that from the age of 17 years, the average achievement of boys exceed that of girls in the field of science (especially mathematics). The researcher attributed this to the attitudinal, psychological and social factors of the females. Habeeb (2001) also believes that quite a number of factors are responsible for the low achievement of females in sciences. Oluwatoyin (2007) observed that women perform better when they are exposed to science. The result of some studies also showed no significant difference between the achievement of boys and girls in science before they enter primary or Secondary school (Lassa, 1984). The findings of Bichi (2002) and Aweriale (2006) showed no significant difference between male and female achievement in science. The findings of Aigbomian (1994) and Aguokagbu (1997) showed that boys perform better than girls academically. In this research study therefore, discussion and lecture methods are used to compare their effects on the academic achievement and anxiety levels of boys and girls.

2.6 Concepts and Theories of Anxiety in Science Teaching:

Anxiety refers to a feeling of worry, nervousness or agitation often about something that is going to happen, a condition marked by intense apprehension of fear of seen or imagined danger. It is a painful uneasiness of the mind concerning an anticipated task (Kundu and Tutoo, 1988; Scort, 2008). Anxiety is one of the commonest neurotic symptoms and is a state of continuous fear which is a response to anticipated future troubles. This differs from normal fear which is a response to threatening stimuli which is the immediate present (Sperling, 1982; Berger, 1978; Menucha, 2006).

Anxiety is a condition of being worried, uneasy, eagerly wishing or distressed towards an anticipated task(s) (Geddes and Grosset, 2007). The nature and extent to which anxiety influences achievement differs from one individual to another, and depends to a large degree on the individual's level of preparedness to undertake the task. For example, students in schools find it difficult to cope with the different stressful conditions in which they find themselves, especially during test and examination conditions or both (Nwosu and Philomena, 2008; O'Hair and McIntyre, 1996). Recalling their experiences in the course of learning over the years, some secondary school students in the study area revealed having found certain learning situations very tasking to cope with. For instance, some SS II and SS III students interviewed revealed having experienced some difficulties to ask or answer questions during a lesson. For others, no matter the level of preparation towards test or examination, they still experience nervousness or anxiety when writing the test or examination. (Personal interview with some students, 2010). It is against this background that the researcher investigated into the problem of anxiety and academic achievement of Senior Secondary School Students.

Fear on one hand is usually viewed as a reasonably rational response to a substantial threat or impending danger which is likely to disappear when the individual learns to overcome the threatening situation. Anxiety on the other hand comprises internal conflicts that may be viewed as irrational to others. These feelings may persist even long after children have gained knowledge and experience. They also observed that both fear and anxiety affect the child's ways of approaching and dealing with his/her task of learning and general productivity. This is because anxiety seems to appear in almost every aspect of human endeavour (Scott, 2008; Site, 2011). Anxiety is sometimes considered situational when the anticipated danger or hazard is imminent and probable, and in which case, the anxiety is relieved when the situation that led to it is overcomed. This is called "normal anxiety" (Kundu and Tutoo, 1988). Anxiety is viewed as a reaction to emotional discomfort and is normal if it is not serious, exaggerated and prolonged, so as to interface with the individual's capacity to function adequately (David, and Stanley, 1986). Anxiety is a response to stress which could lead to both physiological and behavioural changes which connects to anticipated negative stimuli. It is therefore important to note that every individual experiences anxiety at certain level(s) which may either be detrimental (neurotic anxiety) or normal (normal anxiety). For instance, it is normal for students to experience certain degree of anxiety before exams while those who become too anxious to the extent of anticipating danger (failure) when approaching exams hall exhibit some form of anxiety (Kundu & Tutoo, 1988). It is therefore the reason why the researcher investigated whether Secondary school Students experience anxiety due to the factors enumerated by these authors, or due to other factors yet to be discovered.

There are several theories about how this anxiety situation develops. Some theorists view anxiety as a response to threatening situations, while others see it as a

drive that leads to coping responses (Leonard, 1973; David, Derald & Stanley 1986). Anxiety itself is a powerful physical experience that may involve rapid or pounding heartbeats, difficult breathing, sweating, dry mouth, tightness in the chest sweating palms, dizziness, weakness, nausea, diarrhoea, cramps, insomnia, fatigue, headache, loss of appetite and sexual disturbances. These symptoms may easily be mistaken for physical illness. In addition, anxiety results in a narrowing of one's time perspective so that only the present matters. It also results in an inability to attend to more than one task at a time or to organize thoughts and plans effectively. Low levels of anxiety may temporarily increase an individual ability to do a simple task, due to the greater vigilance and narrowing of attention associated with anxiety, but as anxiety increase, behaviour becomes more disorganized and ineffective (Fischer, 1970; Sajeev, 2006), Students examined under these circumstances are likely to perform poorly academically.

The multidimensional theory of anxiety is based on the assumption that competitive anxiety is comprised of two (2) distinct parts: a cognitive component and a somatic component both having dissimilar effects on achievement. Theoretically the cognitive component has been defined as the negative expectations and concerns about one's ability to perform and the possible consequences of failure. Whereby the somatic component is the physiological effects, like palpitations, tense muscles, shortness of breath, clammy hands and in some cases even nausea are being experienced. These are some of the physiological characteristics experienced by many students during test or examination situations (Lovell, 1973; 1990). Anxiety affects physiological factors, such as heart beat rate and cognitive processes such as heart beat rate and cognitive processes such as mental reasoning. This also affects an individual's achievement whenever such is faced with a challenging or competitive situation such as sports. This is similar to the

feeling of nervousness experienced by students when faced with test or examination situation. This gives the researcher the basis to investigate whether or not these factors would have any effect(s) on the anxiety level and academic achievement level of SS II students, since both physiological and cognitive processes are components of learning.

In learning theory, anxiety is seen as both response to learned signals (Geddes and Grosset, 2007) and as a drive or motivator of behaviour. Most learning theories maintained that anxiety is derived from reaction to pain. Anxiety can thus be reduced by removing or avoiding the source(s) from where the pain comes. Avoidance may become firmly established and lead to constricted or unusual behaviour. A better way to reduce anxiety is to pair a strong positive re-enforcer such as food with the frightening situation so that the stimulus that formally elicited anxious responses becomes associated with positive feelings (Winston, 2002). The learning theory gives the researcher the basis to use Discussion method to serve as positive re-enforcer in finding out its effect on the academic achievement and anxiety levels of Senior Secondary School students. The researcher also investigated whether low academic achievement is associated with anxiety or some other emotions. For instance, some psychologists such as Fischer (1970) showed that, the interpretation of a situation determines whether a person experiences anxiety or some other emotions. Winston (2002) also believed that measuring students' academic achievement is challenging, this is because students' achievement is a product of socio-economic factors some of which include; parents' level of income, mother's age, mother's level of education, classroom setting and harsh behaviour of the instructor during test period also contributes to the arousal of emotions, thus affecting their achievement.

2.6.1 Anxiety and Academic Achievement in Science:

Anxiety is a situation-specific trait that refers to the anxiety states and worry conditions that are experienced during examination situations, leading to poor academic achievement. The level of anxiety can fluctuate over a time in response to both internal and external stimulation. Observable behaviour of anxiety can be noticed during the completion process of a quiz (Spielberger & Sarason, 1989; Olamie, 2011).

Sometimes certain behaviours are compatible with classification of high and low test anxiety groups and that there are also individual differences in the degree to which anxiety is manifested in any given situation. It was observed that a disruption or disorganization of effective problem-Solving and cognitive control including difficulty in thinking clearly can also be used to test anxiety. Another is self-awareness that is the feeling of being observed or evaluated by others. Also, other people perception of the individual may have an impact on academic achievement (Freud, 1936; Smith, 1964; Levitt, 1980; Friedman & Bendas-Jacob, 1997).

A more common factor of test anxiety recognized is the classroom factor: Majority of people have the general desire to manipulate and control their surroundings in order to produce a comfortable environment. In classroom setting, however, there may not be the opportunity to control the surroundings. This opens the door to the possibility of different levels of arousal. The extent of arousal in relation to an individual's level of adoption will determine to a large extent whether a positive or negative experience will result (Spielberger & Sarason, 1989; Kirkland, 1996).

In order to determine the effect of anxiety on academic achievement, it is important to put into account the level of anxiety, type of task and difficulty of the task. For instance, if anxiety is moderate, it will have positive effect by enhancing achievement. In the same manner, high anxiety will lead to negative or lowering of

achievement. Evidence to this assertion is the work of Hollandsworth (1999) in which they tested high-anxious and low-anxious children for achievement in reading and arithmetic. The low anxious group was found to be superior in arithmetic. For reading, there was a slight though insignificant difference in favour of the high-anxious group.

Similarly, it is important to consider motives, aptitudes, cognitive assessments of task, and past experience when analyzing test anxiety and how it relates to achievement. He further stressed that if an individual's learning experience is positive then the test anxiety level will be lower thus leading to higher achievement. This is also part of the reason(s) why the researcher intends to utilize teaching strategies which are learner-centred and likely to create positive learning experience, lower students' anxiety and enhance higher academic achievement (Smith, 1964; Spielsberger & Sarason, 1989; Menucha, 2006)

Test-anxious students usually develop feeling of inadequacy, loss of status and esteem, helplessness and implicit attempts at leaving the test situation. This affects their academic achievement. Apparently, the level of achievement of the test-anxious students does not reflect their true intellectual abilities because test anxiety has adversely affected their academic achievement (Sarason, 1972; spielberger, 1978; Ajagun, 2001). Discussion also develops cognitive abilities such as reasoning, creativity, memory, language construction, encourage language speaking, composure, self- confidence, etc (Mobile Site, 2011). This informs the basis for the present study.

2.6.2 Gender and Anxiety in Science Teaching

The gender difference has been found to play a significant influence in individual's level of anxiety in the various facets of life. In an independent study on fear generally among boys and girls, it was found that girls have both total scores and number of fears that are significantly higher than boys (Engel, 1972; Jimoh, 2011). It

was also found that fear seem to increase in both sexes during late adolescent. This shows that girls are more prone or exposed to various anxieties than boys because girls are considerably more restricted than boys in career option, the girls appear more likely to experience anxiety in pursuance of that career (Aguokagbu, 1997).

Sajeev (2006) further revealed that although women tend to report higher levels of death-related anxiety, it is also women who provide most of the professional and volunteer services to terminally old people and their families. It is still the girls who mostly involve in death related though and feeling and men are somewhat more concerned about keeping these thoughts and feelings in check. The relatively higher level of reported death anxiety among women perhaps contributes to empathy with dying and grieving people and the desire to help them cope with their ordeals.

In another finding, white girls are found to be higher than white boys in both general and test anxiety. This finding coincides with the cultural expectations of boys and girls trying to live up to their ideal sex roles. The difference in anxiety levels may be due to the girls' tendency to care a great deal about approval and affection and to try to win these prizes through their achievement efforts. Smart and Smart (1973) and Aguokagu (1997) both believed that boys with their more internalized standards of excellence would understandably worry less about what people thought of them. On the other hand, black boys were no less anxious than black girls, meaning that their anxiety level was strongly connected to their mothers' educational level. This implied that the poor, lower class parents give few rewards and little encouragement for desirable behaviour, especially verbal efforts that require obedience and discourage exploration, curiosity and independent thinking, level of intelligence, motivation and state of cognitive process, entry behaviour and impact of forgetting. It is against this background that the researcher intends to use Discussion to serve as source of

motivation towards learning, believing that this may reduce their anxiety level and improve academic achievement. In this study therefore, a comparative study was made on the effect of Discussion and Lecture methods on anxiety level, Academic achievement and gender among Senior Secondary School Biology Students.

2.6.3 Causes of Anxiety:

Anxiety is a common mental issue that can come in the form of panic disorder, agoraphobia, social anxiety and even observed compulsive disorder. Many psychologists have been able to identify different causes of anxiety. Sorosky (1977) believes that every individual experiences stress at one point or another but it can affect people differently. Pressures at work, relationship issues or the death of a loved one are a few of the more common reasons for high stress. This built up of worry can take a toll on individual both mentally and physically. Other causes of anxiety may include parental socio-economic status, educational background, and emotional climate in the school and at home, teacher-pupil relationship, heredity and low intelligence (Zieder, 1998; Lilly,2010). All these conditions reduce students' attention towards learning in the classroom and lead to low achievement academically. Students under this stressful conditions coupled with the traditional lecture method used by most secondary school teachers, would leave students to learn very little in the classroom; since the teacher is not involving them in the leaning process.

It is against this background that the researcher believes that the use of teaching method which is participatory (e.g. discussion) may reduce anxiety among students, increase concentration towards learning, thus improves academic achievement. This is because the methods have the potential to reduce anxiety since they facilitate teacher-learner interaction and learner-instructional materials interaction and enhances academic achievement (Callahan & Clark, 1979; Bonet, 2007).

Other emotional disturbances developed from frustration and conflict experienced in school, from unhealthy parent-child relationships or from other unfortunate personal or social experiences, e.g. sibling jealously, parental overprotection, parental rejection, social-class differences, general home insecurity, personal handicaps and other conditions producing feelings of anxiety, aggression, inferiority and guilt have all been associated with learning difficulties, but children differ in their reactions to such frustrations (Frandsen, 1961)

Similarly, psychologists such as Mischel (1971), Ramadan (1986) and Mettler (2010) observed that certain number of adolescents experience psychological conflicts leading to many behavioural problems which may include anxiety. This anxiety is often regarded as developmental disturbances which affect students' learning and achievement in tests or examinations.

Tests or examinations are important measuring instrument for academic achievement. Test and examination results therefore form the basis for many decisions about a school child. It is therefore not surprising when some students become anxious about taking test or examinations even though the specific purposes of tests or examinations and the intended use of the test result may differ from one school to another, it is essential therefore to recognize the value that test/examination result can play in the life of the students, as well as parents, teachers, counsellors and other educators. For instance, teachers can help reduce students' anxiety towards learning by adopting teaching methods that would encourage students' active participation (student-centred); good home climate, etc can also improve academic achievement (Victor, 1971; Sajeev, 2006). This is the more reason why the researcher used discussion and Lecture methods in order to determine their effects on students 'academic achievement and anxiety levels in biology at secondary school level.

2.6.4 Strategies to Overcome Test Anxiety

Experimental psychologists have developed principles derived from researchers which are applied to alleviate problems and enhance development. This process is viewed as a scientific method that seeks to correct or change behaviour on the basis that the observed behaviour is abnormal, non-functional or undesirable (Nwake, 1988; Vogel, 2010). In the psychology of learning which explains human personality by basic learning principles, it means that if abnormal behaviour have been learned, it can be unlearned and that if negative habits and attitudes are learned, responses and best ways to get rid of them is to learn new positive ones (Papalia & Olds, 1988; Elservier, 2002; Uyoata, 2006).

In the reduction of test anxiety, different techniques or treatment methods have been used, such as cognitive reorientation. This is used to reduce tension and anxieties, and improves academic achievement (Hassan and Okatahi (1990); Walters (1998). It is against this background that the researcher utilized the teaching method which is learner-centred (eg discussion) in order to determine its effect on students academic achievement and anxiety levels among secondary school biology students.

2.7 Overview of Similar Studies.

The overview of related empirical studies on the effects of discussion method on academic achievement has been reviewed. The research work of Atadoga and Lakpini (2012) was conducted on the effects of discussion and eclectic instructional methods on academic performance of senior secondary physics students and secondary school effectiveness in Kogi State. The study involved a sample of 250 SS II physics students. The results showed significant difference between the SS II physics students' academic performance exposed to discussion and eclectic methods in favour of eclectic instructional method.

The research work of Hackathorn, Solomon, Blankmeyer Tennial and Garezynsky (2011) was on learning by doing: an empirical study of active teaching techniques. The study examined the effectiveness of four(4) teaching techniques (lecture, demonstration, discussions and instructor and students). The study used a sample of 51 students (18 males and 33 females). The result showed that discussion method recorded the second highest achievement of students while lecture recorded the least achievement of students.

The research work of Ugwuadu and Nzewi (2012) was conducted on the effect of Dialogic, Peer and Guided Discussion on students' achievement in biology and gender. The researchers used a sample of 164 SS II students (94 males and 70 females). The result of the study revealed that the three discourse pattern enhanced students' academic achievement in biology, but there was no significant difference between the mean academic achievement scores of males and females taught using the method. The research work of Suleiman, Hassan and Musa (2012) used discussion method in teaching greenhouse effect to secondary school students and found the method suitable in the enhancement of academic achievement.

The research work of Bichi (2006) was conducted on the effects of constructivism and lecture methods on students' achievement in science. A total sample of 104 SS II biology students were used for the study. The result showed that the experimental group taught using constructivism achieved significantly higher than the control group taught using lecture method.

The research work of Okatahi (2006) was conducted on the reduction of test-anxiety among secondary school students through study skill training. A total sample of 60 students was used for the study. The result showed that there was significant difference in test anxiety levels and academic achievement of experimental and control

groups, while there was no significant difference between the academic achievements of males and females. This indicated that study skill training (student-centred) has helped to reduce the anxiety of students and enhanced their academic achievement.

In an independent study on fear among boys and girls, it was found that girls recorded higher level of fear than boys (Engel, 1972; Jimoh, 2011). It was also found that fear seemed to increase in both sexes during the late adolescent. This shows that girls are more prone to various anxieties than boys (Aguokagbu, 1997). It was also observed that because girls are considered more restricted than boys in carrier option, the girls appear more likely to experience anxiety in pursuance of that career.

2.8 Implication of Literature Reviewed on Present Study

In the light of the literature reviewed, the findings indicated that discussion method have the capability of enhancing the academic achievement of students (Atadoga & Onaolapo, 2008; Udofia, 2009). While some research works revealed that discussion method reduces anxiety, lecture method has been found to lead to anxiety among secondary school students. However, the effects of these methods (discussion and lecture) on the academic achievement and anxiety of boys and girls have not been clear-cut. For instance, the work of Atadoga and Lakpini (2012) on the effects of discussion and eclectic instructional methods on academic performance of secondary school students showed significant difference between academic achievent of student exposed to discussion and eclectic methods in favour of eclectic method. The work of Hackathon, Solomon, Blanckmeyer, Tennial and Garezynsk (2011) examined the effectiveness of four (4) teaching techniques in which the result showed that discussion method recorded second highest achievement, while lecture method recorded the least achievement of student. The work of Ugwuandu and Nzewi(2012) on the effects of Dialogic, Peer and Guided Discussion on students' achievement in biology and gender,

showed improvement in achievement in biology but no significant difference between the achievement of males and females. Suleiman, Hassan and Musa (2012) used discussion method in teaching greenhouse effect to secondary school students and found discussion method suitable in the enhancement of academic achievement.

The work of Bichi (2006) on the effects of constructivism and lecture methods on students' achievement in science showed that experimental group exposed to constructivism achieved significantly higher than control group taught using lecture method. The work of Okatahi (2006) on the reduction of test-anxiety among secondary school students through study skill training showed significant difference in anxiety and academic achievement of experimental and control groups, but no significant difference between the academic achievements of males and females. This indicated that study skill training (student-centred method) helped in reducing anxiety and enhancing academic achievement.

This research work is unique in that no work have been reviewed in which discussion and lecture methods were used on academic achievement and anxiety using pollution concept in biology. Therefore, this study has added to the existing body of knowledge supporting the merits of teacher-centred teaching strategies

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study compared the effects of discussion and lecture methods on the academic achievement and anxiety among secondary school biology students. In this chapter, the methodology was discussed under the following sub-headings:

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Technique

3.5 Instrumentation

3.6 Validity of Research Instrument

3.7 Selection of Biology Topics

3.8 Pilot Test

3.9 Administration of Treatment to Experimental Group

3.10 The Control Group

3.11 Procedure for Data Collection

3.12 Procedure for Data Analysis

3.2 Research Design

A pretest posttest Quasi - experimental - control group design was used in which subjects were randomly assigned into experimental and control groups. This was in order to determine any possible treatment effect. This study comprised of two (2) groups, one experimental (E) and one control (C) groups. Experimental group (E) received treatment involving Discussion method only and Control group (C) were taught using Lecture method only.

The pretest was used to find out the equivalence of the two (2) groups in their anxiety level and academic achievement, while the posttest was used to determine their academic achievement and anxiety after exposure to treatment. The design is illustrated in fig. 3.1.

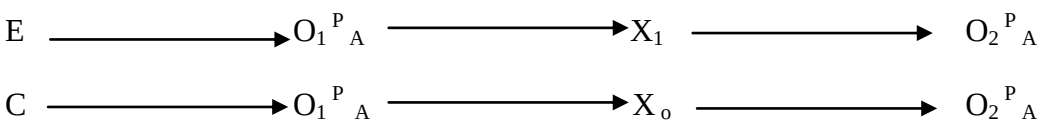


Fig. 3.1: Research Design Illustration(Experimental-Control Group Design).

Where:

E = Experimental Group

C = Control Group

O_1 = Pretest

O_2 = Posttest

Xo = Lecture Method

X_1 = Treatment Group (Discussion Method)

P = Achievement Test (BAT)

A = Anxiety Test (BSAT)

3.3 Population for the Study

The target population for the study comprised all SS II students of the 4 Public Co-educational Senior Secondary Schools in Gashua Educational Zone. The total number of students is 532 (363 boys and 169 girls), as shown in Table 3.1;

Table 3.1: Population for the Study:

S/N	Name of Schools	Boys	Girls	Total
1.	ADSS Nguru	140	088	228
2.	GSS Yusufari	086	038	124
3.	GSS Machina	112	034	146
4.	GSS Gwiokura	025	009	034
	Grand Total	363	169	532

3.4 Sample and Sampling Technique:

Since only four (4) Co-educational schools are in the study population, and in order to ensure relative similarities in the variables of interest such as gender, the students in the four (4) schools were given the pretest. The scores obtained were subjected to analysis of variance (ANOVA) in which the f-value calculated was 31.56. This was higher than the f-value critical of 2.76 at $P \leq 0.05$ level of significance. This showed that there was significant difference (Appendix H). Based on the analysis of the pre-test scores, the classes in the two (2) schools which were found to have equivalent means were selected as the sample for the study through Shaffer's Test Duncan's Multiple Range Test (See Appendix J). A total of 71 students (49 boys and 22 girls) served as the sample for the study. The number is viable for the study based on central limit theory (Tuckman, 1975) recommendation that minimum of 30 study samples is viable for experimental study (Tuckman, 1975; Fraenkel & Wallen, 2000). The schools and number of students in each of them is presented in Table 3.2.

Table 3.2: Sample for the Study.

S/N	Name of Schools	Groups	Boys	Girls	Total
1.	GSS Yusufari	Experimental	28	13	41
2.	GSS Gwiokura	Control	21	09	30
	Grand Total		49	22	71

3.5 Instrumentation

Two (2) instruments were used for data collection. These are:

a. Biology Achievement Test (BAT)

b. Biology Students' Anxiety Test (BSAT)

The BAT was developed by the researcher from West African Examination Council (WAEC) past questions for the years 2007, 2008, 2009 and 2010. This consisted of 20 multiple choice items in order to test the students' knowledge on the biology topic taught (Pollution). The questions picked also covered the topics taught

The Biology Students' Anxiety Test (BSAT) was adapted from that developed by Hamilton (Hamilton, 2006 in JRank, 2010). The anxiety questionnaire also followed the theoretical literature that; the nature of science instruction strongly affects attitude of students to learning science (Anameze, 1998). The questionnaire therefore consisted of statements suggesting how subjects felt about test or examination in biology before and after treatment, and how the treatment had affected their attitude to learning and achievement in biology. The BSAT required the students to use a four point Likert scale to report how they felt before taking an examination. The four (4) response options are; Strongly Agree (SA) with score of 4 indicating high test anxiety, Agree (A) with score of 3, Disagree (DA) with score of 2 and strongly disagree (SD) with score of 1 indicating low test anxiety. (Details on appendix D).

3.6 Validity of Research Instrument

The validity of the two instruments of data collection has been ensured. The Biology Achievement Test (BAT) was developed by the researcher from West African Examination Council (WAEC), while the Biology Student Anxiety Test (BSAT) was adapted from Hamilton Anxiety Scale (HAS) i.e. the researcher restructured some of the wordings in the Hamilton scale to suit the present study.. However, both instruments were validated two (2) experts in biology and two (2) experts in psychology, respectively.

3.7 Selection of Biology Topics:

The researcher in consultation with some senior secondary biology teachers went through the SSCE biology syllabus and selected Pollution (Air pollution, Land pollution, Water pollution and Noise pollution) as the instructional topic.

The topic was selected because it is part of SS II biology syllabus. Also selection covers the topic adequately (See Appendix I for table of specification).

3.8 Pilot Testing

The Biology Achievement Test (BAT) and Biology Students' Anxiety Test (BSAT were pilot tested using the SS II biology students of Government Day Secondary School, Gashua. The aims of pilot test was to establish if the instruments can be used to identify students' academic achievement and anxiety, determine the appropriateness of the wordings of the instruments, establish the reliability of the instrument and identify items that are not suitable in the instrument. The students were eighty (80) in number and were tested using the BAT and BSAT packages. The 80 students were given copies of BAT and BSAT to attempt and return. The pilot school was not part of the study and have a distance of about 53 kilometres from the study schools. The reliability of the instruments was obtained through Test-retest method and

Kuder-Richardson (K-R)21 reliability coefficient. Hence, the coefficients of BAT and BSAT were calculated to be 0.80 and 0.70 respectively (Hamilton, 2006 in JRank, 2010). Details of the reliability index for the two (2) instruments are presented in appendix E and I.

3.8.1 Items Characteristics of BAT.

Item analysis was carried out on the result of the Biology Achievement Test (BAT) to determine the facility indices (FI) and discrimination indices (DI) of the items.

The facility index (FI) of a test is the percentage of the students that got an item right (Wood, 1990). The formula is given by:

$FI = R/T$

Where; R = Number of correct responses

T = total number of students

The recommended values within the range of 0.3 to 0.7 for good test item values in assessing achievement (Furst, 1958; Satterly,1986; Inyang ,1988; & Usman,2001). For the present study 0.3 to 0.7 was used.

3.8.2 Item Difficulty Index.

This is the percentage of students who obtained the correct answer and those who obtained the wrong answer on the item. For computing the difficulty index for each item, the following steps were taken:

- The scores on the whole test scripts were ranked in order from highest to lowest.
- One third of the scores of the high scoring students and one third of the bottom scoring students were selected.
- The percentage of the high scoring one third and the low scoring one third of the total test items was calculated.

- The item difficulty index was computed by adding the percentage of those that got the items correct in the bottom scoring and high scoring groups and then divide by two.

The formula is given as follows:

$$P = \frac{RU + RL}{N}$$

Where:

P = item difficulty

RU = number of students that got the item correct in the upper one third percent.

RL = number of students that got the items correct in the bottom one third percent.

N = number of students involved in the analysis (not the entire students that sat for the test).

A difficulty index of 75% or higher is regarded as easy in terms of difficulty level, while where the index is 25% or less, it is regarded as hard in terms of difficulty level. In the Biology Achievement Test (BAT), items with difficulty index ranging from 25% to 75% were retained; as such the instrument was reduced from 30 to 20. Details on appendix K.

3.8.3 Discrimination Index (DI):

The discrimination indices of a test are the capacity of that test to discriminate or distinguish between high and low achievers among students in the sample. If an item has positive discrimination index, it implies that a large proportion of the more competent students got the item correct than the less competent ones. If the value is zero, the item has zero discrimination, which means the items are unable to distinguish between competent and incompetent students. The negative value of discrimination index indicates that more of the poorer students got the item correct compared to the

more competent ones (Furst (1992) in Olorukooba (2001)). The formula used for calculating the discrimination index is given as follows:

$$DI = \frac{RU - RL}{\frac{1}{2} N}$$

Where:

DI = Discrimination index

RU = Number of upper 27% of respondents

RL = Number of lower 27% of respondents

N = Total number of respondents

Details on appendix K.

3.9 Administration of Treatment to Experimental Group

The administration of treatment was done by the researcher himself so as to remove any form of biasness. The main treatment involved teaching using discussion method. The presentation of the discussion method to Experimental group (E) was in line with the model adopted from Socrates (1983; 2000) which has three (3) stages of activities:

Stage I: The lesson package (lesson note) on the topic of discussion was provided by the researcher and gave each member of the group to study and also come up with question(s) related to the instructional contents.

Stage II The questions were vetted by the teacher in preparation for the discussion process. The questions also determine the course of the discussion.

Stage III Presentation of the lesson which involves clarifying the aims of the lesson to the student and how each student is expected to ask or answer question(s) or make contribution(s).

3.10 The Control Group

The control group (C) was exposed to the same instructional contents using lecture method. The researcher fed the facts of the contents to the students using lecture method. After the lecture period which lasted for six (6) weeks, BAT and BSAT were given to the control (C) group as post- test. The post-test was given to determine the effect of the lecture on academic achievement and gender. The scores drawn were used to answer the research questions and tested the hypotheses formulated in chapter one.

3.11 Procedure for Data Collection

The Pretest consisted of 20 multiple choice questions (BAT) on pollution concept which was administered to the students in their classrooms under the supervision of the researcher for duration of 40 minutes. The scripts/questionnaires were collected and marked. The BSAT also consisted of 20 items which the students attempted. The scripts were also collected and marked. After six (6) weeks period of instruction by the researcher, both BAT and BSAT items were administered to the two(2) groups as posttest which lasted for 40 minutes each.

3.12 Procedure for Data Analysis

The post-test means scores for the experimental and control groups were analysed using t-test statistic. The t-test was used because the groups were two (2), that is, experimental and control groups. Also t-test was used to find out the difference between the mean scores according to gender in experimental and control groups exposed to discussion and lecture methods respectively. All the null hypotheses of this research study were decided at the significant level of $P \leq 0.05$.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This study is a comparative study of discussion and lecture methods on academic achievement and anxiety level among secondary school biology students in Gashua Educational Zone, Yobe State, Nigeria. This chapter deals with data analysis, results and discussion. The post-test mean scores of the experimental and control groups were analysed using a computer software i.e. Statistical Package for Social Sciences (SPSS Version 20 for Windows) used to answer the research questions stated as follows:

4.2 Answering Research Questions

Research Question 1

What is the difference between the academic achievements of senior secondary school biology students exposed to discussion method when compared to those exposed to lecture method?

Table 4.1: Mean and Standard Deviation of Students in Experimental and Control Groups

Variables	N	X	SD	M/D
Experimental	41	11.07	9.11	
				0.78
Control	30	10.29	7.21	

The Table 4.1 presented data on the mean and standard deviation of academic achievement students in the experimental and control groups. From the result, students taught pollution concept using discussion method has a mean score of 11.07 and those taught using lecture method has a mean score of 10.29. The difference in mean score on

academic achievement between the two (2) groups is 0.78. The experimental group achieved higher than the control group.

Research Question 2

Is there any difference between the academic achievement of boys and girls exposed to discussion method?

Table 4.2: Mean and Standard Deviation of Boys and Girls in Experimental Group.

Variables	N	$\bar{X}$	SD	M/D
Experimental (boys)	28	16.28	6.45	
				0.19
Experimental (girls)	13	16.09	6.28	

The Table 4.2 presented data on the mean and standard deviation of academic achievement of boys and girls in experimental group. From the result, boys had a mean score of 16.28 and girls had a mean score of 16.09 when both of them were taught evolution concept using Discussion Method. The difference in mean score on the academic achievement between boys and girls is 0.19. This showed that there is no difference in the academic achievement of boys and girls taught using Discussion Method.

Research Question 3

What is the effect of discussion method on the anxiety exhibited by senior secondary school biology students?

Table 4.3: Means and Standard Deviations of Anxiety of Boys and Girls in Experimental Group.

Variables	N	X	SD	M/D
Experimental (boys)	28	11.07	9.11	
				0.78
Experimental (girls)	13	10.29	7.21	

The Table 4.3 presented data on the mean and standard deviation of anxiety levels of boys and girls in the experimental group. From the result, boys had a mean of 11.07 and girls had a mean of 10.29 when both of them were taught using discussion method. The difference in mean score on anxiety level between boys and girls is 0.78. This showed that the anxiety of boys was higher than that of girls when both were taught using discussion method.

Research Question 4

Does lecture method have the same effect on the anxiety exhibited by boys and girls exposed to the method?

Table 4.4: Means and Standard Deviations of Anxiety of Boys and Girls in Control Group.

Variables	N	X	SD	M/D
Control (boys)	21	14.14	6.10	
				2.42
Control (girls)	09	11.72	4.53	

The Table 4.4 presented data on the mean and standard deviation of the anxiety levels of boys and girls in the control group. From the result, boys had a mean score of 14.14 and girls had a mean score of 11.72 when both of them were taught using lecture

method. The difference in mean scores on anxiety between boys and girls is 2.42. This showed that boys had higher anxiety than girls when both were taught using lecture method.

4.3 Data Analysis and Hypotheses Testing

To test the difference in means of pretest and posttest of the experimental and control groups in academic achievement and anxiety, t-test was used. The results were presented in the tables below:

Ho_1: There is no significant difference between the mean academic scores of students taught pollution concept using discussion method and those taught with lecture method.

The posttest mean scores of the academic achievement of experimental and control groups were analysed using t-test statistic.

The results of the t-test analysis are presented in Table 4.5:

Table 4.5: **t-test Analysis of Posttest Mean Scores of Experimental and Control Groups:**

Variables	N	X	SD	t-cal.	t-crit.	DF	P	Remark
Experimental	41	11.07	9.11					
				6.96	1.98	69	0.00	Sig.
Control	30	10.29	7.21					

Significant P≤0.05

From the result in Table 4.5, t-value (calculated) is 6.96 and is greater than t-value (critical) which is 1.98 at $P \leq 0.05$ with df = 69. This means that there is significant difference between the post-test scores of the experimental and control groups in favour of the experimental group. Therefore, the hypothesis is rejected. This implies that the experimental group taught using discussion method achieved

significantly higher than the control group taught the same concept using lecture method.

Ho_2: There is no significant difference between the mean scores for academic achievement of boys and girls taught pollution concept using discussion method.

The posttest mean scores of the academic achievement of boys and girls taught using discussion method was analysed using t-test statistic. The results of the t-test analysis are presented in Table 4.6:

Table 4.6: t-test Analysis of Posttest Mean Scores for Academic Achievement of Boys and Girls Exposed to Discussion Method:

Variables	N	X	SD	t-cal.	t-crit.	DF	P	Remark
Experimental (boys)	28	16.28	6.45	1.86	2.08	39	0.08	Not sig.
Experimental (girls)	13	16.09	6.28					

From the result in Table 4.6, t-value (calculated) was 1.86 and less than t-value (critical) which was 2.08 at $P \leq 0.05$ with df = 39. This showed that there was no significance differences between the posttest mean scores of boys and girls when both of them were taught using discussion method. Therefore the null hypothesis is retained.

Ho_3: There is no significance difference between the anxiety level of boys and girls taught pollution concept using discussion method.

The posttest mean scores of the anxiety of boys and girls taught using discussion method was analysed using t-test statistic. The results of the t-test analysis are presented in Table 4.7:

Table 4.7: t-test Analysis of Posttest Mean Scores for Anxiety of Boys and Girls Exposed to Discussion Method:

Variables	N	X	SD	t-cal.	t-crit.	DF	P	Remark
Experimental (boys)	28	12.39	5.32	2.01	2.08	39	0.06	Not sig.
Experimental (girls)	13	12.25	5.19					

From the result in Table 4.7, t-value (calculated) is 2.01 and less than t-value (critical) which is 2.08 at $P \leq 0.05$ with df = 39. This showed that there is no significance difference between the post-test mean scores of boys and girls when both of them were taught using discussion method. Therefore the null hypothesis 3 is rejected.

Ho_4: There is no significant difference between the anxiety levels of boys and girls taught pollution concept using lecture method.

The posttest mean scores of the anxiety of boys and girls taught using lecture method was analysed using t-test statistic.

The results of the t-test analysis are presented in Table 4.8:

Table 4.8: t-test Analysis of Posttest Mean Scores for Anxiety of Boys and Girls Exposed to Lecture Method.

Variables	N	X	SD	t-cal.	t-crit	DF	P	Remark
Control (boys)	21	14.14	6.10	4.12	2.08	28	0.00	Sig
Control (girls)	09	11.72	4.53					

Significant P≤0.05

From the result in Table 4.8, t-value (calculated) is 4.12 and greater than t-value (critical) which is 2.08 at $P \leq 0.05$ with df = 28. This showed that there was significance difference between the post-test scores of boys and girls in favour of boys. Therefore, the null hypothesis 4 is rejected. This implied that the anxiety level of boys was significantly higher than the anxiety level of girls when both of them were taught using lecture method.

4.4 Summary of Major Findings

The study revealed the following findings:

1. There was significant difference between the posttest mean scores of academic achievement of Experimental and Control groups in favour of the Experimental group.
2. There was no significant difference between the academic achievement of boys and girls taught using discussion method
3. There was no significant difference between the anxiety level of boys and girls taught using discussion method.
4. There was significant difference between the anxiety of boys and girls (in favour of boys) when they are taught using lecture method.

4.5: Discussion of the Results

Null Hypothesis One

The analysis in Table 4.5 showed that the experimental group taught using discussion method achieved higher than the control group taught the same concept using le cture method. This significant difference in achievement in favour of the experimental group suggested a greater effectiveness of the discussion method over the lecture method. The finding is similar to that of Blankmeyer, Tennial and Garezynsky (2011) on empirical study of active teaching techniques in which they examined four (4)

teaching techniques (Lecture, demonstration, Discussion and Instructional and Students). The result showed discussion method to with second highest students' achievement, while lecture had the lowest students' achievement. The work of Ugwuandu and Nzewi (2012) on diologic, peer and guided discussion on students' achievement showed that guided discussion enhanced students' achievement in biology. While the result is contrary to the research work of Atadoga and Lapkini (2012) on the effect of discussion and electic instructional methods on the academic performance of senior secondary physics students in Kogi State, in which the electic method achieved higher than discussion method. Capraviis, Barman and Magee (2001) also reported that discussion method produced higher achievement and comprehension over the lecture method. Further research works proved discussion method to not only produce favourable student achievement outcomes, but also foster greater participation and self-confidence (Perkins & Soris, 2001; Yoder & Hochevar, 2005).

Null Hypothesis Two

The analysis in Table 4.6 showed that there was no significant difference between the posttest mean scores for academic achievement of boys and girls when both of them were taught using discussion method. This agrees with the findings of Bichi (2002) on the effect of gender on academic achievement in evolution concept among senior secondary school students using problem solving instructional strategy, in which the result showed no significant difference in the achievement of boys and girls. Similarly, the findings of Aweriale (2006) on gender achievement in physics also showed no significance difference between the mean scores of boys and girls. The explanation to this could be that since both students were given equal opportunities to participate actively in the learning process by interacting among themselves and with the teacher in the discussion method (learner-centred), the process could have helped to

improve the students' achievement irrespective of gender. This also agreed with the findings of Hassan and Okatahi (2006) that when both male and female students were exposed to the same study skill training techniques, such training session will usually have effect on subsequent exams grade of the subjects irrespective of gender.

Null Hypothesis Three

The analysis in Table 4.7 showed that there was no significance difference between the anxiety level of boys and girls when both of them were taught using discussion method. The explanation for this is that discussion method proved to be gender friendly especially when compared to lecture method. This agrees with the findings of Kirkland (1996) in Hassan and Okatahi (2006) that training programmes such as teaching methods which are student-centred, e.g. discussion method enables students to get better equipped to face evaluative situations which could have helped in reducing test-anxiety irrespective of gender.

Null Hypothesis Four

The analysis in Table 4.8 showed that the anxiety level of boys was significantly higher than the anxiety level of girls when both of them are taught using lecture method. This finding is similar to the work of Okatahi (2006) which indicated significant difference in test anxiety level of boys over girls when both were pretested prior to study skill training. It also supports the finding of Gerald (1995) who attributed high anxiety level of male over female to family setting where parents exert pressure on their children to excel in school, especially male who are perceived as future heads. This pressure often leads boys' results to indicate high anxiety.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This study compared the effect of discussion and lecture methods on academic achievement, anxiety and gender among SS II biology students. In the previous chapter, data obtained for the study were analysed and results discussed based on the hypotheses formulated. This chapter is presented under the following sub-headings:

5.2 Summary of the Study

5.3 Major Findings

5.4 Conclusion

5.5 Recommendations

5.6 Limitations of the Study

5.7 Contribution to knowledge

5.8 Suggestion for Further Studies

5.2 Summary of the Study

This study compared the effects of discussion and lecture methods on the academic achievement and anxiety among senior secondary school biology students in Gashua Educational Zone of Yobe State. The main variables compared were; academic achievement, anxiety and gender on pollution concept in biology teaching at senior secondary school level using discussion method, while the control group was mainly taught using lecture method.

Several literatures related to the study were reviewed which included teaching biology at secondary schools, science teaching methods, models for discussion method, anxiety and academic achievement, anxiety and gender among others. The implication of literature review on the present study was also taken into account.

A pretest-posttest Quasi-Experimental-Control Group Design was used in which subjects were randomly assigned into experimental and control groups. The experimental group received treatment using discussion method and control group were taught using lecture method. The study sample comprised of a total of 71 students (49 boys and 22 girls) selected through random sampling by balloting.

The instruments used for the study were; Biology Achievement Test (BAT) comprising of twenty (20) items selected from pollution (i.e. Land Pollution, Air Pollution, Water Pollution and Noise Pollution) and Biology Students Anxiety Test (BSAT) also comprising of twenty (20) items. These instruments were pilot tested to find their reliabilities which were; r = 0.77 and r = 0.76 respectively. The items were used for data collection and the data obtained were analysed using t-test statistic. The results obtained were presented and subsequently discussed as the major findings in the sub-section 5.3.

5.3 Conclusion

T he findings of the study showed that Discussion method which is a form of learner-centred method have significant effects on students' academic achievement over the lecture method in biology, but showed no significant difference between the achievement of boys and girls exposed to the method. This indicated that discussion method is gender friendly while lecture method proved to be gender sensitive.

Therefore, it is imperative from the findings of this study that teachers should focus on teaching using learner-centred methods such as discussion rather than teacher-centred methods. This is because discussion method was found to appeal more on the academic achievement of students and reduced anxiety level, while lecture method lead to low academic achievement and high anxiety.

5.4 Recommendations

Based on the findings in this study, the following recommendations are made:

1. Teachers should adopt discussion method which is learner-centred in their day-to-day classroom instruction and encourage students to actively participate in the discussion process, as this will play a major role in their understanding of the instructional content, hence improves their academic achievement.
2. Teachers trainers should endeavour to adopt and also imbibe in their students the culture of adopting discussion method, so as to implement same when they are out teaching in secondary schools. This will further enhance the academic achievement of students.
3. At the local education authority level, efforts should be geared towards organizing workshops/seminars on teaching methodology to emphasize the use of learner-centred methods such as discussion for teaching of science subjects including biology at secondary school level. This is to compliment the efforts of the Millennium Development Goals (MDGs) for re-training of science teachers.

5.5 Contribution to Knowledge

Discussion is something that is used every day to resolve many issues outside the classroom, but from the result of this research finding the researcher discovered that discussion method has enhanced the teaching-learning process in the classroom and thus enhanced the academic achievement of students in science over the traditional lecture method on pollution concept in biology. This research study also established that discussion method can be used to reduce anxiety level of biology students on pollution concept.

This research work is unique in that the researcher could not lay hands on works reviewed in which discussion and lecture methods were used on academic

achievement and anxiety using pollution concept in biology. Therefore, this study has added to the existing body of knowledge supporting the merits of teacher-centred teaching strategies.

5.6 Limitations of the Study

This study had the following limitations:

1. The study was only restricted to two (2) co-educational Senior Secondary Schools within Gashua educational zone of Yobe State. This made the scope of generalization fairly narrow.
2. Only a sample size of 71 students (49 boys and 22 girls) was involved in the study.

5.7 Suggestions for Further Studies

- Similar studies could be conducted in teacher training institutions such as Colleges of Education and Faculties of Education in Universities. It could also be extended to polytechnics and other higher institutions of learning in Nigeria for widening the scope of generalization.
- The result obtained in this research was for pollution concepts in biology. The methods can therefore be tried in other science disciplines such as chemistry, physics and mathematics in senior secondary schools.

REFERENCES

Abdullahi, A. (1982). *Science Teaching in Nigeria*. Atoto Press Ltd, Ilorin, Nigeria, 69-87.

Aguokagbu, C. (1997). The Dearth of Women in the Sciences; Causes and Constraints. In G.A. Badmus and L.A. Techno (eds*). Science Mathematics and Technology Education in Nigeria*. 166-176.

Aigbomian, D.O. (1994). Students Perception of Technical Words in the Learning of Physics. *Studies in Education,* 2 (1), 86-92.

Ajagun, G.A. (2001). A Study of the Achievement of Science Students in the Senior Secondary School Certificate Examinations in Sellected Schools in Kaduna State. Tambari. *Kano Journal of Education.2(1) .114-115.*

Aliyu, B.I. (2008). Primary Schools' Teachers' Perception on achievement in Mathematics in Bade L.G.A of Yobe State. *Yobe Journal of Education. 2 (1).* 108-112.

Anameze, L. (1998). *Students Guide to Academic Success*. A Handbook on how to study and pass Examination. Uwani, Enugu: CPA and Gold Publishers.

Atadoga, M.M. & Onaolapo, M.A.O. (2008). *A handbook on Science Teaching Methods (I).* Nigeria: Shola Press.

Atadoga, M.M. & Lakpini, M.A. (2012). First AFTRA Teaching and Learning in Africa Conference. *An annual International Conference of the African Forum of Teaching Regulatory Authorities*. Proceedings Vol.1 85-92.

Ausubel, D. (1978). in Azdina, W., Azura, A., Razali, L. & Hassan, Y. (2003). Learning theory by Ausubel. *Cognitive Learning Theories and its Implication on Science Classroom Teaching*. www.slidesbase.net/leaningtheory-ausubel-catched-similar. Retrieved: August 11th, 2011.

Aweriale, P.E.O. (2006). Gender achievement in Physics. A Case Study in Auchi Polytechnics, Auchi. *Nigeria Journal of Professional Teachers, 1 (2), 223-224*

Azdina, W., Azura, A., Razali, L. and Hassan, Y. (2003). Learning theory by Ausubel. *Cognitive Learning Theories and its Implication on Science Classroom Teaching.* www.slidesbase.net/leaningtheory-ausubel-catched-similar. Retrieved: August 11th, 2011.

Bello, G. (2002). Gender Difference in School Science: implication for Science Teacher Education. *Journal of Curriculum and Instruction, 6, (1), 55-63.*

Benson, H. (2000; 2011). The Socratic Method. *Socratic Wisdom Oxford University Press. www.G:/socraticmethod. Amazon.co.uk.* Retrieved: 26/08/2013.

Berger, J.R. (1978). *School Psychology in Contemporary Society. An Introduction.* Columbus Ohio. Charles, E. Merrill Publishing Company.

Bichi, S.S. (2002). The Effect of Gender on Academic Achievement in Evolution Concept among Senior Secondary Students Using Problem Solving Instructional Strategy. *Zaria Journal of Students in Education, 3(1), 132-138.*

Bichi, S.S (2006). Constructivism and the teaching of science in the 21st century. *Journal of educational research and Development of the Faculty of Education, A.B.U. Zaria. 1(3,).*

Bonet, A.P (2007). Methods and techniques of teaching; *A hand book for students and teachers.* Kaduna: PTP Printers.

Borg, W.R. & Gall, M.D. (1999). *Educational Research. An introduction* (6th Edition). WAEC (2002). How to Design and Evaluate Research in Education. New York: McGrowhill Co. Inc.

Brookfield, N., Stephen,S. & Stephen,P. (1999*). Discussion as a Way of Teaching. and Tools Techniques for Democratic Classrooms.* San Fransisco: Jossey-Bars Publishers.http//www.ntlf.com/html/lib/support/83brook.htm.

Brown, R. N., Oke, F. E. and Brown, D. P. (1982). Curriculum and Instructions. *An Introduction to Methods of Teaching*. Hong Kong: McMillan Publishing Co. Inc.

Brown, C. (2005*). Scholarly Articles for Researches Conducted on Discussion Teaching Strategies.* Principles of Language Learning and Teaching. *5(2).*

Bruner, J. (1966; 1996). Constructivism Theory. *Towards a Theory of Insruction*. Cambridge MA. Harvard University Press. Retrieved, 13/12/14.

Carpenter, J. M. (2006). Effective Teaching Methods for Large Class. *Journal of Family and Consumer Sciences Education.*University of South Carolina. 3(1),102-104.

Callahan J.E and Clark M.A (1997). *Teaching in the elementary school*. Planning for competence. London: McMillan Publishing.

David, S.; Derald, S: and Stanley, S. (1986). *Understanding Abnormal Behaviours*. Boston: Houghton Miffling Co.

Driver, R. (1986). *Reconstruting the Science Curriculum: The Approach of the Children's Learning in Science Project*; paper presented at American Edocational Res. Association Annual Conference, San Fransisco. Retrieved,14/12/14.

Driver, R. And Bell, B. (1986). Students Thinking and the Learning of Science: A Constructivist view. *School Science Review.* March. Retrieved, 14/12/14.

Elservier, S. (2002). Reducing Test Anxiety. *Journal of Contemporary Educational Psychology*. *Therapeutic Aspects.* New York Inc. 1(27), Issue 2.

Engel, M. (1972). Psychopathology in Childhood' social, Diagnostic and achievement. *A Journal of Applied Psychology*. (69) 69-78.

Eyetsemitan, P.E. (2002). Curriculum Design and Development: The Teaching and Learning of STM with the Primary Science Curriculum. 43rd *STAN Annual Conference Proceedings*, 420-425.

Fansto-Sterling, A. (1992). Myths of Gender. *Biological Theories About Women and Men.* New York: Basic Books.

Federal Ministry of Education. National Policy on Education (1998; 2004). NERDC, Lagos.

Fennena, E.H (1979). *Women and Girls in Mathematics*: Equality in Mathematics Education. U.S.A 10(4), 397- 397.

Fisher, W. (1970). *Theories of Anxiety; Psychoanalytic Quarterly.* New York: Harper and Row Publishers Inc.

Frandsen A.N (1981). Educational Psychology. *The principles of learning in teaching.* London: Mc. Graw-Hill Books Company.

Freud, S. (1936). *The Problems of Anxiety*. New York: Norton Publishers Ltd.

Furst, E.J. (1958). *Constructing Evaluation Instrument*. New York. Longman Green Company.

Furst, A. (1992) in Olorukooba, S.B. (2001). The Relative Effects of Cooperative Learning Strategy and Traditional Method on the Achievement of Senior SecondarySchool Chemistry Students. An Unpublished PhD Thesis, A.B.U., Zaria.

Gastein, N. (2002). Scholarly Articles for Researches Conducted on Discussion Teaching Strategies. *Teaching Language Comprehension Strategies to Students.*

Geddes, O. & Gorsset, C. (2007). *Websters Universal Dictionary and Thesaurus.* David Dale House, New larnak, ML 11 9D, Scotland UK.

Getso, A.M. (2008). Modern Methods of Teaching Primary Science for Higher Achievement: A Paper Presented in a Workshop for Teachers Organized by SUBEB in Collaboration with Sa'adatu Rimi C.O.E., Kano. 15th-17th Sept.

Gregory, V. V. (1983). The Socratic Method of Elentic Elunchus. *Oxford Studies in Ancient Philosophy.* 1: 27-58. Retieved: 26/08/2013.

Haas, M. S. (2002). The Influence of Teaching Methods on Students' Achievement for Secondary level. *U.S.A.www.ajol. journal >home> vol. 12(1-2).*

Habeeb, N.N. (2001). De-Mystifying Science for Full Female Perticipation. In: *42th Annual Conference of STAN*, 153-155.

Hackathorn, J., Solomon, E.D., Blankmeyer, K.L., Tennial, R.E. & Garezynski, A.M. (2011). Learning by doing: An empirical Study of Active Teaching Techniques.
A Journal of Effective. *An on-line Journal Devoted to Teaching Excellence.* Vol.11 (2). 40-54.

Hamilton, A. (2006) in JRank, P. (2010). *Encyclopedia of mental disorders*. Mhtml://c/doc/hamiltonanxietyscale-children,adult. Retrieved: March 10th, 2010.

Hassan, T. & Okatahi, A. (1990). Relative Efficacy of Cognitive Restructuring and Impulsive Therapy in the treatment of Test-Anxiety. *Journal of Research in Counselling Psychology*. 2, 102-109.

Heather, M., Vogel, H.L. & Collins, A.L. (2010; 2011). *The Relationship between Test Anxiety and Academic Achievement.* Department of Psychology. Missouri WesternUniversity.http://clearinghouse.missouriwestern.edu/manuscripts/333.php Retrieved: 22/07/2010.

Holandsworth, M. (1999). Test Anxiety and Direction of Attention. *Psychological Bulleting* 20, 92-104 http.//www.vtande.com

Hoxby, A. (2000). Factors Affecting Academic Achievement. *Bangladesh e-journal of Psychology.* 3(1), 29-33.

Hunt,B.A., Coverdale, J. And Richards, E.C. (2003). Model for Discussion Method of Teaching in Secondary Schools. Secondary School Education. http//712educators.about.com/od/Lesson Plan/p/discussion.htm.

Ibe, E. (2006). Breaking Gender Barrier on Achievement in STME Using Hands-on, Minds-on Science: Implication for Supply of Resources. *47th STAN Annual Conference Proceedings.*

Inyang, N.E. (1988). The Constructing Validation. Standerdized Integrated Science Achievement Test for Junior Secondary Schools. Unpublished Ph.D Thesis A.B.U. Zaria.

Jack, U.G.(2012). Innovative and Effective Science Teaching Strategies for Quality Assuarance in Nigerian Secondary Schools. Pakistan Journal of Social Sciences. 9(4), 173-179.

Jimoh, A. T. (2001). The Place of Women Education in the Devt. of Science, Mathematics and Technology. *42th Annual Conference of STAN*, 170-173.

Kelly, G. M. & Onyeka, J. O. A. (1992). An Introduction to Statistics and Experimental Design For the Life Sciences. ABTC Publishers. 78.

Kelly, M. (2014). Whole Group Discussion as a Teaching Method.About.com. Secondary School Education.http//712educators.about.com/od/Lesson Plan/p/discussion.htm.

Kirkland, M. V.(1996). Relieving Anxiety in Classroom Examination. *British Journal of Educational Psychology*. 50, 53-60.

Kochchar, S. K. (2012: 2000). *Methods and Techniques of Teaching*. Sterling Publishers Pvt Ltd. New Delhi 110020.

Kundu, C.I. & Tutoo, D.N. (1988). *Educational Psychology*. 5th Edition New Delhi: Sterling Publishers Pvt, Ltd.

Lassa, B.I. (1984). The sorry State of Mathematics Education in Nigeria. *An inaugural Address Delivered at University of Jos* on 20th January, 1984.

Lasisi, A.R. & Daniel, T.A. (2009). Effect of Vedeo-taped Instructional Package on Students' level of Practical Skills Acquisition in Physics. 50th *STAN Annual Conference Proceedings*, 311-315.

Lazarus S.R. (1964 Ed.) *Educational Psychology*. Foundations of modern Psychology. New Jersey:series practice Hall Inc.

Leonard, K. (1973). *Behaviour Influence and Personality*. The Social Matrix of Human Action. New York. Hold Hort, Rinhard Winsor.

Levitt, E. E. (1980). *The Psychology of Anxiety (2nd Edition)*. New Jersey: Lawrence Erlbaum Associates, Inc.

Lilly, C. (2010). Generalized Anxiety Disorder. Anxiety Symptoms; causes and treatment.http;/www.medicinenet.com/anxiety/article/htmRetrieved: September 2nd, 2010.

Linver,M.R., Davis-Kean, P.E. and Ecclec,J.S. (2002).Influence of Gender on Academic Achievement. A Paper Presented at Biennial Meeting of the Society for Research on Adolescence, L.A. 1-14.

Lovell, K. (1973). *Educational Psychology and Children*. 11th Edition London. Hodder and Stoughton Ltd.

Menucha, B. (2006). Assessment and Instructional Preferences and their Relationship with Test Anxiety and Learning Strategies. *Journal of Higher Education* 53: 6, 749-757.

Mettler T. (2010). Scale for Measuring Anxiety. Mhtml:file:/doc/scale for measuring enxiety-google search. Retrieved: March 10th, 2010.

Miller D. (2009). Certificate in further education teaching City and guilds 7407 stage I. www.dounmlller.co.uk/study/7407si/no.3pdf retrieved: September 10th, 2009.

Mischel, W. (1971). *Introduction to Personality*. New York: Richard and Winston Inc. 5(1) p.87-89.

Mobile Site (2011). Creating Successful Research Skills. *Assignments. Library Support for Faculty*.http://gethelp.library.upenn.edu/faculty/researchassignments.ht np. Retrieved: 15th August 2011.

National Commission for Colleges of Education (2008). *Minimum Standards for Nigeria Certificate in Education (NCE) (Science and Mathematics) 4th Edition.*

Nigerian Television Authority. Network News (2011). Nigeria's Education Minister Decries Mass Failure in Public Exams. NTA Network News programme; 13th December, 2011.

Ngada,A.J. (2008).*Princples and Practice of Effective Education.*Lagos:Kolas Printing Co.(3), 17-21.

Nwosu, A.A. & Philomena C.C.(2008). The effect of mode of presentation of material resources on acquisition of science process skill among primary science pupils implication for primary science, curriculum delivery. *STAN, (2008). 49th Annual Conference Proceedings 262-267.*

Ogunleye, A. O. (2000). *An Introduction to Research Methods in Education and Social Sciences.* Sunshine International Publications (Nig.) Ltd.

O'Hair M.J and McIntyre J.D (1996). The reflective role of the classroom teacher www.googlebook.mhtml/document.org.retrieved: 18th January, 2010.

Okoye, N. & Ovri, R.O. (2008). Relative Effect of Guided Discovery; Discussion and Expository Methods of Teaching Investigated Science on Students' Achievement. FCT Education Secretariat. *Journal of Curriculum Studies and Instruction 1 (1)182-191.*

Olajide, J.O. (2002). The Effects of Analogical Reasoning and Extended Wait-Time on Students Achievement and Attitude to Biology. An unpublished Ph.D.Thesis Dept. of Education, A.B.U Zaria.

Olamie, K. (2011). Students' Academic Achievement. http://wiki.answers.com/Q/what is meant by academic achievement? Retrieved: 10th February, 2011.

Oluwatoyin, A.J.(2007). Gender and Subject Choice Effects on Students psycho-Cognitive Outcomes in Mathematics. *Journal of Arts and Education. (JOLAE), 1(1), 1-12.*

Ortese, P.T. (2004). New Trends in the Teaching Preparation for Primary Education in the 21st Centuary in Nigeria. *Journal of Education Foundation, 1(1), 136-145.*

Oyedokun, O. A. (1998). Effect of Conceptual Change Model on Students' Achievement, Retention and Attitudes to Biology Concepts. Unpublished Ph.D Dissertation, A.B.U, Zaria.

Papalia, D.E. & Olds, S.W. (1987). *Psychology*. *International Edition.* Signapore: McGraw Hill Books Co.

Piajet, J. (1947) in Seymour, P. (1999). Child Psychologist Piaget. Time Magazine U.S.A. http://www.time/magazine/article/0,917,990617,00html. Retrieved:11/08/2011

Ramadan, J.B. (1986). The effect of test Anxiety on Achievement in Classroom Tests. M. Ed. Unpublished thesis, University of Jos.

Sajeev, V. (2006). Theories of Anxiety. Book Review Vasudevan Publishers. www.shvoob.com>medicine and health>Neurology-cached-similar. Retrieved: 12th August, 2010.

Sulieman, A.D., Hassan, B. & Musa,H.Y. (2012). Nigerian Journal of Teacher Education and Teaching. Vol. 10 (1).

Sanabria, E. J. (2005). Discussion as a Teaching Strategy. http://www.com.ng/researches conducted discussion teaching strategies. Retrieved: 21/01.2013.

Sarason, I.G. (1980). Examination Approaches to test Anxiety: Attention and the Uses of information.

Satterly, D. (1986). *Assessment in School Theory and Practice in Education*. New York Black Well Ltd. 107-108

Science Direct, (2010). Contemporary Educational Pschology: Cognitive Test Anxiety and Academic Achievement. http://www.sciencedirect.com/science? Retrieved: 22th July, 2010.

Scott, M.S.E. (2008). Social Causes of school Anxiety http://stress.bout.com/od/studentsress/a/schoolanxiety.htm. Retrieved: 22th July, 2010.

Shaibu, A. A. M. (2008). Science Technology and Mathematics Education for National Development: Teacher is the Key. A Paper Presented at a National Conference Organized by the School of Science, Federal College of Education, Zaria, April, 2008.

Smith, C.P. (1964). Relationships between Achievement Related Motives and intelligence, achievement level and persistence. *Journal of Abnormal and social psychology (68), 523-532.*

Sperling, A. (1982). Psychology Made simple. London. Hienemann, Ltd. Spielberger, C. et'al (1978*). Examination Stress and Test Anxiety.*New York: John Wiley and Sons, (5) 98.

Spielberger, C.D. and Sarason, I.G. (1989). Stress and Anxiety. Washington: Hemisphere Publishing Corporation, (12) 72-75.

Site, (2010). Anxiety and stress. http://www.thesite.org/healthandwellbeing/mentalhealth/anxietyandstress.thecauses. Retrieved: 05th September,2011.

Terry, D. (2002). Evaluating Teachers effectiveness http://www.ferris.edu/fct/ teaching and learning tips/research. Retrieved Feb. 18th February, 2010.

Tuckman B.W. (1975). *Measuring educational outcomes Handou*t. New York: Base Huvawick Publhers.

Udo, E.E. (2006). Resources as Enhancement of Effective Teaching and Learning of Primary Science. *47th STAN Annual Comference Proceedings, 335-338.*

Udofia N.A. (2009). STAN. Developing Enterpreneurial skills through science technology methematics Education. *50th annual conference. Ibadan HEBN publishers PLC.*

Ugwuadu, O.R.&, Nzewi, U. (2012). African Jourral of Science, technology and Mathematics Education (AJstme). Vol.2(1).

Usman, I.A. (2000; 2007). The Relationship Between Students' Achievement in Practical Activities and their Achievement in integrated science using NISTEP mode of Teaching.; Unpublished Ph.D Thesis, Dept. of Education, ABU, Zaria.

Usman, I.A. (2008). Using a Sellected Method of Teaching in Enhancing Slow Learners' Academic Performance Among Senior Secondary School Integrated Science Students.

Uyoata, U.E. (2006). Instructional Strategies and Retention of Science Concept among Primary School pupils. *Journal of Educational Studies* 12 (1) 189-194.

Victor, K.S. (1991). Correlates of Test Anxiety in Schools. A paper presented at the 7th Annual Conference of Nigerian Association of Educational Psychologists, Held at Ahmadu Bello University, Zaria. 24th – 27th March, 1991.

Vygoski, R. (1979; 1998). Constructivism Learning Theory. Paradigms and Perspectives. http:/www.learning-theories.com/constructivism.html. Retrieved, 13/12/14.

West African Examination Council (2003, 2005, 2006). Chief Examinar's reports.

West African Examination Council (2007; 2008; 2009). Yobe State Ministry of Education Schools' results

Walters, Y.B. & soyibo, K. (1998). Factors Affecting Academic achievement. *Bangldesh e-journal of Sosiology. Vol. 3 No.1*

Weekend File (2011). Mass Failure in NECO May/June 2011 Results. NTA Network News Programme. 14th OCT. 2011.

Wikianswer, (2011). What are the causes of Good Academic Achievement http://wiki.com/Q/causes of good academic achievement. Retrieved: 11/02/2011.

Wikipedia, (2011). Factors Affecting Academic Achievement http://wiki..answer.com?Q/what_is_meant_academic_performa nce? Retrieved: 11/02/2011.

Wikipedia, (2009; 2010). The Free Encyclopedia. www.wiki/homemaker.Retrievedfromgoogle.14/01/09

Winston, K. (2002). Factors affecting Achievement. *Bangladesh e-Journal of Sociology Vol. 3, No.1*. Retrieved: 5/01/2010.

Zieder, M. (1998). Test Anxiety. The State of the Art. New York. Plenum Press. Zimmerman, A. (1999, 2001, 2006). Factors Affecting Academic Achievement. *Bangladesh e-journal of Sociology. 3(1).* Retrieved: 5/01/2010.

APPENDIX A

BIOLOGY ACHIEVEMENT TEST (BAT)

Dear Respondents,

This questionnaire comprise of two sections (A and B). Please respond to both sections appropriately.

SECTION A: (PERSONAL DATA).

Name----------

Sex----------Age----------

School/Institution----------

Course of Study: Arts ( ) Science ( )

Others (indicate) ----------

Occupation of Parents: Father----------

Mother----------

Qualification of Parents: Father……..

Mother…….....

i.e. i) University (First Degree and Above)

ii) NCE/OND

iii) Secondary School

iv) Primary School/Adult Education

v) No Formal Education

SECTION B: Biology Achievement Test (BAT)

Read each of the following questions carefully and select the correct answer from the list of options (a-d), given below each question:

1. Acidity of the soil is partly caused by?

a) Sulphuric acid b) Water c) NaOH d) Oxygen

2. Indiscriminate dumping of refuse provide breeding ground for the following insect and animal pests, except?

b) House flies b) Rats c) Cockroaches d) Pisces

3. One of the major sources of sewage pollutant is the?

a) Homes b) Automobiles c) Atmosphere d) Rainfall

4. Any substance introduced into the environment by man which causes harm to the environment and living organisms including man are called?

a) Pollution b) Pollutant c) Chemicals d) Habitat

5. Improper irrigation practices in areas with poorly drained soil may result in?

a) Water deposit b) Salt deposit c) Soil deposit d) Filtration

6. Sewage, industrial wastes, fertilizers and pesticides are the main causes of?

a) Air pollution b) Water pollution c) Noise pollution d) Land pollution

7. Wearing away of top soil by wind and rain, can contribute to:

a) Land pollution b) Air pollution c) Water pollution d) Noise pollution

8. Farmers are advised against the use of gammalin 20 for fishing, because it is considered:

a) Harmless b) Poisonous c) Convenient d) Civilized

9. The following are water borne diseases due to water pollution, except?

a) Dysentery b) Bilharziasis c) Typhoid d) Annemia

10 The process of adding heat to water bodies such as streams, rivers, lakes, etc is called?

a) Thermal pollution b) Photo pollution c) Wind pollution d) Temperature

11. Urban air pollution is commonly known as:

a) Dust b) Smog c) Snow d) Fuels

12. Most pollutants are washed out of the air by the following processes, except:

a) Rain b) Snow c) Fog d) Wind

13. One of the greatest challenges caused by air pollution is:

a) Heat b) Ozone c) Global warming d) Ultraviolet radiation

14. The following are agents of air pollution, except:

a) Dust b) Soot c) Oxygen d) Carbon dioxide

15. Air pollution causes the following diseases to man, except:

a) Asthma b) Lung cancer c) Bronchitis d) Long sightedness

16. Noise pollution refers to the sound/noise produced by:

a) Radio house b) Traffic c) T.V station d) Sound proof

17. The following can be caused by noise pollution, except:

a) Stress b) Sleep loss c) Distraction d) Sound sleep

18. The unit for measuring noise pollution is the:

a) Decibels b) Decimetre c) Noise meter d) Nanometre

19. Hardening of the artery due to noise pollution is called:

a) Diastole b) Arteriosclerosis c) Artrio-ventriclosis d) Arteriosis

20. The following are effects of noise pollution, except: a) Emotional disturbance b) High blood pressure c) Short temper d) Comfort

APPENDIX B

MARKING SCHEME FOR BIOLOGY ACHIEVEMENT TEST (BAT)

1. A
2. D
3. A
4. B
5. B
6. B
7. C
8. B
9. D
10. A
11. C
12. D
13. C
14. C
15. D
16. B
17. D
18. A
19. B
20. D

Note:

One mark for any question answered correctly.

APPENDIX C

BIOLOGY STUDENTS ANXIETY TEST (BSAT)

Dear Respondents,

This test is designed to identify the reason(s) why some students experience anxiety during test/examination situations. The aim is to trace the sources of anxiety and try to help in finding solution to the problem(s).

INSTRUCTION:

The statements below describe some of the ways people feel before undertaking an important event such as examination. Please read each statement carefully and tick in the column that best describes your feelings. Give your first reaction to each item without wasting too much time. An example on how to respond to the items is given below:

Table 5.1: Example of how students are expected to respond to anxiety questionnaire.

	SA	A	DA	SDA
My hands always tremble while waiting to write a test		√		

The person who responded in this agreed with the statement and so ticked column 2.

KEY:

SA = Strongly Agree

A = Agree

DA = Disagree

SD = Strongly Disagree

Now fill in your details as provided and proceed to respond to the items:

SECTION A: (PERSONAL DATA).

Name(s)----------

Sex----------Age----------

School/Institution----------

Course of Study: Arts ( )

Science ( )

Others (indicate) ----------

Occupation of Parents: Father----------

Mother----------

Qualification of Parents: Father……..

Mother……

i.e. i) University (First Degree and Above)

ii) NCE/OND

vi) Secondary School

vii) Primary School/Adult Education

viii) No Formal Education

SECTION B (Biology Students' Anxiety Test (BSAT)

Read each of the following statements. Decide the extent to which you either agree or disagree with it and tick (√) the appropriate response for each item:

Table 5.2: Anxiety questionnaires

		SA (4)	A (3)	DA (2)	SDA (1)
1.	I don't like anyone to talk to me while waiting to write a test.				
2.	My palms usually become sweaty while waiting to write a test.				
3.	While waiting to write a test, am already convinced that I could not do very well.				
4.	I become generally restless prior to taking a test				
5.	I never feel I have prepared enough for writing a test				
6.	I am usually very confident about writing a test				
7	Prior to writing a test, I experienced increase in my heart beat rate.				
8	I experienced dryness in the mouth prior to writing a test.				
9	I usually find it difficult to eat while waiting to write a test				
10	I usually experienced stomach upset prior to writing a test.				
11	When I write a test, I sometime forget the answers to questions I know the answer to.				
12	I rush to finish an examination because I don't want to be the last to finish.				
13	I usually write my tests in a relaxed environment.				
14	I often feel like urinating prior to writing a test				
15	I am usually the last person to finish an examination.				
16	I always make sure that I spend enough time to go through the work when I finish writing the test				
17	I ensure that I do not rush to submit my work				
18	Sometime I remember the answer(s) to some questions after I have left the exam hall.				
19	I hardly finished any exam completely before the time of the exam lapses.				
20	Sometime the answer to a question disappears after I have started answering it.				

Source: Adapted From Hamilton (2006) in JRank, 2010

APPENDIX D

MARKING SCHEME FOR BIOLOGY STUDENTS' ANXIETY TEST (BSAT)

Strongly Agree (SA) = 4 marks

Agree = 3 marks

Disagree = 2 marks

Strongly Disagree = 1 marks

Note:

Maximum marks for the items are 80 (i.e. 4 × 20 = 80 marks)

Minimum marks for the items are 20 (i.e. 1 × 20 = 20 marks)

APPENDIX E

RESULTS OF PILOT TEST

Subclasses	**Internal Consistency**	**Test-Retest** (2wks)
1. Achievement Test	0.770	0.889
2. Anxiety Test	0.759	0.866

The above values were found to be 'perfectly reliable'. This is confirmed using the Kuder–Richardson Reliability Coefficient (K – R) 21, given below:

+/-	0.0	and	+/- 0.25	= Very Weak Reliability
+/-	0.26	and	+/- 0.50	= Moderately Weak
+/-	0.51	and	+/- 0.75	= Strong Reliability
+/-	0.76	and	+/- 1.00	= Perfect reliability

The formula for (K-R) 21 is given as:

r = K/K—1 [1—X (K-- X)/KV].

Where:

K = Number of cases in the test item

V = Variance (E x^2_1/N--1)

X = Mean

r = Reliability index

Source: Ogodulunwa and Ugwanyi (1999); Ogunleye (2000).

APPENDIX F

LESSON I (DISCUSSION METHOD)

Group: Experimental Group (E)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Time: 40 minutes

Previous Knowledge: The lesson notes on the concept of pollution was given to every student of the experimental group and instructed to read and digest in preparation for the discussion process. Every student is expected to contribute by asking question(s) and/or answer question(s). This is necessary because for any classroom discussion to be meaningful, the students are expected to have prior knowledge on the topic of discursion

Behavioural Objective: At the end of the lesson, the students should be able to:

a. Define pollution
b. Name air pollutants and their sources/
c. State the harmful effects of air pollutants.
d. State the effects of air pollution on plants and animals.
e. Measures of controlling air pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher starts the discussion process by asking the students the following questions to be discussed: Teacher: What is pollution?	The students attempt to answer the teacher's question in form of discussion, thus; **Student(male):** Pollution is the unfavourable

		changes of the environment by the addition of impurities by man, causing to danger to his health and natural resources.
II	The teacher asked a female student to also attempt the question	**Student(female):** Pollution is the dumping of refuse in the environment which dirty the surrounding and cause ill health.
III	The teacher continues the discussion process by encouraging more students to ask questions	**Student(male):** What are air pollutants? Attempt by other students to answer questions asked by their colleagues: **Student(male):** Air pollutants are substances that pollute the air, eg dust.
IV	The teacher guides the course of the	**Student(female):** Smoke, soot, CO2, SO2, etc. released into the air harm man. **Student(female):** SO2, CO2 alter the composition of the atmosphere, causing harm to both plants and animals. **Student(female):** What are the sources of the air

	discussion by selecting who asks question and who answers question at a time.	pollutants mentioned? Attempted answers; **Students(male):**
V	Teacher: Teacher selected one student to ask/answer question from the many that raised their hands	Dust = from blowing wind carrying sand particles into the air. Smoke = from burning firewood, automobile, cigarette, etc. CO_2 = from burning of coal, natural gas, etc. SO_2 = from burning coal, oil, etc. **Students(male):** Air pollutants reduce visibility of the atmosphere, eg fog and dust reduces amount of light reaching the atmosphere.
VI	The teacher continue the discussion process by asking the students ask the following question to be discussed: Teacher: What are the harmful effects of air pollutants: Teacher:	**Student(male):** SO_2 causes damage to tress, fruits, vegetables and flowers, etc. **Students(female):** Reduction in amount of light reaching the atmosphere also reduces the rate of photosynthesis by plants.

VII	The teacher also selected one student (at a time), to attempt from the many who raised their hands in order to answer the question.	May kill both harmful and useful insects in the soil. May sink into the soil and kill useful organisms which help to aerate the soil. **Student(male):** What is the effect of air pollution on the soil? Student attempts to answer question(s) in form of discussion:
VIII	The teacher encourages the students to ask / answer questions.	**Student(female):** Sulphuric acid (H_2SO_4) and Nitric acid (HNO_3) reaching the soil makes it acidic and unfit for planting crops. **Student(male):** What is the effect of air pollution on vegetation? **Student(male):** Sulphur (IV) oxide damage trees, fruits, vegetables and flowers. **Student(female):** Dust particles, smoke and soot may block the stomata of leaves which also affect the rate of

		photosynthesis, respiration and transpiration rates.

Conclusion: The teacher concludes the lesson by giving a brief summary on air pollution, its sources and effects to both plants and animals, including man, thus:

6 Air pollution is addition of air-borne substances such as dust, smoke (from automobiles, wood, etc), soot and SO2 into the air which causes harm to both plants and animals.

7 These substances cause chronic respiratory diseases to man, eg asthma, bronchitis and lung cancer among others.

8 Air pollution leads to nervous disturbances, eye and nose irritations, general discomfort and unhappiness.

LESSON II (DISCUSSION METHOD)

Group: Experimental Group (E)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Land Pollution

Time: 40 minutes

Previous Knowledge: The lesson notes on the concept of pollution was given to every student of the experimental group and instructed to read and digest in preparation for the discussion process. Every student is expected to contribute by asking question(s) and/or answer question(s). This is necessary because for any classroom discussion to be meaningful, the students are expected to have prior knowledge on the topic of discursion

Behavioural Objective: At the end of the lesson, the students should be able to:

a. Define land pollution
b. Name land pollutants and their sources/
c. State the harmful effects of land pollution.
d. State the effects of air pollution on plants and animals.
e. Measures of control measures of land pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher starts the discussion process by asking the students the following questions to be discussed: Teacher: What is land pollution?	The students attempt to answer the teacher's question in form of discussion in the order that the teacher selected them, thus; **Student(male):**

II		Land pollution is the dumping of refuse on the land by man which make s the environment dirty. **Student(female):** Land pollution is the dumping of rubbish and chemicals on land by man which causes harm to plants and animals. **Student(male):** What are land pollutants?
III	The teacher selected one student at a time, from the many students that raised their hands to attempt the question.	Attempt by other students to answer questions asked by their colleagues: **Student(male):** Land pollutants include; refuse, used cartons, empty tins etc, which litter the land
IV	The teacher contributes to the discussion process, thus; **Teacher**: Among land pollutants are human and animal excrement, broken bottles, etc	**Student(female):** Land pollutants include; empty pure water sachet, polythene bags, fallen trees, etc.
	The teacher selects who asks or	**Student(female):**

	answers questions so as to maintain orderliness.	What are the sources of the land pollution mentioned? Attempted answers; **Students(male):** Sources of land pollution include; homes, industries, markets, schools, offices, etc.
V	The teacher guides the course of the discussion by selecting who asks question and who answers question at a time. Teacher: Selects one student at a time, to ask/answer question from the many that raised their hands	**Students(male**): Sources of land pollution also include; bottle and glass manufacturing industries, laboratories, oil companies, etc. Air pollutants reduce visibility of the atmosphere, eg fog and dust reduces amount of light reaching the atmosphere. **Student(male):** kill useful organisms which help to aerate the soil. **Student(male):** What are the effects of land pollutants to man? Students attempts to answer question(s) in form of discussion:
VI	The teacher continue the discussion	**Student(female):**

	process by encouraging the students to ask more questions on land pollution: Teacher: What are the harmful effects of air pollutants: Teacher: The teacher also selected one student (at a time), to attempt from the many who raised their hands in order to answer the question. The teacher encourages the students to ask / answer questions. The teacher ask the students the following question: Teacher: What are some of the methods used in controlling land pollution?	Refuse provides breeding ground for insects and animal pest that cause diseases to man. **Student(male):** Refuse breeds germs which are harmful to man. **Student(Male):** Refuse is ugly in sight and cause discomfort due to its bad smell. **Student(Female):** Refuse occupies space and prevent easy passage of vehicles and for farming. **Student(male):** What is the effect of air pollution on vegetation? Students attempted answers: **Student(male):** Residents should be encouraged to always burn or bury their refuse from time to time, to avoid contaminating the environment. Sulphur (IV) oxide damage trees, fruits, vegetables and flowers.
VII		
VIII		
IX		

X	The teacher encourage more students to attempt to answer the question(s)	**Student(female):** Refuse should always be deposited in dust-bins and covered. **Student(Male):** Residents should stop indiscriminate dumping of refuse which litters the environment. **Student(Female):** Government should provide dust-bins at designated places for refuse dumping and also collect the refuse from time to time.

Conclusion:

The teacher concludes the lesson by giving a brief summary on pollution, its effects and control:

Teacher's summary:

9 Land pollution is the indiscriminate dumping of rubbish and chemicals by man or his activities which makes land infertile and causes harm to both plants and animals.

10 Ugly sight and odour of causes discomfort, harbours germs which are harmful to man and occupy space which would have been used for agriculture.

Indiscriminate refuse dumping be discouraged, refuse should be dumped in dust-bins, burnt or buried.

LESSON III (DISCUSSION METHOD)

Group: Experimental Group (E)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Water Pollution

Time: 40 minutes

Previous Knowledge: The lesson notes on the concept of pollution (Water pollution) was given to every student of the experimental group and instructed to read and digest in preparation for the discussion process. Every student is expected to contribute by asking question(s) and/or answer question(s). This is necessary because for any classroom discussion to be meaningful, the students are expected to have prior knowledge on the topic of discursion

Behavioural Objective: At the end of the lesson, the students should be able to:

a. Define water pollution
b. Name water pollutants and their sources
c. State the harmful effects of water pollution.
d. Measures of controlling water pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher starts the discussion process by asking the students the following question to be discussed: Teacher: What is water	The students attempt to answer the teacher's question in form of discussion in the order that the teacher selected them, thus;

II	pollution?	**Student(male):** Water pollution is the release of unwanted substances by man into the water which spoils the water.
	The teacher selected one student at a time, from the many students that raised their hands to attempt the question.	**Student(female):** Water pollution is the discharge of substances into water bodies such as rivers, dams, etc which become harmful to plants and animals.
III		**Student(male):** Dumping of refuse into water bodies as a result of man's makes the water unfit for human consumption.
	The teacher continues the discussion process by encouraging the students to ask questions	**Student(male):** What are the causes of water pollution?
IX	**Teacher**: Selects students who are to ask/answer questions in an orderly manner.	Attempt by other students to answer questions asked by their colleagues: **Student(male):** Wastes from human activities from homes, industries, offices, which pollute the water and makes it unfit for drinking.

		Student(female): Human wastes eg faeces and urine may contain disease causing organisms which could harmful to both plants and animals. **Student(female):** What are other sources of water pollution mentioned?
V	The teacher guides the course of the discussion by selecting who asks question and who answers question at a time. Teacher: Selects one student at a time, to ask/answer question from the many that raised their hands	Attempted answers; **Students(male):** Washing in rivers and lakes release phosphate detergents into the water which pollutes the water and makes it unfit for drinking. **Students(male**): Oil spillage into water bodies reduces amount of oxygen entering the water and thus suffocating many water organisms. **Student(male):** What are the effects of chemicals put into water bodies for fishing purposes?
VI	The teacher continue the discussion	

	process by encouraging the students to ask more questions on water pollution: Teacher: Selects students who are to ask/answer questions in an orderly manner. Teacher: The teacher also selected one student (at a time), to attempt from the many who raised their hands in order to answer the question.	Attempted answers by students: **Student(male):** Gammalin 20 is poisonous and kills both fish and other water creatures. It's dangerous to man when he consumes such fish. Students attempts to answer question(s) in form of discussion: **Student(female):** Fertilizers washed into water bodies causes overgrowth of aquatic plants, and this upsets the equilibrium of aquatic environment. Refuse provides breeding ground for insects and animal pest that cause diseases to man. **Student(male):** Refuse breeds germs which are harmful to man.
VII		
VIII	The teacher encourages the students to ask / answer questions.	**Student(Male):** Refuse is ugly in sight and cause discomfort due to its bad smell. **Student(Female):**

IX	The teacher ask the students the following question: Teacher: What are the effects of industrial chemicals dumped in water bodies?	Refuse occupies space and prevent easy passage of vehicles and for farming. Attempted answers by students: **Student(male):** Mercury, Lead or Cyanide contaminates water and is injurious to man's health and may cause death. **Student(female):** Fish stores mercury in their tissues and when man such fish may die of poison.

Conclusion: The teacher concludes the lesson by giving a brief summary on water pollution and its effects.

Teacher's summary:

11 When animal, domestic and industrial sewage or wastes are discharged into water bodies, it may become harmful to plants and animals which become unfit for human consumption.

12 Untreated human and animal wastes/sewage may harbour viruses, bacteria and eggs of worms that cause diseases such as cholera, dysentery, typhoid, hepatitis and bilhaziasis.

LESSON IV (DISCUSSION METHOD)

Group: Experimental Group (E)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Noise Pollution

Time: 40 minutes

Previous Knowledge: The lesson notes on the concept of pollution (Noise pollution) was given to every student of the experimental group and instructed to read and digest in preparation for the discussion process. Every student is expected to contribute by asking question(s) and/or answer question(s). This is necessary because for any classroom discussion to be meaningful, the students are expected to have prior knowledge on the topic of discursion

Behavioural Objective: At the end of the lesson, the students should be able to:

a. Define noise pollution
b. What are the causes of noise pollution?
c. State the harmful effects of noise pollution.
d. Measures of controlling noise pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster, etc

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher starts the discussion process by asking the students the following question to be discussed: Teacher: What is noise	The students attempt to answer the teacher's question in form of discussion in the order that the teacher selected them, thus;

II	pollution?	**Student(male):** Noise pollution is the loud sound produced or released into the environment which disturbs the air **Student(female):** Noise pollution is the abnormal sound released into the environment which disturbs the quality of air. **Student(male):** Dumping of refuse into water bodies as a result of man's makes the water unfit for human consumption.
III	The teacher continues the discussion by encouraging the students to ask questions Teacher selects one student at a time, from the many students that raised their hands to attempt the question.	**Student(male):** What are the causes of noise pollution? Attempt by other students to answer questions asked by their colleagues: **Student(male):** Noise pollution is caused by excessive sound from automobiles (cars, motorbikes, aeroplanes, etc).

		Student(female): Human wastes eg faeces and urine may contain disease causing organisms which could harmful to both plants and animals. **Student(female):** Sounds from music sets, television sets tuned to high volumes, etc. **Student(male):** Singing and drumming from clubs, disco halls, hotels, sound of guns, bombs, etc, constitute noise pollution.
IV	The teacher continues the discussion process by encouraging the students to make more contributions by asking or answering questions **Teacher:** Whoever has any contribution to make should raise his/her hand and until one is called before he/she talks.	Students' question: **Students(male):** What are the effects of noise pollution? Attempted answers**:** **Student(male):** High noise may lead to either temporary or permanent deafness, because it affects the hearing organs.

		Student(female): Persistent noise may lead to emotional disturbances and stress. **Student(male):** Too much noise can cause high blood pressure and sudden death.
V	The teacher guides the course of the discussion by selecting who asks question and who answers question at a time.	**Student(male):** When noise is too much, it may lead to high anxiety and fright. **Student(female):**
VI	Teacher: Selects one student at a time, to ask/answer question from the many that raised their hands	Too much noise from cities/towns may lead to the deterioration of human hearing organs. **Student(male):** Noise pollution may lead to high temper and changes in behaviour.

Conclusion:

The teacher concludes the lesson by giving a brief summary on noise pollution and its effects, i.e.:

-Noise pollution is an impairment of the environmental quality of the air by noise, especially in major towns and cities.

-Major causes of noise pollution include aeroplanes, automobiles, Musical sets, television sets, etc.

-Noise pollution leads to general irritation, tension, discomfort and tiredness, and may lead to arteriosclerosis (hardening of the artery) leading to high BP.

APPENDIX G

LESSON I (LECTURE METHOD)

Group: Control Group (C)

Class: SS2 Science

Subject: Biology

Topic: Air Pollution

Time: 40 minutes

Previous Knowledge: The students have an idea about Environmental Sanitation and its importance to health.

Behavioural Objective: At the end of the lesson, the students should be able to:

i. Define Pollution

ii. Name air pollutants and their sources

iii. State the harmful effects of pollutants

iv. State the control measures for air pollution

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster, etc.

Introduction: The teacher introduces the lesson by giving an overview on Environmental Sanitation and its importance to human health.

Presentation:

The teacher presents the lesson in the following steps:

Step I	The teacher introduces the lesson by defining the concept of Pollution, thus: Pollution is the unfavourable alteration of the environment due to the addition of impurities by man to constitute to danger to either his health or natural resources.	Students listen to the teacher's explanation attentively.
Step II	The goes on to enumerate some of the air pollutants to the students, ie:	The students listen to the teacher and

	13 Dust 14 Smoke 15 Carbon dioxide 16 Sulphur dioxide, etc. These substances when released into the air alter the composition of the atmosphere, causing harm to both plants and animals.	take some notes.
Step III	The teacher further explains to the students the sources of air pollutants listed above, ie; Dust = from blowing wind carrying sand particles into the air. Smoke = from burning firewood, automobile, cigarette, etc. CO2 = from burning of coal, natural gas, etc. SO2 = from burning coal, oil, etc. The teacher explains to the students the harmful effects of air pollutants, thus;	Students listen to the teacher attentively and take some notes Students listen and take notes.
IV	Air pollutants reduce visibility of the atmosphere, eg fog and dust reduces amount of light reaching the atmosphere, thus reduces the rate of photosynthesis SO2 causes damage to tress, fruits, vegetables and flowers, etc.	Students listen and take some notes.
V	The teacher explains to the students the effects of insecticides, artificial fertilizers and herbicides to terrestrial organisms, ie; 17 May kill both harmful and useful insects in the soil 18 May sink into the soil and kill useful organisms which help aerate the soil, etc. The teacher pauses to encourage students to ask question, if any.	Students ask few questions.

	The teacher explains to the students the effect of fertilizers, insecticides and herbicides to aquatic organisms, i.e.; 19 May be washed into water bodies eg streams, rivers and lakes causing the death of aquatic lives, e.g. fishes, crabs, etc.	Students listen and take notes.
VI	The teacher explains to the students the meaning of sewage, i.e.; Sewage refers to human faeces, urine and fluid discharges from households, factories, schools and offices, etc.	Students listen and take notes.
VII	The teacher explains to the students the effect of sewage to the wellbeing of man, i.e.; May contain harmful chemicals eg Mercury and radioactive elements which when washed to water bodies (rivers, lakes, ponds, etc.) may be consumed by fishes and stored in their muscles. Consumption of such fish by man can cause ill-health.	Students listen and take notes.
VIII	Sewage washed from land to source of drinking water may contain harmful microbes eg protozoans and bacteria that cause diseases such as cholera, dysentery and typhoid, etc. The stinking odour from decay of sewage causes discomfort, nose irritation, vomiting, etc.	
Step IX	The teacher encourages students to ask questions, if any.	Students ask few questions.

Conclusion: The teacher concludes the lesson by giving a summary on the concept of pollution, its sources and effects to both aquatic and terrestrial organisms, including man. The teacher also pointed out the importance of environmental sanitation in checking the menace of pollution.

LESSON II (LECTURE METHOD)

Group: Control Group (C)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Land Pollution

Time: 40 minutes

Previous Knowledge: The students have learnt the concept of air pollution, air pollutants and their effects to man and his environment.

Behavioural Objective: At the end of the lesson, the students should be able to:

i. Define land pollution

ii. Name land pollutants and their sources/

iii. State the harmful effects of land pollution.

iv. State the effects of land pollution on plants and animals.

v. Measures of controlling land pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher introduces the lesson by explaining what is meant by land pollution:	The students listen to the teacher's explanation attentively.
II	Teacher: Land pollution is the dumping of refuse on the land by man which makes the environment dirty.	

III	The teacher continues the lesson by listing some the land pollutants commonly found: Land pollutants include; empty pure water sachet, polythene bags, fallen trees, empty tins, and used cartons etc which litter the land.	Students listen attentively to the teacher's explanations.
IV	The teacher further listed other land pollutants to the students and wrote them down on the blackboard, thus; Among land pollutants are human and animal excrement, broken bottles, etc	Students listen to the teacher and also take some notes in their exercise books.
V	The teacher explains to the students the sources of land pollutants: The sources of land pollutants includes; homes, industries, schools and offices.	
VI	The teacher encourages the students to ask question(s) if any.	

	The teacher explains to the students some of the harmful effects of land pollutants: a)Refuse provides breeding ground for insects and animal pest that cause diseases to man. b)Refuse breeds germs which are harmful to man. c)Refuse is ugly in sight and cause discomfort due to its bad smell. d)Refuse occupies space and prevent easy passage of vehicles and for farming. **f)**Refuse kill useful organisms which help to aerate the soil.	Students listen to the teacher and also take some notes in their exercise books.
VII	The teacher explains to the students some of the measures for controlling land pollution' thus; a)Residents should stop indiscriminate dumping of refuse which litters the environment.	

	b)Refuse should always be deposited in dust-bins and covered. c)Residents should be encouraged to always burn or bury their refuse from time to time, to avoid contaminating the environment. d)Government should provide dust-bins at designated places for refuse dumping and also collect the refuse from time to time.	Students listen and take some notes.

Conclusion:

The teacher concludes the lesson by giving a brief summary on pollution, its effects and control:

Teacher's summary:

- Land pollution is the indiscriminate dumping of rubbish and chemicals by man or his activities which makes land infertile and causes harm to both plants and animals.
- Ugly sight and odour of causes discomfort, harbours germs which are harmful to man and occupy space which would have been used for agriculture.
- Indiscriminate refuse dumping be discouraged, refuse should be dumped in dust-bins, burnt or buried.

LESSON III (LECTURE METHOD)

Group: Control Group (C)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Water Pollution

Time: 40 minutes

Previous Knowledge: The students have learnt about the concept of land pollution, its sources and effects to living organisms and their environment.

Behavioural Objective: At the end of the lesson, the students should be able to:

a. Define water pollution
b. Name water pollutants and their sources
c. State the harmful effects of water pollution.
d. Measures of controlling water pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher introduces the lesson by explaining to the students what is meant by water pollution,ie: Water pollution is the release of unwanted substances by man into water bodies which spoil the waters. The teacher continue the lesson by explaining further that;	The students listen to the teacher's explanations.
II	The discharge of substances into	

	water bodies such as rivers, lakes, dams, etc which becomes harmful to plants and animals.	
III	The teacher explains to the students that; Dumping of refuse into water as a result of man's activities makes the water unfit for human consumption.	Students listen to the teacher.
IV	The teacher enumerates to the students some of the causes of water pollution, ie; Wastes from human activities from homes, industries and offices pollutes the water and makes it unfit for drinking.	Students listen to the teacher attentively
V	The teacher also explains to the students that human wastes eg; Faeces and urine may contain disease causing organisms which could be harmful to both plants and animals.	Students listen to the teacher attentively
VI	The teacher encourages the students to ask question(s) if they have any.	
VII	The teacher explains to the students that;	Students listen to the teacher's

		explanations.
	Washing in rivers and lakes release phosphate detergents into the water which pollutes the water and makes it unfit for drinking.	
VIII	The teacher explains to the students that;	Students listen to the teacher attentively.
	Oil spillage into water bodies pollutes the water and reduces oxygen entering the water which leads the suffocation of water organisms.	The students listen to the teacher attentively and also take some notes.
IX	The teacher explains to the students some of the effects of chemical substances put in water bodies for fishing purposes,ie:	
	Gammalin 20 is poisonous and when put in water kill both fish and other water creatures. It is also dangerous to man when he consumes such fish and water.	The students listen and take notes.
X	The teacher explains to the students the harmful effects of fertilizers into water bodies, ie;	
	Fertilizers washed into water bodies from farms, causes overgrowth of aquatic plants and this upsets the	

XI	equilibrium of the aquatic environment. The teacher explains further that; Mercury, Lead or Cyanide contaminates water and is injurious to man's health and may also cause death. The teacher also explains that; Fish stores Mercury in their tissues and when man consumes such fish may die of poison.	The students listen and take some notes.

Conclusion:

The teacher concludes the lesson by giving a brief summary on water pollution and its effects.

Teachers Summary:

- When animal, domestic and industrial sewage or wastes are discharged into water bodies, it may become harmful to plants and animals which become unfit for consumption
- Untreated human and animal sewage/wastes may harbour viruses, bacteria and eggs of worms that cause diseases such as cholera, dysentery, typhoid, hepatitis and bilhaziasis.

LESSON IV (LECTURE METHOD)

Group: Control Group (C)

Class: SS 2 Science

Subject: Biology

Topic: Pollution

Unit: Noise Pollution

Time: 40 minutes

Previous Knowledge: The students have learnt about the concept of water pollution, its sources and effects to living organisms and their environment.

Behavioural Objective: At the end of the lesson, the students should be able to:

e. Define Noise pollution
f. Name noise pollutants and their sources
g. State the harmful effects of noise pollution.
h. Measures of controlling noise pollution.

Instructional materials: Text books, Charts, Chalkboard, Chalk, Duster etc.

Introduction: The teacher introduces the lesson by giving an overview on environmental sanitation and its importance to human health.

Presentation: The teacher presents the lesson in the following steps:

Steps	**Teacher Activity**	**Students Activities**
I	The teacher introduces the lesson by explaining to the students what is meant by noise pollution; Noise pollution is the loud sound produced or released into the environment which disturbs the air. It is also the abnormal sound released into the environment which	The students listen to the teacher's explanations and also take some notes. Students listen to the teacher attentively.

	disturbs the quality of the air and causes inconvenience to man.	
II	The teacher continue the lesson by enumerating some of the causes of noise pollution, ie;	
	Noise pollution is caused by the excessive sound from automobiles (cars, motorbikes,etc), aeroplanes, etc. Sounds from music sets, television sets tuned to highest volumes, etc. Singing and drumming from clubs, disco halls, hotels, sound of guns, bombs, etc constitutes noise pollution.	Students listen to the teacher attentively
III	The teacher continues the lesson by explaining to the students some of the effects of noise pollution, ie;	Students listen to the teacher attentively
	High noise may lead to either temporary or permanent deafness because it affects the hearing organs.	Students listen to the teacher's explanations.
	Persistent noise may lead to emotional disturbances and stress or anxiety.	
IV	Too much noise can cause high	

	blood pressure and sudden death. When noise is too much, it can lead to high anxiety and fright. Too much noise from cities/towns may lead to the deterioration of law and order and general security. Noise pollution may lead to short temper and changes in behaviour.	Students listen to the teacher attentively. The students listen to the teacher attentively and also take some notes.

Conclusion;

The teacher concludes the lesson by giving a brief summary on noise pollution, and its effects, ie;

- Noise pollution is the impairment of the environmental quality of air by noise, especially in major towns and cities.
- Major causes of noise pollution include aeroplanes, automobiles, musical sets, television sets, etc.
- Noise pollution leads to general irritation, tension, discomfort and tiredness, and may lead to arteriosclerosis (Hardening of the artery) leading to high blood pressure.

APPENDIX H

SUMMARY TABLE FOR ANOVA

Analysis of variance (ANOVA) of the pre-test achievement scores of the four (4) schools was carried out. This was to determine the equivalence of the four groups at the start of the work. The result obtained is in the table below:

: Table 6.0: Summary Table for ANOVA for Comparing the Means of Four (4) Co-Educational Secondary Schools

Source	S S	D F	M S	f	P
Between	17408.9	k-1=4-1=3	174018.9 = 5672.97 3	MSB =31.56 MSW	<0.05
Within	13661.1	N-K80-4=76	13661.1=179.75		
TSS	187650		76		

Critical value at 0.05 level = 2.76 since calculated value of 31.56 is > table value of 2.76, the H0 is rejected. Later two (2) schools with equivalent means were selected and used for the study. This is presented on appendix XVII.

APPENDIX I

TABLE OF SPECIFICATION FOR BAT

A table of specification was constructed for the purpose of generating the test items. This covered the topic/units within the content area. The table below give the topic, total number of units, total number of questions set and the questions' numbers on the BAT test items.

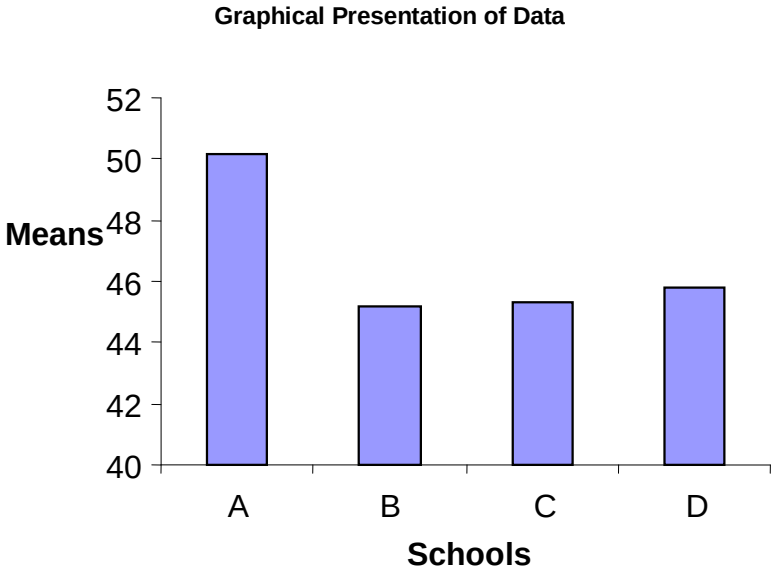
Table 7.0: Table of Specification for BAT:

S/N	Topic/Units	Total number of questions	The questions
1	Land Pollution	5	1, 2, 3, 4, 5
2	Water Pollution	5	6, 7, 8, 9, 10
3	Air Pollution	5	11, 12, 13, 14, 15
4	Noise Pollution	5	16, 17, 18, 19, 20
	Total	20	

APPENDIX J

BAR CHART COMPARING MEAN SCORES OF FOUR SCHOOLS

The graph below shows that the vertical lines on each bar indicates 95% confidence limits and makes it clear that two (2) sample means (45.15 and 45.3) are equivalent, while one (45.8 and 50.15) are significantly different.



Source: Model of Kelly and Onyeka (1992).

Key:

A = ADSS Nguru (Mean Score = 50.15)

B = GSS Gwiokura (Mean Score =45.15)

C = GSS Yusufari (Mean Score = 45.30)

D = GSS Machina (Mean Score = 45.80)

APPENDIX K

ITEM ANALYSIS OF BIOLOGY ACHIEVEMENT TEST (BAT)

S/N	U	L	$P = \frac{RU + RL}{N}$	$DI = \frac{RU - RL}{\frac{1}{2}N}$
1.	6	2	0.53	0.53
2.	7	2	0.60	0.67
3.	6	1	0.47	0.67
4.	9	4	0.87	0.67
5.	3	2	0.33	0.13
6.	2	1	0.20	0.13
7.	5	1	0.40	0.53
8.	5	2	0.47	0.40
9.	4	1	0.33	0.40
10.	4	2	0.40	0.27
11.	8	1	0.60	0.93
12.	4	2	0.40	0.27
13.	9	3	0.80	0.80
14.	3	1	0.27	0.27
15.	3	2	0.33	0.13
16.	4	1	0.33	0.40
17.	3	2	0.33	0.13
18.	4	2	0.40	0.27
19.	5	2	0.47	0.40
20.	7	2	0.60	0.67
21.	4	2	0.40	0.27
22.	2	1	0.20	0.13
23.	2	1	0.20	0.13
24.	4	2	0.40	0.27
25.	4	1	0.33	0.40
26.	5	2	0.47	0.40
27.	7	2	0.60	0.67
28.	2	1	0.20	0.13
29.	4	2	0.40	0.27
30.	3	1	0.27	0.27

APPENDIX L

INSTRUCTIONAL PACKAGE (EXPERIMENTAL GROUP)

Pollution:

Pollution is the unfavourable alteration of the environment due to addition of impurities by man to constitute danger to either his health natural resources. Pollution results from the by-products of human activities. Pollution impairs the usefulness of the environment. Pollution is categorized into four (4) major types, thus;

i) Water pollution
ii) Air pollution
iii) Noise pollution and
iv) Land pollution

Water Pollution:

Is the discharge of substances into water bodies by man which may become harmful to plants and animals in the water and makes them unfit for human consumption.

Causes of water pollution:

- Human and animal wastes and debris of all kind dumped into water bodies. The human wastes such as faeces and urine may contain disease-causing organisms.
- Phosphate detergents increase the quantity of phosphorous in water bodies leading to excess growth of algae (algal bloom or eutriphication). Over population of algae upsets the equilibrium of the aquatic environment.
- Oil spillage covers water surface with film of oil. This film of oil cuts off oxygen supplies to the organisms inside the water and also reduces amount of light entering the water, thus affecting the rate of photosynthesis.
- The use of gammalin 20 for fishing by fishermen kills fishes without knowing the ecological consequences of their action.
- Fertilizers (nitrates and phosphates) from farmlands cause overgrowth of aquatic vegetation.

Effects of water pollution

1. Diseases:

Untreated human and other animal sewage/wastes may harbours viruses, bacteria and eggs of worms that cause diseases such as dysentery, cholera, typhoid, hepatitis (jaundice) and bilhaziasis.

2. Destruction of aquatic life:

Sewage dumped into water bodies encourages rapid growth of bacteria. The bacteria require oxygen for decay and the oxygen comes from the water, hence the dissolved oxygen in the water is reduced to a point that cannot support aquatic organisms. Fish and all other aquatic organisms die of suffocation.

3. Poisonous chemicals

- Drinking water contaminated with either lead, mercury or cyanide is injurious to man's health and death may result. Fish can store mercury in their tissues.
- When such contaminated fish are consumed by man, death may result.
- Fertilizers washed from farmlands could be poisonous to man.
- When nitrate concentration gets high, it can lead to children mortality and toxicity to adults.
- Nitrates causes sickness known as **methemeglobinemia** among babies of three weeks old **(bluebabies),** etc.

Air Pollution:

Air pollution is the addition of air-borne substances such as dust, smoke, soot and sulphur dioxide into the air which alter the composition of the atmosphere causing harm to both plants and animals.

Causes of Air Pollution:

1. Carbon (IV) oxide produced from burning of firewood, coal, oil and natural gases. Carbon monoxide is produced from exhaust of automobiles
2. Sulphur dioxide, Sulphur trioxide and Sulphuric acid:

Sulphur dioxide is produced when sulphur or sulphur containing substances such as coal and oil are burnt. Eg S + O2 -----→ $2SO_2$.

Sulphur trioxide is Produced by the oxidation of Sulphur dioxide with the help of sunlight

Eg $2SO_2$ + O2 ------→ SO_3.

Sulphuric acid is produced when Sulphur trioxide reacts with the moisture of rain water from the atmosphere.

Eg SO_3 + H_2O -----→ $H2SO_4$.

3. Nitrogen monoxide and nitrogen dioxide:

Both gases are produced by automobile. Nitric acid is produced when Nitrogen dioxide reacts with water.

4. Dust:

Dusts resulting from the construction and wear and tear of roads from automobiles. Lead dust from the fume of petrol

5. Microscopic organisms such as bacteria, fugi, parts of insects (eg wings, hairs and legs) all pollute the air.

Effects of Air Pollution:

1. **On Atmosphere**:

Air pollution reduces visibility of atmosphere. Fog reduces the amount of light reaching the earth. This disturbs the air traffic and even causes plane crash.

2. **On Vegetation**:

- Sulphur dioxide causes damage to trees, fruits, vegetables and flowers.
- Ethylene destroys the petals of various flowers.
- It also interferes with the action of auxins.
- The destruction of plants will lead to shortage of food.
- Dust particles in the atmosphere reduce the amount of light reaching the earth.
- The reduction of light reduces the rate of photosynthesis in green plants.
- Dust particles, smoke, soot, may block the stomata of the leaves, adversely affecting photosynthesis, respiration and transpiration.

3. **On Soil:**

- The Sulphuric acid and Nitric acid reaching the soil make the soil acidic
- This affects the fertility of the soil.

4. **Effects on Man:**

- Causes acute illness possibly death.
- Chronic diseases such as asthma, lung cancer and bronchitis
- Irritations, nervous disturbances, eye and nose irritations and offensive odours.
- General discomfort and unhappiness.

Noise Pollution:

Noise pollution is an impairment of the environmental quality of the air by noise. This occur mostly in towns and cities often overcrowded.

Causes of Noise Pollution:

Loud sound of aeroplane, automobiles, guns of various types, bombs, musical sets and television sets tuned to highest volume, singing and drumming constitute nuisance to both humans and other animals.

Effects of Noise Pollution:

- Noise above 85 decibels (unit for measuring sound) may lead to either temporary or permanent deafness.
- The noise from towns and cities is high enough to cause deterioration of hearing as one grows older.
- Noise causes emotional disturbance
- Noise causes high blood pressure
- Loud noise leads to anxiety and fright.

APPENDIX M

MEAN DIFFERENCE FOR ACADEMIC ACHIEVEMENT AND ANXIETY IN PRE AND POSTTESTS.

Table 8.1: **Mean Difference in Academic Achievement of Experimental Group in Pre and Posttest:**

Variables	N	X	SD	t-value	M/D	DF	P	Remark
Pretest	41	8.02	7.80					
				-3.42	3.05	40	0.000	Sig.
Posttestl	41	11.07	9.11					

Significant P≤0.05

The reult in Table 5.1a indicates that there is difference in the pre and posttest mean scores in academic achievement of experimental group (3.05 with t-value of 3.42 at P < 0.000 level of significance).

Table 8.2: **Mean Difference in Anxiety of Experimental Groups in Pre and Posttests:**

Variables	N	X	SD	t-value	M/D	DF	P	Remark
Pretest	41	46.10	6.51					
				2.17	13.73	40	0.001	Sig.
Posttestl	41	32.37	12.73					

Significant P≤0.05

The reult in Table 5.1b indicates that there is difference in the pre and posttest mean scores in anxiety of experimental group (13.73 with t-value of 2.17 at P ≤ 0.001 level of significance).