IMPACT OF COOPERATIVE LEARNING ENRICHED WITH ANALOGY ON RETENTION AND PERFORMANCE IN ECOLOGY AMONG SECONDARY SCHOOL SLOW LEARNERS, KANO STATE, NIGERIA

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A **DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA, NIGERIA IN PARTIAL FULFILMENT FOR THE AWARD OF MASTERS DEGREE IN SCIENCE EDUCATION (M.Sc. SCIENCE EDUCATION)**

DEPARTMENT OF SCIENCE EDUCATION,
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AHMADU BELLO UNIVERSITY, ZARIA

FEBRUARY, 2017

DECLARATION

I declared that the work in this dissertation titled "Impact of Cooperative Learning Enriched with Analogy on Retention and Performance among Secondary Schools Ecology Slow Learners in Dawakin Kudu Education Zone, Kano state Nigeria" has been written by me in the Department of Science Education, The information derived from literature has been duly acknowledged in the text and list of references provided. No part of this dissertation was used previously for another degree or diploma in any university.

_____ _____

Mudassir Yau SANI Date
M.ED/EDUC/40143/12-13

CERTIFICATION

This dissertation titled "Impact of Cooperative Learning Enriched with Analogy on Retention and Performance among Secondary Schools Ecology Slow Learners in Dawakin Kudu Education Zone, Kano State Nigeria" by Mudassir Yau SANI, meets the regulations governing the award of the Degree of Masters in Science Education (M.Sc. Science Education) of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

_____	_____
Dr. T. E. Lawal Chairman, Supervisory Committee	Date
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Dr. S.S. Obeka (Very Rev.) Member, Supervisory Committee	Date
_____	_____
Prof. M. Musa Head of Science Education Department	Date
_____	_____
Prof. K. Bala Dean, School of Postgraduate Studies	Date

DEDICATION

This work is dedicated to my Father, Yau Sani and my Mother Maimuna Yau Sani. I thank you all for your efforts towards my success in life. May Allah (SWT) bless and grant you His mercy, Amin.

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ABBREVIATIONS USED

TWA: Teaching-With-Analogy

AEI: Analogy-Enhanced Instruction

STAN: Science Teachers Association of Nigeria

EPT: Ecology Performance Test

PPMCC: Pearson Product Moment Correlation Coefficient Statis

WAEC: West Africa Examination Council

ICS: International Council for Science

OPERATIONAL DEFINITION OF TERMS

The following are definitions of terms as used in this study:

Cooperative learning strategy: Cooperative learning strategy is an instructional strategy that involves students working in teams to accomplish a common goal.

Analogy: is a comparison of something familiar with something unfamiliar in order to explain a shared principle. In other words, it is an art of exact illustration of real life situations that provides learner the shortest and most effective way to reach learning objectives, and that facilitates his/her learning of concepts.

Retention: Retention is the ability to recall and consequently remember things, experience on what is learnt by an individual at a later time.

Constructivism: is basically a learning theory based on the idea that knowledge is constructed by the students' base on observation and mental activities.

Slow Learners: Slow learners are students with below average intelligence, whose thinking skills have developed significantly more slowly than the normal age mate

Ecology: Ecology defined as a field of study which deals with the relationship of living organism with one another and with their environment in which they live.

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ABSTRACT

The study investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary schools ecology slow learners in Dawakin Kudu Education Zone, Kano State Nigeria. The study adopted a pretest, posttest quasi experimental control group design. The population consisted of 5145 SS2 biology students made up of 3362 males and 1783 females. Stratified random sampling technique was used to select the sample due to gender difference in senior secondary schools in Kano state. Four schools were randomly selected using balloting method which involved picking from the container, two were females' schools and two were males' schools. One hundred and twenty (120) identified slow learners were purposively selected from the four sampled schools. 60 students were in the control group taught using lecture method; while 60 students were in the experimental group and taught using enriched cooperative learning strategy. The two groups were taught ecology concepts for six weeks. One instrument, Ecology Performance Test (EPT) was used for data collection and this instrument was adapted from WAEC objective past question papers which has a reliability coefficient of (r= 0.84). Four research questions were raised; one of which is: what is the mean difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method?. Four hypotheses were raised; one of which is: there is no significant difference on the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. These hypotheses were tested using t-test statistics at $P \leq 0.05$ level of significance. The findings of the study showed that slow learners taught ecology concepts using cooperative learning enriched with analogy performed significantly better than those taught with lecture method. It was recommended that biology teachers should use enriched cooperative learning enriched when teaching ecology concepts.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Science and technology has been recognized worldwide as the key factor in the national development. Based on this relevance of science and technology in the world, developing countries like Nigeria recognize the importance for the nations to develop scientifically and technologically. One of the aims of the Nigeria National Policy on Education (FGN, 2013) is to equip students on how to live effectively in the modern age of science and technology. The gateway to the survival of a nation scientifically and technologically is science literacy which can only be achieved through science education (Bukunola & Idowu, 2012). Science education in Nigeria is facing a large number of problems as outlined by Nwagbo (2001) which include inadequate funding, poor orientation and poor instructional strategies among others. International Council for Science (ICS), (2002) observes science education as a fundamental component of Basic Education that prepares students to live in a world increasingly defined by science and technology.

Science is derived from the Latin"Scientia" which means knowledge and it is a way of enquiry or finding out about the universe (Beli, 2007). According to Stone (1999) biology is a discipline which focuses itself with the study of life and living organism, their structure, function, growth, evolution among others. Some of the biology concepts taught at Senior Secondary School level include cells biology, living and non-living things, reproduction digestive system, hormones, sense organs, ecology, evolution, genetics among others (FGN, 2013). Aina (2009) identified variety of methods with which biology can be taught which include lecture, enquiry, guided discovery, field trips, and cooperative methods among others. Biology concepts can sometimes be difficult particularly when

describing ideas that are abstract in nature which cannot be fully understood by the students for the first time (Chew, 2004). Oyedekun, 2002 and WAEC, (2006), have also shown that a number of concepts in biology which include evolution, physiology, ecology and genetics contain topics that pose difficulty for biology students to understand.

Analogy is like a bridge that span the gap between what the teachers wants the students to learn and the students' previous knowledge. Analogy refers to those aspects of the teacher's explanatory discourse in which a familiar situation similar to the unfamiliar phenomenon to be explained is used (Okigbo, 2010). The unfamiliar domain or phenomenon to be explained is referred to as target and the familiar domain is referred to as source. Olorukooba, Lawal and Jiya (2013), define analogy as a process of identifying similarities between two concepts, the familiar concepts is called the base and unfamiliar concept is called the target. An analogy builds on the framework of the learner's existing knowledge so that students do not start from the scratch. According to Nowrgu and Otum (2013) Analogy is a comparison of something unfamiliar with something familiar in order to explain the shared principles. Analogy was developed to enhance mental activities of students in the learning of scientific concepts and conceptual schemes (Olorukooba, *et a,l* 2012). Therefore, this study determines the impact of cooperative learning enriched with analogy on retention and performance among SS II slow learners students.

Cooperative Learning is considered as an efficient technique to convert students into active learners in classrooms and it makes teaching and learning more satisfying, momentous, enjoyable and effective (Gupta & Pasrija 2012). Cooperative approach constitutes a paradigm shift in the area of learning .It is the learning strategy in which students work as a team in small groups while they share ideas and experience in the process (Johnson & Johnson 1990). Olorukooba (2001) on the other hand supports the claim that, students of small groups are allowed to work together, assist each other, and the conclusion

reached are generally adopted by the group members. Cooperative learning has been proven to be effective for all types of students, including academically gifted and mainstream student because it promote learning and foster respect and friendships among diverse groups of students (Colorin, 2007). Olorukooba, (2001) and Slavin, (2008) have separately documented that when cooperative learning strategy is used, students tend to exhibit higher academic performance, critical thinking skills and deeper understanding of learning materials among others. Cooperative Learning is part of a group teaching and learning techniques where students interact with each other to acquire and practise the elements of a subject matter and to meet common learning goals. However, this study determines the impact of cooperative learning enriched with analogy on performance and retention of SS II slow learners students taught ecology concepts.

Lecture method which is predominantly used in senior secondary schools in Nigeria contributes to the poor academic performance in senior secondary school biology students in Nigeria (Usman, 2008), Oyedekun (2002), referred lecture method as a didactic which involve verbal presentation of ideas, concept, generalization and fact. Bichi (2002) and Usman (2008) had separately observed that lecture method encourages rote learning without profer understanding, thereby resulting in poor performance. Nwosu, (2003), suggested the use of alternative contemporary teaching strategies which would reflect the constructivist approach to learning. Adeoye (2004), maintain that no single method is best for the teaching and learning of science especially biology, he suggested that method that would involve students active participation are cooperative learning, problem solving, use of analogy can improve learning. Akubuilo, (2004), also suggested the use of activity-oriented strategies such as cooperative learning strategy, guided discovery as well as the use of analogy.

Retention is one of the variables to the present study which is measured in collaboration with performance. This means that closely related to performance is retention. Bichi (2002), opines that, retention is the ability to recall and consequently remember things experienced or learned by an individual at a later time. Akinbobola and Falasade (2009), revealed that, when teaching is characterized by rote-learning, meaningless memorizing on verbalism, students make ineffective learning, and the facts thus learned are not long retained, nor do they seem to have much effect in teaching behaviour. Retention is defined as a preservative factor of the mind which in turn acquires the materials of knowledge through sensation and perception (Kundu & Tutoo 2002). These acquired materials in the mind need to be preserved in form of images for knowledge to develop. Whenever a stimulating situation occurs, retained images are revived or reproduced to make memorization possible. Hence, Biology concepts need to be presented to the learners in a way or method that touches their sub consciousness which can trigger quick recalling of the concepts being taught or learnt. Using such teaching method as cooperative learning, both high and low ability learners would be able to cooperate in terms of understanding and explaining their retention ability. However, in this study the researcher used cooperative learning enriched with analogy and taught ecology concepts in order to determine its impacts on performance and retention among slow learners, SS II Biology students.

Slow learners are students with below average cognitive abilities who are not disabled, but struggled to cope with academic demands in the regular class room (Yusha'u, 2012). Academically, slow learners are usually identified based on their attained scores on intelligence tests, with IQ between 75-89. A slow learner differs slightly from normal children in learning ability and cannot meet average academic standards. In this study, the researcher used the term 'slow learner' as those students who are doing poorly in schools, yet are not eligible for special education (Shaw, Grimes & Bulman, 2005). Slow learners

are students who do not learn successfully due to general socio-cultural problems, frustration, inadequate use of diagnosed as "learning-disabled" by specialist in students psychology (Lescano, 2008). There are different reasons for slow learning, which sometimes might be due to mental disability, their background, illiterate parents, cultural problems, lack of emotional growth, the lack of a secure environment, limited opportunities for learning, absenteeism from school, untrained teacher and large class size (Sultan 2012).

Slow learners are students who find it difficult to keep pace with their classmates but they are not mentally retarded, they are capable of achieving academic success at a slower rate compared to their classmate (Malik, 2012). Pujar (2008) reveals that 27 percent of the students are borderline defective or slow learners whose IQ ranged between 75- 85. The slow learners both receptive and expressive language ability were typically limited. They are often delayed in working or talking. According to Shaw (2005), slow learners are students who are not mentally retarded, but are capable of achieving academic success at a slower rate compared to normal or regular class students only. A Slow learner is difficult to identify because there is no difference in appearance and can function normally in most situations (David, 2010). They usually have normal physical dexterity, adequate memory, and possess common sense. A slow learner initially wants to learn, but has a problem with the learning process. In this study, the researcher used cooperative learning enriched with analogy in teaching selected ecology concepts in order to determine its impacts on academic performance and retention among SS II, Biology slow learners.

Another important variable in this research is the issue of gender differences in academic performance. Bichi (2002) defines gender as the amount of masculinity and femininity found in a person and obviously there are mixtures of both in most human beings, the normal male has a preponderance of masculinity and the normal female has a preponderance of femininity. Several studies have also examined the influence of gender

on students' academic performance. Olatoye and Adekoya, (2009 & 2010) found no gender difference in academic performance of students exposed to different teaching strategies in science. Njoku (2007), observed that boys perform better than girls in science, Technical and Mathematical subjects. Oyedeji (1991) on the other hand reported the significant influence of gender on academic performance with boys having better scores than girls in the study. However, this study determines the impact of cooperative learning enriched with analogy on slow learners academic performance and retention in ecology concept of biology.

1.1.1 Theoretical Framework

The theoretical framework that guided this study was based on constructivism theory of learning. The theory of constructivism is attributed by Bruner (1960) and Vygosky (1978). Bruner was one of the founding fathers of constructivism theory. Constructivist theory is of the view that learning is an active process in which learners construct new ideas or concepts based on their current knowledge (Bruner, 1960). He also revealed that, learners select and transform information and make decisions, relying on a cognitive structure, the various representations that an individual construct may be equally valid. Bruner (1966) claims that constructivism is also based on the idea that students construct their learning on past knowledge and that reasoning plays an importance role in the learning process. However, constructivism learning theory was applied in this study on teaching with- analogy because students construct knowledge and creation of new ideas from what they have already known.

Eventually Bruner (1978), was strongly influenced by Vygotsky's writings and began to turn away from the intrapersonal focus he had for learning to social and political view of learning. Vygotsky (1978) opined that, through a process of 'scaffolding' a learner can extend beyond the limitations of physical maturation to the extent that the development

process lags behind the learning process. Vygotsky also states cognitive development stems from social interactions from guided learning within the zone of proximal development as children and their partners co-construct knowledge.

In this study, the teacher's role in constructivist teaching is to serve as facilitator of learning in which students are encouraged to be responsible, autonomous and construct their own understanding of each of the scientific concepts. In a constructivist classroom, ideally, analogy can help students to build meaningful relations between what they already know and what they are setting out to learn. In general, this activity of building relations plays a critical role in constructivist views of learning science, thereby involving students in the construction of knowledge and the creation of new ideas from what they already know. Thus, constructivists believed that students should not learn by receiving message but by interpreting a message. Among the new instructional strategies within the constructivism framework, cooperative learning strategy has been found to enhance student's understanding of science concepts and also bring about meaningful learning (Olorukooba, 2001& Slavin 2009). However, constructivism learning theory was in line with this study which investigated the impacts of cooperative learning enriched with analogy on retention and academic performance of ecology concepts among secondary schools II slow learners.

1.2 Statement of the Problem

Educational researcher David, (2010) revealed a significant high rate of failure in science subjects. The reasons given to explain the situation is that, the methods of teaching employed by the teachers always neglect the slow learners. Khan (2008) revealed that an untrained teacher could not understand the psychology of students and their problems, overcrowded class is also a problem which affects the learning processes and led in creating problem to slow learners and finally led to poor performance in their final senior secondary

school examination. Poor performance of students in science subjects particularly biology, has assumed a serious dimension as reported by West African Examination Council (WAEC 2010 - 2014). The data in Table 1.1 was an indication of the failure rate in biology over the years.

Table 1.1: Performance of Students in Biology in WAEC in Nigeria from 2010-2014

Year	Biology total Entry	Total pass	% Pass at Credit Level	Total Fail	% Fail
2010	1,289,048	437503	33.94	851545	66.06
2011	1,364,655	390019	28.58	974636	71.42
2012	1,072602	381525	35.57	691077	64.43
2013	1,485,048	548868	36.96	936180	63.04
2014	1, 90355	700128	36.78	1203427	63.22

Source: WAEC Annual Report (2014).

Mari (2001) revealed that one of the problems of increased number of students in the class is limited range of teaching method and inability of teacher to provide for the specific learning needs of the individuals student and this has resulted into poor performance of students. In view of these problems, the activity-base teaching strategy such as cooperative learning strategy had been proposed in teaching science especially for slow learners. However, this study investigated the impact of cooperative learning enriched with analogy on retention and performance in ecology concepts among secondary schools slow learners'.

1.3 Objectives of the Study

The objectives of the study are to:

1. determine the impact of cooperative learning enriched with analogy on the performance of slow learners in ecological concepts;

2. examine the difference in the mean scores of slow learners in the pre-test and post-test of the experimental group;
3. determine the impact in retention ability of slow learners taught ecology concepts using cooperative learning strategy enriched with analogy; and
4. find out the difference between the performance of male and female students taught ecology concepts using cooperative learning strategy enriched with analogy.

1.4 Research Questions

The study found answers to the following questions.

1. What is the difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method?
2. What is the difference between the mean scores of slow learners in experimental group before and after taught ecology concepts using cooperative learning enriched with analogy?
3. Is there any change between the mean retention scores of slow learners' taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method?
4. Is there any difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy?

1.5 Null Hypotheses

The following hypotheses were formulated for testing at $P \leq 0.05$ level of significance

Ho_1: There is no significant difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method.

Ho_2: There is no significant difference between the mean scores of the slow learners' in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy.

Ho_3: There is no significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method.

Ho_4: There is no significance difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy.

1.6 Significance of the Study

The findings of this study would hopefully be useful to the followings:

i. **Biology students:** would have the opportunity to learn by themselves with little guidance from their teachers and would enhance interaction among them and demands creative thinking in their cognitive structure. The teaching method would enable students to learn meaningfully and respond better to their class mates and to their teachers. The students would also attain companionship among them and will exercise their skills practically. This would enhance students' performance and retention in Biology.

ii. **Science teachers:** would benefit from this study by adopting the strategy used in teaching ecology concepts, this make the lesson interested to the students In helping them to select the appropriate strategies for teaching ecology concepts so as to cater for different ability level and improve the students' performance in biology.

iii. **Curriculum planners** of senior secondary school biology might consider the findings of this study and make appropriate review of the curriculum where necessary. This would help to enhance the performances of slow learners in biology thus reducing the rate of drop out in the subject.

iv. **Professional Bodies**: such as Science Teachers Association of Nigeria (STAN), Mathematics Teachers Association (MAN) and National Education Researches Department (NERD) among others would consider the result of the research with a view to using the strategy to promote science instruction in schools.

v. **Researchers and educationists** would benefit from the findings of this study because results of this research would form a basic foundation for further studies using cooperative learning enriched with analogy.

vi. **Curriculum developers**: Curriculum developers might consider the findings of this study and make appropriate review of the curriculum where necessary

1.7 Scope of the Study

This research investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary school ecology slow learners in Dawakin Kudu Education Zone Kano State. This research was delimited to SS II biology students of public secondary schools in Dawakin Kudu Education Zone Kano State, Nigeria. Four schools were sampled for this study; two were the experimental and were the control because all schools in Dawakin kudu education zone are either male or female schools only no co-education. SS II students were considered suitable for the study because of their experience in biology and stability in secondary education more than SSI students who have not yet gained much academic experience and the SSIII students are busy preparing for SSCE examination. The chronological age range of the students was 16 – 17 years old.

The research was limited to slow learners only and the topics for this research include the following:

- functioning ecosystem
- aquatic and terrestrial habitat and
- ecology of populations

This was choose because of their link to the environment in ecological studies, direct influence on human social life and It was consider abstract in nature and difficult to understand which has resulted in poor performance among secondary schools students (Danmole & Femi 2004, WAEC 2006).

1.8 Basic Assumptions

The study has the following basic assumptions:

1. That the biology teachers' were experienced and qualified as recommended in the National Policy on Education (FME, 2013).
2. That the sampled schools ran the same academic calendar and use the same WAEC syllabus for biology.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter examined the related literature to this research in Nigeria and other parts of the world in general. These were discussed under the following subheadings:

2.2 Historical development in Science Education

The society we live is dynamic. The changes in the society coupled with the changes in the needs of man has greatly influenced and is still influencing the science education curriculum, bringing about a shift in the content of what is learned to accommodate such changes. The teaching of science in Nigerian schools dated back to the era of Christian missionaries, who brought the western education into the country. With the establishment of Church Missionary Society (CMS) grammar school in lagos in 1859, Roman Catholic Missionary (RCM), Wesleyan Methodist Mission, African Mission of South Baptist Convention, United Presbyterian Church of Scotland Mission, some rudiments of science education were injected in to the schools curriculum including arithmetic, algebra, geometry and physiology. The major development in science education took place in Nigeria starting from Yaba College of Upgraded 1n 1963 to Yaba College of Technology. It produced first set of graduates who taught science in secondary schools and played major role in laying the foundation for the development of appropriate curriculum for science in the secondary schools

The introduction of Higher School Certificate (HSC) in 1951 gave schools the opportunities to offer Chemistry, Biology and Physics at higher level, with emphasis on laboratory work to meet the practical requirements of science subjects. In 1952, an examination board was set up with its headquarters in Accra, Ghana. This followed Jeffrey report of 1950. The board later became the West African examination council (WAEC), which received the curriculum of school subjects including science, with its first examination in 1955.

The Science Teachers Association of Nigeria (STAN), established on the 30th November, 1957, revised the science curriculum of WAEC and HSC in May 1968. The Federal Colleges of Arts, Science and Technology at Ibadan

in 1950, Zaria in 1952 and Enugu in 1954 administered a fairly comprehensive curriculum in science education and science related fields e.g. architecture, engineering, pharmacy etc.

For Nigeria, the historic national curriculum conference held from 8th - 12th Sept 1969 spurred various bodies including government agencies to develop science curricular for both primary and secondary levels of education, which brought about the new NPE of 1977 revised in 1981 which ushered in 6-3-3-4 system of education with the following:

- The Nigerian Secondary Schools Project (NSSP) by the defunct comparative education study and adaptation centre (CESAC), now part of NERDC.
- The Nigeria Integrated Science Project (NTSP)
- Basic Science for Nigerian Secondary School (BSNSS) by CESAC and STAN
- Primary Education Improvement Project: Northern States Primary School Project (NSPSP) by the Institute of Education, ABU, Zaria
- Science is discovering: Mid-Western State Primary Science Project (MSPSP) by Abaraka College of Education.
- Primary Education Improvement Project: Northern States primary Science Project (WSPSP) by the Faculty of Education OAU.
- African Primary Science Project (APSP) by the African Development Council
- Lagos State Primary Science Project (LSPSP) by the Lagos State Ministry of Education.

2.3 Teaching Biology at Senior Secondary School Level

Teaching is regarded as the art of imparting knowledge, skills and attitudes in a person in order to bring about a desired change in behaviour that is relatively permanent. Smith, (2011), defined teaching as the process of carrying out those activities that

experience has shown to be effective in getting students to learn from his own perspective. Aina (2009) described teaching as an articulated attempt by the teacher to help students acquire skills, attitude, knowledge, idea to better their worth in life. This means that the teachers' task is to create or influence desirable positive changes in behaviour and academic achievement of the students. In view of this, the success of any teaching effort is measured by the degree to which the teacher is able to achieve the desired objectives. To achieve these objectives of teaching, the teacher must know the types of learning outcomes expected from the learners and the best methods to employ that will bring about such changes in students' behaviour and academic achievements. Thus, teaching is the only gateway through which the aims and objectives of science education can be achieved using different instructional methods consistent with the nature of science.

The emphasis of modern science teaching and learning is on learners' active participation in the learning process. Moyer *et al* (2007) pointed out that "science viewed in this way, that, science as not just a body of knowledge but rather a process for producing knowledge". The foundational concern has been on how to make the teaching and learning more effective and meaningful so as to achieve the educational goal of the nation (Odoh, 2013). This latter view of science therefore calls for a change from the transmission method of presenting science to students to allowing the students to interact with the natural world to create knowledge.

The teaching of biology requires the teacher should be knowledgeable in the various method and strategy for teaching biology include; lecture, enquiry ,discovery, guided discovery, project laboratory, field trips/excursion, cooperative, individualise method of teaching. The advantages, disadvantages and suggestion for the effective use of such method were highlighted by (Aina, 2009). Biology is a widely read subject in schools probably because of its greater relevance to man and other organisms than any other science

subject. The importance of biology to man is seen in its application in agriculture, medicine and psychology. At the secondary school level, whether the school is purely commercial, technical or comprehensive, the study of biology is compulsory This is not so with other sciences. It becomes necessary therefore, not only to produce teachers who can teach biology but to teach would-be teachers how the subject can be presented through the use of appropriate methods of teaching.

2.3.1 Concept of Ecology

Biology is one of the core science subject expected for learners to undergo at a senior secondary school level. Ishaq, (2014) defined biology as a discipline which is the study of life and living organism, their structure, function, growth, evaluation and taxonomy. Ishaq, (2014) observed that biology involved exposing students to several opportunities that can help them to understand different type of concepts, principle and theory. Some of the concepts taught in secondary schools level biology include; cells and it's organelles living and no living thing, classification of both plant and animals[taxonomy], neurons system, ecology, Reproduction system, Respiratory system, digestive system, hormones, micro-organism, senses organs, vertebrate and invertebrate, environmental pollution, plant and animal pathology, evolution, genetics among others (Sani 2006).

The word 'Ecology' originated from the Greek word 'oikes' meaning dwelling place or home. Literally, Ecology is the study of organism at home. Scientifically Ecology is the study of living organism in his relationship with his environment. Some of the concepts in Ecology are:

- Biotic factors
- Abiotic factors (physical factors)
- Population

- Biotic community
- Ecological Niche
- Succession
- Ecosystem
- Feeding relationship within a community

2.4 Methods of Teaching Science

Prior to the introduction of the formal system of education in Nigeria by the colonial masters, there were methods of teaching or imparting knowledge, skills and attitudes in the traditional society. These methods were not highly popularized until the introduction of formal system of education in Nigeria in 1843 (Kolawole, 2008). The methods that science teachers employ in the classroom to present scientific facts, information, principles, skills on concept to the students are many. Some are more frequently used than others. These methods that are frequently used as stated by Abdullahi, (1982) and Dyel, (2011) include:

- Demonstration method
- Discovery method
- Discussion method
- Field trip
- Individualized learning method
- Project method
- Laboratory/investigation method
- Concepts mapping
- Lecture method of talk and chalk method

Demonstration method refers to the type of teaching method in which the teacher is the principal actor while the learners watch with the intention to act later. Here the teacher does whatever the learner are expected to do at the end of the lesson by showing them how

to do it and explain the step-by-step process to them (Ameh, Daniel & Akus, 2007). Nworgu (2006) described it as a display or an exhibition usually done by the teacher while the students watch with keen interest. He also added that, it involves showing how something work or the steps involved in the processing. Demonstration method simply means to display something which involves the introduction of new skills or ability to learn better way of doing something, usually it is accompanied with a lot of explanation and showing how something work or is done .National Open University (NOUN 2009).

Demonstration in Biology teaching simply refers to a display or an exhibition usually carried out by the teacher while the student watch it mostly used in showing the student corrected use of certain science equipment. Demonstration can be carried out by a single teacher alone or by student or group of students. Certain activities in biology that may require demonstration include action of iodine on green leaf, dissection of animals, manipulation of equipment like microscope, action of iodine on cooked starch (National Open University 2009)

However, demonstration method guides students either individual or in a small groups to enable acquisition of intellectual and manufactured skills which are relevant since it afford when the opportunity to discover for themselves valid scientific fact, derive relationship from a theory and develop, scientific attitudes needful for academic and every deny life, especially in reporting accurately what is observed, data collected and enterprise the result. The advantage of this method according to Nzewi, Onyegegbu, and Nworgu, (2009) include:

- Demonstration is an inexpensive method of teaching biological science because it requires demonstration materials.
- Damages and breakages of science equipment are likely not to occur due to the expertise of the teacher.

Demonstration was used to review experiments which the students carried out previously e.g. practical carried out by student in SS 1 and SS II can be revised in SS 3 through the use of this method. It is time consuming and does not lead to coverage of the syllabus, in cases where the demonstration is restricted to the teacher alone, students find it difficult to acquire manipulative skills. In situation where students are not completely involved in carrying out the demonstration, those involve in learning process may be restricted to few of them. In situation while the class size is very large e.g. sixty and above student; visibility of details of what the teacher is doing is not assured particularly in case where small sized equipped or object are used.

Discovery or inquiry method is a teaching technique that assists the students in Problem solving. This method is a student's-centred and activity-oriented thereby gives the learners the opportunity to discover facts about a particular problem. Olajide and James (2009) explained that inquiry approach assist learners to understand problem-solving as they learn by experimentation. This method gives learner the opportunities to engage in exploitation and sense making with science content (Dyel, 2011). It also gives students self direction to assimilate and accommodate information.

In discussion method, the students talk over a subject from various points of view and the teacher acting as moderator. The teacher does not dispense or communicate knowledge. The teacher does not dictate or influence the viewpoints of the students. Students are free to express their reasons rather than recall. Discussion implies that the students have background information about the subject. It develops positive interpersonal relationship, provides students with a sense of confidence and enables them to gain knowledge through active participation.

Field trip is an excursion taken outside the classroom for the purpose of making relevant observation and to obtain specific information. Field trip is however difficult to

plan, creates financial burden on both the school and students, it is also difficult to conduct (Danbana, 2011). This strategy has significant role in enhancing performance in science. Ado *et al* (2009) in their study on field trip approach for teaching area and volume of shapes for architectural skill yielded better performance than the expository method.

A laboratory activity method is an activity carried out by an individual or a group for the purpose of making personal observation of processes, products or events (Osobonye 2002). Laboratory activity is characterized by two aspects: laboratory exercise and experiment operation or procedures. Laboratory exercise consists of activities carried out in order to provide practice in designing, operating and interpreting experiments, while experiment operations or procedures are used for testing a supposition to confirm the known and to discover the unknown. Laboratory method affords students the opportunity to see and use some equipment and tools, to develop mental processes, increase student's ability to think critically and leads to better retention of information.

2.4.1 Conventional Lecture Method

Lecture method is also known as 'Expository or traditional method' or simply 'talk chalk method' (Ezenwoso, 2013). In this method the main preoccupation of the teachers is talking, giving facts, asking or answering questions and writing on the blackboard. Lecture method which is the predominantly use in senior secondary school in Nigeria, it contributes to the poor academic achievement in senior secondary school biology students in Nigeria, hence it is termed as didactic method.(Aina, 2009).The teacher is looked upon as the repository of the knowledge to be transmitted and the students the recipients. Usman (2008), has observed that lecture method encourages rote-learning without aiding understanding, there by resulting in poor performance. The advantage of this method is that, the teacher presents a large amount of material to a large class in a relatively short period. This helps the teacher to cover the syllabus before examinations begin. This

favours' an educational system that lays emphasis on paper qualification. The use of this method has also generated a number of interesting studies among science educators; Abdullahi (1992) revealed that it does not promote meaningful learning of science as it appeals only to the sense of hearing. Science is a doing subject, and for effective learning to take place many senses must be involved. Hearing alone easily leads to forgetting. Remember the Chinese saying:

I hear and forget

I see and remember

I do and understand

The disadvantages of lecture method as given by Abdullahi (1992) are:

i. It does not develop manipulative skills

ii. It does not take individual differences into consideration

iii. Students soon get tired and bored as they are not involved in any activities.

iv. It encourages rote learning which is not a good way of learning science.

Hussaini (2002) and Okoro (2002) revealed that lecture method made students to develop dislike for lectures, especially when the lecturer is one who is inaudible. Dyel (2011) observed that lecture methods are not satisfactory, especially when used in large class with students of varied ability. The role of students' personal experience in their construction of knowledge has been neglected in previous methods. However, there is need to shift from teaching which is teachers centred to students centred instructional strategy which recognised the role of personal group participation in development of scientific knowledge (Kilic 2008). However, constructivism is often associated with pedagogic approaches that promote active learning or learning by doing. Science educators, recommend for instructional strategy that enhance effective academic achievement in relation to improve students' attitude and retention among science students despite their

number far class. Therefore, the aim is to determine the impact of cooperative learning enriched with analogy on academic performance and retention of SS II slow learners biology students.

2.4.2 Concept of Cooperative Learning Strategy

Cooperative learning is one of the means of active learning might serve as an increase learning effectiveness and providing students with skills of collaborating, cooperating, sharing and socializing. Gupta and Pasrifa (2012) revealed cooperative learning as an efficient technique to convert students into active learners in classroom and it make teaching and learning more satisfying, momentous, enjoyable and effective. cooperative learning is the instructional use of small groups through which student work together to maximize their own and each other learners" In classroom where collaboration is practised, students pursue learning in group of varying size: negotiation, initiating, planning and evaluating together. Salavin (2011) reveal cooperative learning as instructional method in which teachers organised students into small group, which then work together to help one another learn academic content. It can also be seen as one in which the goals of each individuals are linked together with that of the others so that there is positive correlation in the attainment of this goals. Cooperative learning is one of the approaches most frequently evidenced in the areas of research and educational applications in addition to being a concepts drawing attention among teachers, school administrators and educationists (Johnson & Johnson, 1990; Graham, 2005; Maloof & White, 2005). Cooperative learning is an approach in which students help one another with any academic issues for common purpose forming small groups both in and outside the classroom, in which they gain self-confidence, develop their communicative skills strengthen their problem solving and critical thinking abilities and participate in teaching and learning process actively (Eilks, 2005& Gillies, 2006).

The students in cooperative learning classroom are motivated toward working in groups helping one another (Dyel, 2011). All members of the group seek immature benefit so that every member gains from each other support. They worked and discussed the solution to their problems through explanation, listening and encouraging each other by providing academic help (Nzewi *et al,* 2009). During the activities' the students show their developing competence and confidence in learning process, development of school knowledge, social activities and relationship are been build up among the students and they have remarkable depth of knowledge which they share with one another.

Researches in cooperative learning strategy have demonstrated many outcomes, among these are Arthy (2012), opined that, the cooperative learning environment students work together in groups toward completion of some common task. It may be specifically important in teaching science this is because science in actual practice involve working with others create many opportunities that do not occur in lecture method. Mohammadi and Salimzadeh, (2009) investigated the effect of cooperative learning strategy training on reading comprehension and found statistically significant difference between experimental and control group. Isfatul, (2012) examined the implementation of cooperative integration reading and narrative tax at eleventh grade and found its positive effect on reading skills. Mahnaz, (2012) studied the effect of teaching method in exploring the Iranian students. Reading performance, the positive results attained were attributed to the major specifies of the cooperative teaching such as positive inter dependence, group formation, individual accountability, social skills, and structuring and t-test indicated that statistically significance difference between the experimental group and control groups.

Cooperative learning represents a shift in educational paradigm from teacher centred approach to a more student-centred learning in small group. It creates excellent opportunities for students to engage in problems. Olorukooba, (2001), cooperative learning

has the potential in science classroom because of the following factors: science students always work in group during science experiment in the laboratory therefore what they need is skills to work in groups, science laboratory is spacious with a chairs and desk; science class-size are usually two periods with the minute each enough time for cooperative learning and during experiment many values can be inculcated. Ajaja and Eravwoke, (2010) reaffirmed the ability of cooperative learning when used as an instructional strategy to bring about significant improvement in student's achievement in school science subjects. She also suggested that science teachers need to try cooperative learning in order to enhance scientific skills and to inculcate performance in science. In this study cooperative learning enriched with analogy was used to determines its impacts on academic performance and retention among SS II slow learner Biology students.

Essential Characteristics of Cooperative Learning in the Classroom:

Researches that focused on the implementation of cooperative learning as a teaching strategy agree that the teachers must establish some essential element in order to maximize the benefit of cooperative learning to their students. It is only under certain conditions that cooperative learning efforts may be expected to be more productive and individualistic effort those condition according to Johnson & Johnson, (2009) are:

- Clearly perceived positive interdependence
- Considerable promotive (face-to-face) interactions
- Clearly perceive individual accountability and personal responsibility to achieve the group goals.
- Frequent use of the relevant interpersonal and small group skills.
- Frequent and regular group of current functioning to improve the group future effectiveness

The first requirement for an effectively structured cooperative lesson is that students believe that they "sink or swim together" within cooperative learning situation in which students have two responsibilities: (1) learned the assigned materials, and (2) ensure that all member of the group learn the assigned materials. The technical term for that dual responsibility is positive interdependence. Positive interdependence exists when students perceive that they are linked with the group mates in such a way that they cannot succeed unless their group mates do (and vice versa) and/or that they must coordinate their effort with the efforts of their group mates to complete task.

Slavin, (2011) reveals that cooperative learning comprises "instructional methods in which teachers organised students into small groups, which then work together to help one another learn academic content". The lesson will not be cooperative if students do not "swim together" in the group learning activities (Johnson & Johnson, 2008). Hence positive independence needs to be constructed in cooperative learning groups to help students work and learn together. When positive independence is clearly constructed, it establishes that:

- Each group member's effort is required and indispensable for group success.
- Each group member has unique contribution to make to the joint effort because of his or her resources and/or rose and task responsibilities.

Teachers must structure learning tasks so that students come to believe that they can sink and swim together that is, their access to reward as a member of academic team where all members received a reward or no member does. Essentially, tasks are structured so that students must depend upon one another for their personal, teammates and group success in completing the assigned task as well as mastering targeted content and skills. There are number of ways of structuring positive independence within learning group. These are:

- Positive goal interdependence
- Positive reward – celebrate interdependence

- Positive resources interdependence
- Positive role interdependence

Firstly, positive goal interdependence students perceive that they can achieve their learning goals all the members of their groups also attain their goals. The group is united around a common goal. So as to ensure that students believe they "sink or swim" together and care about how much each other learns. The teacher has to instruct a clear group or mutual goals (Johnson & Johnson 2008). Positive reward celebrate interdependence is what each group members receives the same reward when the group achieve its goals. To supplement goal interdependence, teachers may wish to add joint reward. Sometimes teachers give students a group grade for the overall production of the groups, an individual grade resulting from tests and bonus point if all members of the group achieve the criterion on test. Regular collaboration of group efforts and success enhance the quality of cooperation. Positive role interdependence such member is assigned complementary and interconnected roles that specify responsibilities that the group needs in order to complete the joint task. Teachers create role interdependence among students when they assigned them complementary role such as reader, checking of understanding, encouragement of participation and elaborator of knowledge. Positive resources interdependence each group member has only a portion of the resources, information, or materials necessary for the task to be completed; the members resources have to combine for the groups to achieve its goals. Doing so creates a commitment to the success of the group members as well as one's own. So if there is no positive interdependence, there is no cooperative.

The second element of cooperative learning is promotive interaction (face-to-face), positive interdependence results in promotive interaction which may be seen as individual encouragement and facilitating each other's efforts to achieve, complete tasks, and produce in order to reach the group goals. Promotive interaction is characterized by individuals

providing each other with an efficient and effective help and assistance, exchanging needed resources, such as information and material and processing information more efficiently and effectively, providing each other with feedback in order to improve their subsequent performance challenge each other's conclusion and reasoning in order to promote his/her quality decision making and greater insight into the problems being considered; advocating the exception of effort to achieve mutual goals; influencing each other's effort to achieve the group goals; acting in trusting and trustworthy ways; being motivated to strive for mutual benefit; and maintaining a moderate level of arousal characterised by low anxiety and stress. Ajaja (2012) reveals that promotive interaction occurs as individual encourage and facilitate each other's effort to accomplish the groups' goals. Johnson and Johnson (2008) revealed that students are required to interact verbally with one another on learning tasks. Doing so helps to ensure that, cooperative learning groups are both academic support system and personal support system. It is through promoting each other's learning face-to-face that members become personally committed to each other as well as to their mutual goals.

The third essential basic element of cooperative learning is individual accountability and personal responsibilities were two levels of accountability was structured into cooperative lessons. The group must be accountable for achieving its goals and each member must be accountable for contributing his or her share of the work. Individual accountability exists when the performance of each individual is assessed and the results are given back to the group and the individual in order to ascertain who needs more assistance, support, and encouragement in learning. The purpose of cooperative learning groups is to make each member a stronger individual in his or her right. Students learn together so that they subsequently can gain greater individual competency. Parveen, Mahmood and Arif, (2011) noted that individual accountability exists when the

performance of each individual is assessed, the result are given back to the individual and the group to compare against a standard of performance and the member is held responsible by group mates for contributing his or her share to the group's success. Johnson and Johnson, (1990) therefore, suggested that teachers give individuals tests, where by randomly selected students works and have each student explain what he or she learned in order to facilitate individual accountability during cooperative learning. The purposes of cooperative learning group are to make each member a stronger individual in his or her right. Individual accountability is the key to ensuring that all group members are in fact, strengthen by learning together so that they subsequently gain greater individual competency. Johnson, (2009) reveal that students ask for assistance, do their best work, present their ideas, learn as much as positive, take their tasks seriously, help the group operate well, and take care of one another.

Fourth essential basic element is the appropriate use of interpersonal and small group skills students to coordinate effort for achieving mutual goals, and they must get to know and trust one another, communicate accurately and unambiguously, accept and support each other and resolve conflict constructively (Johnson, 2008). Placing socially unskilled students in a group and telling them to cooperate does not guarantee that they have the ability to do so effectively. Interpersonal group and small group skills do not magically appear when they are needed. Students must be taught the social skills for high quality collaboration and be motivated to use them. Cooperative groups can be productive if the whole fields of group dynamics are based on the promise that social skills are the key to group productivity (Johnson & Johnson 1991). The more socially skilful students are and the more attention teachers pay to teaching and rewarding the use of social skills, the higher the achievement expected within cooperative learning groups.

Fifth essentials element of cooperative learning is grouped processing which is influenced by whether or not group reflection on how well they are functioning. Yamarik, (2010) revealed that group proceeding improve students effectiveness toward contributing to the shared effort in order to achieve the group goals via reflection on the learning processes. Groups need to distribute members actions that can be helpful and unhelpful and make decisions about their beliefs of working together and determining how group effectiveness can be achieved the group goals. Tran, (2013) observed the purpose of group processing is to clarify and improve the effectiveness of the members in contributing to the collaborative effort to achieve the groups' goals.

However, teachers are systemically monitoring the cooperative learning groups; he or she attains a "window" into what students do toward understanding the concepts as they explain to one another how to complete the assignment. Listening to the students' explanation provides valuable information about how well they understand the instruction, the major concepts and the strategies being learned. There are two level of processing-small group and whole class. In order to ensure small group processing take place when the teachers allocate time at the end of each class session for each cooperative group to process how effectively members worked together. Parveen *et al (*2011). *G*roup needs to describe what member action both helpful and unhelpful in completing the groups work and make decision about behaviours then decided to continue or change. Such processing, enable learning groups to focus on maintaining good working relationships among members, facilitates the learning of cooperative skills, to ensure that members receive feedback on their participation, To ensure that students think on the metacognitive as well as the cognitive level and provide the means to celebrate the successes of the group and reinforce the positive behaviours of group members (Johnson, 2009).

In addition to small-group processing, the teacher should periodically engage in whole class processing. When cooperative learning groups are used, the teacher observes the groups, analyses the problem and gives feedback to each group on how they are working together. The teacher should systematically monitor from one group to another and observe their work. A formal observation may be used to gather data or collect specific data for each group. At the end of the class the teacher then conduct a whole class discussion of the result of each group with the students. (Johnson & Johnson 1998) in Dyel (2011)

Models of Cooperative Learning Strategy

Several models are utilized in cooperative learning structure in order to improve students' learning. These models of cooperative learning vary considerably from one another (Johnson, 1990). Four most widely used models of cooperative learning strategies include:

i. The Jigsaw model

ii. Student Team Achievement Division (STAD Model)

iii. Johnson and Johnson model of learning together

iv. The group investigation model

Jigsaw Model: The "Jigsaw model" is a cooperative learning which is applicable to team assignment that calls for expertise in several distinct areas. This model is one of cooperative learning techniques which is based on group dynamics and social interaction. It is one of the pure cooperative learning strategies which allow students to actively participate in learning processing (Sahin, 2010). By being constantly subjected to this method, students feel more comfortable about their roles. This model enhances cooperative learning by making students responsible for teaching some of the material to the group (Slavin 2011).

In the application of Jigsaw model students separate from their group of either four or six with other students who are responsible for preparing the same subject. Either the

teacher or the team members designate which member will be responsible for each areas then all the experts in each area are given specialized training, which may involve getting handouts or presentation by the course teacher. They make plans about how they can teach the subject to their friends, and prepare a report. Afterwards, they turn to their own groups and teach their subject to them with the help of the reports they have prepared. In the last stage of completing, teacher can perform some activities with individuals, small groups on the whole class in order to unify the student learning. However, if the overall students are tested on all of the area of expertise, the overall learning from the assignment will improves dramatically. The test requires all students to understand the entire assignment not just the part they were the expert in (individual accountability) and the expert have the responsibility of transmitting their expertise to their team-mate (positive interdependence) (Slavin, 2008).

Student Team Achievement Division (STAD):

STAD was originated by Robert Slaving and his colleagues in (1978) at Johns Perkins University, United States of America. The STAD model underscores many of the attributes of direct instruction, and it's very easy model to implement in science classroom. STAD operates on the principle that student's work together to learn and are responsible for their team mate's learning as well as their own. This model is structured and organized on such a way that students in each classroom were divided into groups with four or five member for group and the students in the group are balance in terms of academic ability, gender and ethnicity. The teacher is responsible for introducing the class topic and assigning sub-topics to each group. There are four phase to the STAD model.

Phase I. Teacher (Class presentation): The class presentation is a teacher directed presentation of the material such as concepts, skills and processes that the students are to learn. The teacher should carefully write and planned objectives that can be used to determine the nature of class presentation and the team study to follow.

Phase II. Team study: Team members work together with prepared worksheets and make sure that each member of the group can answer all the questions on the worksheet. Students should move their desks so that they face each other in each small team. The principles that is integral, not only for STAD, but to all cooperative learning models is that student must talk with one another in team learning session. It is during that session students will teach one another and learn from each other.

Phase III. Test: After the team study is completed, the teacher administers a test to measure the knowledge that students have gained. The students take the test/guise individually and are not permitted to help one another. To encourage students to work harder STAD use an individual improvement score. Each student is assessed based on his or her previous performance on similar guise and test.

Phase IV. Team recognition: Teacher can use special words to described the team performance such as science stars, science geniuses etc. Recognition of the work of each team can occur by means of a newsletter, handout, or bulletin board that reports the ranking of each team within the class. It is important to praise students academically from low status groups because it is an integral part of the effectiveness of cooperative learning group (Whitley, 2010).

Essentially, in the STAD model the team rules are explained as students have responsibility to make sure that their team mates have learned the materials, no one should finish studying until all team mates have mastered the subject, student should ask team members for help before asking the teacher and team members may talk to each other softly.

Individual is the focus of learning but development and improvement scores were assessed for a team studying group.

Johnson and Johnson Model of Learning Together:

Learning together model of cooperative learning was developed by Johnson and Johnson at the University of Minnesota in 1998. This model is one of the cooperative learning techniques which are based on group dynamics and social interaction. This model involves students working on assignment sheets in four- or five-member heterogeneous groups. The groups hand in a single sheet and receive praise and rewards based on the group product. Their methods emphasise team-building activities before students begin working together and regular discussions within groups about how well they are working together in their groups. It is one of the pure cooperative learning strategies which allow students to actively participate in learning processing (Sahin, 2010).

The Johnson model of cooperative learning is characterized by interdependence (sink or swim together) by the explicit and sustained teaching of structured social skills. Johnson & Johnson model of cooperative learning is an instruction that involves students working in teams to accomplish a common goal, under conditions that include the following steps:

Step 1: - students are in their different groups.

Step 2: -introduction of the topic and behavioural objectives of the lesson.

Step 3: -study materials and activity worksheet are given to each group.

Step 4: - Subgroup members are working together on the activities following the instructions on the activity worksheet to complete the activities, and each student in the group has a role to play. These are:-

Role A: Reader/checker will read the instructions for performing the activities to group and ensure all group members understand the instructions.

Role B: Questioner/Gate keeper will ask the researcher questions noted by the group members and ensure that every member participate in the activities.

Role C: Reminder/prober, this member will assist group members to remember and address each other by name and encourage his group members.

Role D: Recorder will assimilate the group reasoning and restate its approach in arriving at a sound conclusion and record the group members result.

Step 5: The activity worksheet will be collected from the subgroup and score by the researcher.

Step 6: Whole class discussion of the activities result by the teacher with the students.

Step 7: evaluation, conclusion of the lesson and review of cooperative learning skills used during the lesson.

Step 8: activity worksheet returned to the study subjects for encouragement of the group members.

Therefore, this study used learning together model of cooperative learning to investigate the impact of cooperative learning enriched with analogy on retention and performance in ecology concept among SS 2 slow learners in Dawakin kudu education zone Kano State, Nigeria.

Group Investigation Model:

This model was developed by Yeal, Shlomo, and Sharan (1989), the group investigation method is one of the most complex forms of cooperative learning models. It philosophy is to cultivate democratic participation and an equitable distribution of speaking privileges. It also encourages students to study different topics within a group, and to share what they learn with group members and with the whole class. This method place maximum responsibility on the students, who identify what and how to learn, gather information, analyze and interpret knowledge, and share in each other's work. Group investigation place

more responsibility on each group to make decision about content and processing the teacher must stay in contact with the groups, and facilitate their flow through the phases. There are several phase to the group investigation which are:

Phase I: Topic and problem selection. Students are organised into groups of two to six and choose a specific topic or problems in general subject of science. Each group plans its own topic or subject of investigation and strategy for exploration then individuals or pairs with the group select sub-topics or specification investigatory task and decide how they will carry them out.

Phase II: cooperative learning: teacher and students in each learning team plan specific learning procedure, tasks, and goals consistent with the sub-topic of the problem selected.

Phase III: Implementation: students carry out the plans formulated in the second step learning should involve a wide range of activities and skills, and should lead students to different kinds of sources, both inside and outside the schools. Students might work in small groups or individually to gather data and information.

Phase VI: Analysis and synthesis: Students meet to discuss the result of their sub-group or individual work. Meeting of this nature will naturally take place more than once during the implementation of group investigation.

Cooperative Learning and Academic performance

Many different researchers in different academic fields undertook experimental studies to compare the effects of the cooperative learning strategy and the traditional learning pedagogy on students learning and other outcomes. These varied fields are as follows: mathematics and science (Souvignier & Kronenberger, 2007; Mehra, V. & Thakur, K. 2008; Chianson, M. M. , Kurumeh, M. S., Obida, J. A2010 &, Yusha'u, 2012); biological sciences (Isaq U.2012); chemistry (Olorukooba 2001;Doymus, 2008, Doymus *et al.*, 2010;&Odoh 2013); physics (akinbobola 2009). In an attempt to assess the effect of

cooperative learning, an individual reward structure and accountability on productivity and learning. Three experimental conditions were used:

- A cooperative reward structure in which students were allowed to help one another during the study but should not help one another to take test.
- A reward structure in which students were allowed to help each other to study as well as take a test and.
- An individual reward structure in which students both worked and took test by themselves.

Mohammadi and Salimzadeh (2009) investigated the effects of cooperative learning strategy on reading comprehension and found statistically significant differences between control and experimental groups. Isfatul, (2012) also examined the effect of Implementation of Cooperative Integrated Reading and Composition Technique to Teach Reading Narrative Text at Eleventh Grade and found its positive effects on students' reading skill. Olorukooba, (2001) in her research on the relative effect of cooperative instructional strategy and traditional lecture method of instruction on the performance of students in chemistry among secondary schools, she used chemistry achievement test (CAT), Attitude to Cooperative Instructional Strategy Inventory (ACISI) and Cooperative Instructional Package (CIP) was used to collect data from 264 students.

From her finding, the fallowing conclusions were made;

i. Cooperative instructional strategy has positive impacts on:
    a. Performance of students in chemistry
    b. Retention of concepts in chemistry
    c. Students attitude in chemistry.

ii. Experimental group performed significantly better than those in control group.

iii. Cooperative learning strategy is effective in reducing gender inequality in the performance mean score of the subject in chemistry.

iv. Students that expose using cooperative instructional strategy retained concept better than those taught using lecture method.

v. Students in experimental group have positive attitude to Cooperative learning strategy.

Ajaja and Eravwoke (2010), studied the effect of cooperative learning strategy on students' achievement in Integrated Science. The findings of the study indicated that, students in cooperative learning group scored higher than those in the lecture group in an achievement test, a higher attitude score by students in cooperative learning group than those in the lecture group and there is no significant difference in achievement scores between male and female students in the cooperative learning group.

Mahnaz, (2012) studied the effect of teaching method in exploring the Learners' reading performance the positive results attained were attributed to the major specificities of the cooperative teaching such as positive interdependence, group formation, individual accountability, social skills, and structuring. t-test indicated statistically significant differences between the experimental and control groups. Sharma, (2008) studied problem-solving ability and scientific attitude as determinant of academic achievement of higher secondary students and found that higher achievers had high problem-solving ability in comparison to average and low achievers; there exist positive relationship between achievement, problem-solving ability and scientific attitude.

Faryadi (2007) compared the effect of cooperative learning with individual learning and concluded that cooperative learning enhances learner's emotional and social performance and improve their academic achievements. Adeyemi, (2008) found that students exposed to cooperative learning strategies performed better in their academic

achievements than their counterparts in the other groups. Arthy, (2012) investigated the relative effectiveness of Small Group Interaction Techniques in Enhancing Reading Comprehension Skills and concluded that cooperative learning to be an effective method for improving reading comprehension. Therefore, it is the interest of this study to investigate the impact of cooperative learning enriched with analogy on students' retention and performance in ecology concept among SS 2 slow learners in Dawakin kudu educational zone Kano State.

2.5 Retention Ability in Science

Report from different researchers in different academic fields undertook experimental studies to compare the effects of the cooperative learning strategy and the traditional learning pedagogy on students' retention. Olorukooba, (2001) in her research on the relative effect of cooperative instructional strategy and traditional method of instruction on the performance of students in chemistry among secondary schools, she used chemistry achievement test (CAT). And she concluded that, cooperative learning enhances learner's retention ability. Nuhoglu and Yalcin(2006) found that learning cycle enhanced the retention of science knowledge. They specifically emphasized that learning cycle makes knowledge long lasting and that students become more capable to apply their knowledge in other areas outside the original context.

Maleri *et al* (2008) studied the effect of cooperative learning on academic achievement style by taking sample of 112 students of 7 grades and found that students that are exposed to cooperative learning yield better mean gain on achievement and retention scores as compared to those taught through conventional group learning; field independent student yielded comparable mean gain on achievement scores but field independent and field dependent students yielded better mean gain on achievement and retention score through cooperative learning than conventional group learning.

2.6 Concept of Analogy in Science Teaching

Analogy was developed to enhance mental activities of students in the learning of scientific concepts. Sani (2006) as cited in Olorukooba *et al* (2012) analogy is a comparison of something familiar and unfamiliar in order to explain a shared principle. Analogy refers to those aspects of the teacher's explanatory discourse in which a familiar situation similar to the unfamiliar phenomenon to be explained. An analogy builds on the frame work of the learners existing knowledge so they are not starting from the scratch. Abimbobola (2002) refers to analogies as pictorial, metaphorical or model methods of thinking that suggests areas of similarities between two or more things that require observation and/or experimentation to empirically establish findings. Analogy according to the oxford advanced learners dictionary is a comparison of one thing with another thing that has similar features.

In addition an analogy is a comparison between two domains of knowledge-one that is familiar and one that is less familiar. The familiar domain is often referred to as the "vehicle," "base," "source," or "analogy" domain; the less familiar domain, or the domain to be learned, is usually referred to as the "target" domain (Akbar, Haluk, & Badrin (2013). According to Akbar *et al* (2013) described analogy as a mapping of knowledge between two domains such that the system of relationships that holds among the objects in the analogy domain also holds among the objects in the target domain. Thus, the purpose of an analogy is to transfer a system of relationships from a familiar domain to one that is less familiar (Mason & Sorzio, 1996). Analogies are most often used in an educational setting to help students for understanding new information in terms of already familiar information and to help them relate that new information to their already existing knowledge structure (Beall, 2009).The unfamiliar domain or phenomenon to be explained is referred to as target and the familiar domain is referred to as source. Analogy is built on the framework of the

learners' existing knowledge so that learners are not starting from the scratch. In teaching with analogies, the goal is to transfer ideas from a familiar concept (the analogue) to an unfamiliar one (the target). Analogy may play a significant role in problem solving, decision making, creativity, explanation and communication (Nworgu & Otum 2013), However, Treagust (1993) see analogy as a mapping of knowledge from one domain (the base) into another (the target) which conveys a system of relations that hold among the base objects and among the target objects.

Analogy is like a bridge that span the gap between what a teachers wants the students to learn and what a students have already know (Olorukooba *et al* 2013). Research studies have delineated cognitive steps that occur when people reason on the basis of analogical comparisons and have provided fundamental insights into how features of the source and target analogy affect reason processing. They have long been used as tools of discovery in science and mathematics and are often used as explanatory device in the classroom. For effective use of analogies, three conditions are necessary:

- It is essential that the analogy be familiar to as many students as possible
- Shared attributes should be precisely identified by the students
- The unshared attributes should be explicitly identified.

The most common way of coping with novelty is by the use of metaphors and analogies. By using analogy in an instruction, we link the new to the old, novel to the familiar. In using analogy in the classroom, care must be taken to ensure that an impression is not given that the analogy is a true description of the target concept. Analogies can be utilized in two ways: verbal and pictorial. While diagrams, figures, and pictures are given to learners to teach the concepts that are hard to learn, verbal explanations which correspond to verbal analogies can support the understanding of the pictures (Vianville, 1998).

2.6.1 Different Models of Analogy in Science Teaching

Analogy could be made an essential part of the teaching-learning process if all dimensions of analogies are carefully and adequately incorporated (Sani, 2006). Analogies are of various types depending on the nature of what they represent and the problem they are intended to solve in the teaching and learning situation. Examples of analogy models are:

i. General Model of Analogy Teaching (GMAT), .Zeitoun (1984)

ii. Focus, Action, and Reflection (FAR).Model Treagust, Harrison, and Venville (1998)

iii. Bridging-Analogy Model (BA) Clement (1987),

iv. Teaching-With-Analogy (TWA) model. Glynn's (1995)

General Model of Analogy Teaching (GMAT):

General Model of Analogy Teaching (GMAT) was developed by Zeitoun (1984). This model underlines nine-stages on how to conduct teaching involving analogy in a cycle of continuous revision and improvement. This model is to plan analogy in advance to take into account students' prior knowledge and abilities, to assess the effects of the analogy and to revise the analogy to meet the requirements of the pupils. The GMAT model comprises of the following steps:

- Measure some of the students' characteristics related to analogical learning in general;
- Assess the prior knowledge of the students about the topic;
- Analyze the learning material of the topic;
- Judge the appropriateness of the analogy to be used;
- Determine the characteristics of the analogy to be used;

- Select the strategy of teaching and the medium of presenting the analogy;
- Present the analogy to the students (with its purpose, the analogous attributes, the handover statements and the inappropriate attributes);
- Evaluate the results of using the analogy in teaching (determine whether students use the analogy to study the topic, assess the students' knowledge of the attributes of the topic and identify the misconceptions that result from the analogy) and
- Review the stages of the model if needed.

As part of this model, Zeitoun offers three alternative teaching strategies of how to use of analogy in teaching. First, with the guided teaching strategy, students are encouraged to investigate correspondences across domains for a given analogy and detect any irrelevant features, under the guidance of the teacher. Second, with the expository-teaching strategy, students are merely given the analogy. Third, and most interestingly from the perspective of the present review, Zeitoun introduces the student self-developed analogy strategy. Here, students are encouraged to come up with their own analogies for a taught topic. He regards this strategy as a way for students to use analogy in their thinking, but acknowledges that it may be challenging to apply it in the learning of difficult concepts, about which the students have limited prior knowledge.

Focus, Action, and Reflection (FAR).Model:

Focus, Action, and Reflection (FAR) model was developed by Treagust, Harrison and Venville, 1998. They found that, teachers did not use the steps in any consistent order. Instead, they adapted the order of the steps to meet the needs of their students and of the lesson they were teaching. The FAR is simpler than either the TWA or GMAT models. The designers of the FAR observed that, there were too many steps in the TWA and GMAT models, so they wanted to develop a guide for teaching with analogies that any teacher

could remember easily (Treagust, Treagust, Harrison and Venville, 1998). The steps of their FAR guide are stated below:

- Focus on the concept being taught and the analogy to be used.
- Action obviously connects the similarities between the familiar domain and target concepts and discusses the limitations of the analogy.
- Reflection evaluates how the analogy is faced by the students and makes expansions as needed.

Teaching-With-Analogy (TWA) Model:

Glynn developed a model namely Teaching-With-Analogies (TWA) model which was cited most often in the literature (Glynn, 1991). Glynn developed his guidelines for teaching with analogies by examining what he considered to be exceptional analogies from science textbooks. Glynn (2007) observed that Teaching-With-Analogy (TWA) model suited for use in teaching biology and he summaries four steps that teachers should follow when using analogies as teaching tools. These steps are:

- Introduce students to the unfamiliar concept,
- remind students of a familiar concept,
- Compare and contrast the features of the two concepts, and
- Draw conclusion about the analogy and highlight the overall similarities between the two concepts.

In this study, Teaching-With-Analogies model used by Glynn (2007) was adopted. Because (TWA) model suited for teaching biology and it focuses on the teacher in class presentation of the analogy, and can be easily implemented and evaluated. However, it is the interest of this study to investigate the impact of cooperative learning enriched with analogy on retention and performance in ecology concept among SS 2 slow learners in Dawakin kudu education zone Kano state.

2.6.2 Analogy and Academic performance in Science

Academic performance can be described as something that students achieved at school, college or university, in class, in a laboratory, library or fieldwork. Olorukooba, Lawal and Jiya (2012) concluded that, teaching with Analogy has the potential in enhancing male and female NCE Biology Students performance and retention of evolution concepts. It is commonly measured using examination or continuous assessment but there is no general agreement on how best it can be measured since teachers employ different teaching methods. However, despite the various methods of science teaching employed in teaching science courses and biology in particular, both in secondary schools and tertiary institution, students' achievement and interest in biology continue to deteriorate yearly. Abimbola and Mustapha (2002) reported that use of analogy in teaching will improve academic performance and retention in the students, as well as encourage active participation of the learners.

Ezenwa, (2004) investigated the effectiveness of teaching with analogy in biology concepts using 120 SS2 biology students. In the study, two classes in one school were used as control group and taught the concepts of digestion and blood circulation without analogies for six weeks while two classes from another school were used as experimental group and taught the same concepts with analogies. A t-test analysis of results showed that students taught with analogies performed better than students taught without analogies. The results also revealed that low achievers had higher gain in knowledge than high achievers when taught with the same analogies.

Still on the effectiveness of analogical application, Yilmaz, Eryilm and Gebar (2006) assessed the impact of bridging analogies in mechanics. After a pilot study with 67 students in a nearby high school, the researchers administered the revised Mechanics Misconception Test (MMT) to 119 students as pre-test. Students in the experimental group

were taught using bridging analogies teaching strategy. At the end of a 3-week treatment period, a post-test was administered to the students and the test scores were analyzed using ANCOVA. The results showed that bridging analogies teaching strategy was an effective means of reducing the misconceptions students held about normal forces, frictional forces, tension, gravity, inertia, and Newton's third law.

However, Apolonio, (2010) examined the effects of analogical instruction on comprehension and attitude of slow learners in physics. She recommended that her study should be validated in other science areas and that other variables should be further explored. This led to the conceptualization of the present study on Analogy-Enhanced Instruction (AEI) in general science. The main purpose of this study is to determine the impact of cooperative learning enriched with analogy on academic performance and retention of SS II slow learners biology students.

2.7 Gender and Academic Performance in Science

Gender in this context can be referred to as the categorization of people into two namely, "male and "female" .Apart from the question of effective instructional strategies, science educators are also faced with the problem of attracting girls to science (Bichi, 2008). Several studies have also examined the influence of gender on students' academic achievement in science. Yusuf and Afolabi (2010) reported that, gender had no effect on academic performance of students in computer-assisted cooperative learning. Kajuru (2010) found out that at lower level of education, differences in mathematical abilities of boys and girls are not so much identified. Van Bavel (2012) reported that, no significant gender related differences, but female achieved slightly higher grades than male students. Boys performed better than girls after being exposed to experimental treatment, which is in accordance with the common truth that boys are more co-operative in nature (Gupta & Ahuja, 2014). Kajuru and kaura,(2010) have found out in the study they conducted in two

primary schools that boys had an upper hand over their girls counterparts when they experimented using constructivist teaching strategy to teach pupils.

However, Kolawole (2007) found that boys performed better than girls in both cooperative and competitive learning strategies when he conducted a research on the effects of competitive and cooperative learning strategies on Nigerian students' academic performance in mathematics. Erinosho,(2005) reported that. the main focus of great concern in the field of science education are the biases and misconception about women and male. In this study gender was used to determine the difference in academic performance and retention between male and female slow learners thought ecology concept using cooperative learning enriched with analogy.

2.8 Concepts of Slow Learner

Public secondary schools in Nigeria consist of students with varied abilities; these are high ability students, medium ability students and low ability or low achievers (slow learners). Yushau, (2013) admitted that every class has a composition of 20% to 30% or more slow learners. The slow learners do not fall into the category of special education students as they do well outside the classroom and show no evidence of having a medical problem. They simply do poorly in some science subjects. Lakpini, (2012) categorised the ability level of students as follows:

Top 25% =High ability

Middle 50% =average ability

Bottom 25 % = low ability

The term slow learners has been commonly used by teachers and educationists in describing students who have learning problems. Slow learner is a term/concept inherently riddled by contemporary educational, psychological and cultural interpretations and representations (Williamson, 2012). Indeed, the word of "slowness" itself as a living

expression is alive in our everyday words, images and actions all of which convincingly attach themselves to children, adolescents, and adults. Slow learner, across time, becomes otherwise categorically referred to as apathetic, dawdling, delaying, disinclined, dreamy, drowsy, easy, gradual, idle, imperceptible, inactive, indolent, inert, lackadaisical, lagging, leaden, lethargic, listless, loitering, negligent, passive, plodding, ponderous, postponing, procrastinating, quiet, reluctant, remiss, slack, sleepy, slothful, slow-moving, sluggish, snail-like, stagnant, tardy, torpid, and tortoise-like (Williamson, 2012).

A slow learner is difficult to identify because he/she is no different in appearance and can function normally in most situations. He/she usually has normal physical dexterity, has adequate memory, and possesses common sense (David, 2010). Slow learners are capable of achieving academic success at a slower rate compared to normal children and enrolled in the normal / regular classroom only (Pujar, 2008). These students are known to be slow to 'catch on' are called slow learners. Slow learners are students who differ slightly from normal students in learning ability and cannot meet average academic standards. Academic slow learners are also labelled as borderline mentally retarded, dull, below average children. Academically slow learners are usually identified based on their attained scores on intelligence tests, with IQs between 75to89 (Malik, 2012). Their intelligence test scores are likely to be low from average test scores. However, not too low to meet the large discrepancy set as an inclusion criterion for special educational services (Malik,2012). Although slow learner may have special educational needs, yet they do not fit neatly into the special education system and generally study at normal school. Academic slow learners are also labelled as borderline mentally retarded, dull, below average children. They are generally slow learner when they are faced with tasks requiring abstract, symbolic, and conceptual skills (Lowenstein, 2003). Borderline intellectual functioning contributes negatively in their life as they lack concentration, have poor memory, imagination, and

foresight; an inability to express ideas clearly through the medium of language (Bhatt, 2009).

Research indicates that academically slow learners pose significant educational and behavioural difficulties in the schools because of their deficiencies in intellectual and psychosocial skills (Shaw, 2008). This is also well documented that slow learners do work at their ability level but below their grade level, which in turn leads to their adjustment problems in mainstream class rooms (Krishnakumar *et al*., 2006). To ensure slow learners' success in schools, their rate of slower learning needs to be accommodated through specifically designed interventions in accordance with their ability level (Shaw, 2008).Strategy which is students cantered, cooperative is where students are actively involved in knowledge construction has positive influence on students performance (Lakpini, 2012). It also helps to increase their ability to apply knowledge acquired to solve real life problems. Hussein's (2009) opined that; students' mental health is largely influenced by students' home environment, schooling, and the society at large**.** A slow learner initially wants to learn, but has a problem with the process. In general, slow learners students may also display some or all of the following characteristics, depending on their age and degree of problems (Sultan 2012 & Benny, 2014). These are:

- They have a hard time maintaining social interactions and social skills. This is attributed to their low IQ levels. Also, they don't understand the rules of social engagement.
- They like talking to people but they are not the first ones to start a conversation. This is attributed to their shyness which stems from low self-esteem.
- A slow learner needs somebody so he/she can learn and do assignments together. On their own, they are unable to learn or complete assignments.

- They have difficulty transferring what they have learnt from one assignment to another.
- They are slow in forming relations between words and phrases.
- They lack innovation and creativeness.
- Have low intelligence and academic performance but do not qualify for special education for either cognitive or learning disabilities.
- Perform at a higher level when information is presented in a concrete fashion. Abstract concepts and instruction are difficult for them.
- Have difficulty transferring or generalizing skills, knowledge, and strategies.
- Have trouble cognitively organizing new material and assimilating incoming information into previously acquired information.
- Have difficulty with long-term goals and time management.
- Slow learners Benefit from increased academic engaged time. They often require extra practice and more time on task to develop the same level of academic skills as their typically developing peers.
- Nearly always develop academic motivation deceits.
- Suffer poor self-concept and can develop emotional and behavioural problems.
- Are at high risk for dropping out.

Educational Programmes for Slow Learners

Psychologists and educationists have recommended various educational programmes to surmount the problem of slow learners in the mainstream. Most of the measures are within the purview of the teachers (Chauhan, 2011). A clear perception of the educational programmes meant for slow learners will enable the teacher to combat slow learning in an effective manner. The following are the remedial measures which constitute the educational programmes for slow learners.

- Motivations
- Individual attention
- Restoration and development of self confidence
- Elastics Curriculum
- Remedial Instruction
- Healthy environments
- Special Methods of teaching

2.9 Overview of Similar Studies

Jiya, (2011) investigated the effects of teaching-with-analogy on academic Achievement and retention of evolution concepts among NCE Biology students in College of Education Minna, Niger State, Nigeria. The study adopted the pre-test, post test, post-post test quasi experimental and control group design. A total of 280 students consisting of 100 females and 180 males formed the sample for the study. The instrument was Evolution Achievement Test (EAT) which was adopted from biology textbook questions and past moderated NCE III examination questions. Three null hypotheses were tested and t-test statistic was used for analysis at $P \leq 0.05$. Major findings include (i) There is significant difference in the academic performance scores of experimental and control groups in favour of experimental group.(ii) There is a significant difference in the retention ability of the experimental and control groups in favour of experimental group.(iii) Teaching-With-Analogy favoured male students more than the female. But this study investigated the impact of cooperative learning enriched with analogy among slow learners in ecology concepts among secondary schools Dawakin Kudu Educational Zone, Kano State, Nigeria.

Nworgu and Otum (2013) studied the effects of guided inquiry with analogy instructional strategy on students' acquisition of science process skills among junior secondary school in Enugu state Nigeria. The study adopted non-equivalent control group quasi experimental design. The participants comprised 160 junior secondary schools three (JSIII) students from four schools. Two schools were exposed to the used of guided inquiry with analogy instructional approach (experimental) while the remaining two used the conventional instructional approach (control). The instrument is a Science Process Skills Acquisition Test (SPSAT) consisting 40 short-answer questions items. t- test and the analysis of covariance (ANCOVA) were used to test the hypotheses at 5% level of significance. Based on the findings, they recommended that science teachers should adopt the guided inquiry with analogy teaching method in science classrooms since it would encourage both male and female students to perform well and reduce the gap between the two groups. But this study used cooperative learning enriched with analogy on ecology concepts among secondary school slow learners in Dawakin kudu, Kano State Nigeria.

Naseriazar, Özmen and Badriant, (2011) investigated the effects of Analogy-Based Instruction (ABI) on students' understanding of chemical equilibrium first year of Marand Azad University, Iran. A quasi-experimental design was used in the study. A total of 65 students were used as study sample, 30 students were randomly assigned to the experimental group and 35 students for the control group. The study utilized a pre-test/post-test design. The Chemical Equilibrium Achievement Test (CEAT) was the instrument used for data collect. The CEAT consisted of 20 multiple-choice questions prepared by the researchers. Collected data were analyzed by using t-test and ANCOVA. The results indicated that, the students' in the experimental group showed significantly greater achievement than the students in the control group. Based on the findings they recommended that, a combination of different methods could enhance students'

understanding of chemical equilibrium and help to alter their alternative conceptions. However, this study investigated the impact of cooperative learning enriched with analogy on slow learners in ecology among secondary school students Dawakin Kudu Education Zone, Kano State, Nigeria.

Odoh, (2013) investigated the effect of cooperative instructional strategy on senior secondary chemistry student's achievement in the three Education Zone in Benue State, Nigeria. Three hundred and thirty SS2 chemistry students were selected from six secondary schools as a simple of the study. Three schools were assigned randomly as experimental and control groups. His instrument was Chemistry Achievement Test (CAT). Three null hypotheses were tested and t-test statistic was used to determine significant difference of the two groups at $P \leq 0.05$. One finding of the study showed that the experimental group achieved higher than the of control group. This study however, used cooperative learning strategy enriched with analogy in ecology concepts among slow learners in Dawakin Kudu Education zone, Kano State.

Dyel, (2011) investigated the effect of cooperative teaching strategy on academic achievement and retention of basic science students in large class in mangu educational zone, plateau state, Nigeria. Two hundred and twenty basic science students were selected from two of junior secondary school in mangu education zone, plateau state which comprised of 110 male students and 110 female students as the sample of the study. The instrument used is basic science achievement test (BSAT) and student attitude to cooperative learning leaving strategy questionnaire (SACLSQ) were used for the study from his finding, he concluded that comparative learning strategy has the potential of enhancing basic science students' performance and attitude in large class. But this study was conducted at senior secondary school slow learners in Dawakin Kudu Education Zone of Kano State using cooperative learning enriched with analogy in ecology concepts.

Pujar and Gaonkar, (2008) investigated the effect of Instructional Strategies to Accelerate Science Learning Among Slow Learners in medium primary schools prevailing in Dharwad Taluka, India. The sample for the study comprised of 122 slow learners, 92 students were considered as experimental group and 30 students were selected for control group. The slow learners were identified from both Government and Private Kannada medium primary schools using four screening methods: academic achievement, teacher's assessment, intelligence test and achievement test. The instruments used were Standard Progressive Matrices (SPM) developed by Raven (1988), Socio Economic Status inventory developed by Venkataramaiah (1983) and self structured Questionnaire: Correlation coefficient, t- test and chi square tests were used to analyze the data. The results revealed that, the prevalence of slow learners was higher in Government school studying in third standard compared to Private and Aided schools. Gender, ordinal position, type and size of the family did not influence the rate of learning among slow learners. But this study investigated the impact of cooperative learning enriched with analogy in ecology concepts among secondary school slow learners in Dawakin Kudu Educational Zone, Kano State, Nigeria.

2.10 Implication of Literature Reviewed for the Present Study

The study investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary schools ecology slow learners in Dawakin kudu education zone Kano State. This part was focus on the implications of reviewed literature on the present study.

Odoh, (2013) investigated the effect of cooperative instructional strategy on senior secondary chemistry student's achievement in the three Education Zone of Benue States and recorded high gains in academic achievements and retention. Dyel, (2011) investigated the effect of cooperative learning strategy on academic achievement and retention of basic

science students in large class and recorded high gains in academic achievements and retention. However, Jiya, (2011) and Nworgu and Otum (2013) have separately reported that, teaching with analogy recorded high gain in academic achievement and retention. This shows that effective use of cooperative learning method of instruction can be an advantageous learning strategy in teaching science. From the review of related literatures that constant use lecture method of instruction revealed consistence poor performance and retention ability among science students and also slow learners. Reports in most of the literature showed that, the studies were carried out on students of mixed ability level without considering ability level of students (slow learners). In the light of this reports, the researcher used cooperative learning enriched with analogy among secondary school slow learners in Dawakin Kudu Educational Zone, Kano State, Nigeria. .

The literature revealed that, because of the peculiar nature of slow learners learning needs and the level of their cognitive ability, certain methods actually impede their performance and inhibit their cognitive skills development making them failure oriented, destroying their self image, frustrating and discouraged them from learning. The review of related literature revealed that, using cooperative learning strategy bring about increased of retention ability and high academic performance among science students. However, from literature the used of cooperative learning enriched with analogy for learning in Biology is scanty. Most of the studies carried out are at college of education, junior and senior secondary in large class. But this study was conducted at Senior Secondary School in Dawakin Kudu Education Zone. The aspect of using cooperative learning enriched for teaching slow learners ecology concepts and more especially in Nigeria was not addressed in the literature cited. In this study the researcher taught ecology concepts with cooperative learning enriched with analogy among SS 2 slow learners in Dawakin kudu education zone Kano state, Nigeria which is relatively new area.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In this chapter, descriptions of the methodology and procedure that was employed in conduct of this research were discussed under the following headings:

3.2 Research Design

The design for this study was quasi- experimental control groups design as recommended by Kerlinger (1973). The design involved four schools in Dawakin Kudu Education Zone. Two schools were used as experimental and two schools were used as control groups. The two groups were pre-tested with (EPT) in order to determine the

equivalence in their ability level of the two groups. Treatment was given to the experimental group by exposing the study subjects to cooperative learning strategy enriched with analogy for six weeks and control groups was taught ecology concepts with lecture method only for six weeks. At the end of six weeks treatment period, the post-test was administered to both groups (experimented and control). Same instrument (EPT) was used for post-test. Then after two weeks the researcher also administered another test that called was postpost-test with the same instrument in order to determine the retention ability of both control and experimental groups. The scores from the groups were collected and analyzed to determine the differences in the students mean scores using the SPSS statistical package. The design of the study is represented as follows:

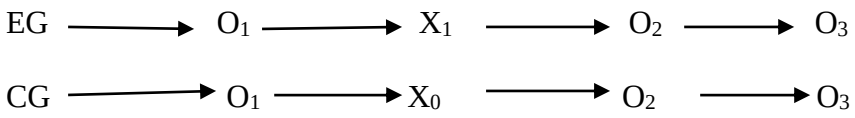


Figure 3.1 Research Design Illustration

Adopted; by Krejecie and Morgan, (1970) and Kerlinger (1973).

Key

EG = Experimental Group

CG = Control Group

X_1 = Treatment

X_o = Lecture Method only

0_1 = Pre-test

O_2 = Post-test

O_3 = Post-post-test

3.3 Population of the Study

Population of this study comprised the entire public senior secondary schools, (SSII) students in Dawakin Kudu Education Zone, Kano State. There are 36 senior secondary schools in Dawakin Kudu Education Zone which consist of single sex secondary schools. Some of these schools are day and some are boarding schools. Records of enrolment showed that, 5145 students in the tagged population which comprised 3362 boys and 1783 girls. A summary of the description of the population is presented in Table 3.1.

Table 3.1: Population of the Study

S/N	Name of schools	Location	No. of SSII student		Total
			Male	Female	
1	Govt. Sec Sch. Tanagar	Tanagar	89	-	89
2	Govt. Sec Sch. Gogel	Gogel	61	-	61
3	Govt. Sec Sch. Warawa	Warawa	82	-	82
4	Govt. Sec Sch. Giwaran	Giwaran	65	-	65
5	Govt. Sec Sch. Gano	Gano	148	-	148
6	Govt. Sec Sch.Dawakigi	Dawakigi	114	-	114
7	Govt. Sec Sch.Yargaya	Yargaya	186	-	186
8	Govt. Sec Sch. Tsakuwa	Tsakuwa	70	-	70
9	Govt. Sec Sch. Mariri	Mariri	302	-	302
10	Govt. Sec Sch. Yankatsari	Yankatsari	115	-	115
11	Govt. Sec Sch. Naibawa	Naibawa	318	-	318
12	Govt. Sec Sch. Panshekara	Panshekara	332	-	332
13	Govt. Sec Sch. Sheka	Sheka	415	-	415
14	Govt. Arabic Sec Sch.D/kudu	D/kudu	158	-	158
15	Govt. Girls Sec Sch. Yargaya	Yargaya	-	278	278
16	Govt. Girls Sec Sch. Audu Mariri	Mariri	-	171	171
17	Govt. Girls Sec Sch. Kumbotso	Kumbotso	-	50	50
18	Govt. Girls Sec Sch. Wailari	Wailari	-	240	240
19	Govt. Girls Sec Sch. Chiranci	Chiranci	-	242	242
20	Govt. Sec Sch. Panshekara	Panshekara	-	72	72
21	Govt. Girls Sec Sch. Tamburawa	Tamburawa	-	60	60
23	Govt. Girls Sec Sch. Gano	Gano	-	40	40
24	Govt. Girls Sec Sch.Isah Waziri	Sheka	-	277	277
25	Govt. Girls Sec Sch.panshekara	Panshekara	-	170	170
26	Govt. Sec Sch. D/kudu	D/kudu	90	-	90
27	Govt. Girls Sec Sch.D/Nasidi	D/Nasidi	-	122	122
28	Govt. Sec Sch.Tamburawa	Tamburawa	120	-	120
29	Govt. Sec Sch. Danbare	Danbare	58	-	58
30	Govt. Sec Sch.Chalawa	Chalawa	33	-	33
31	Govt. Sec Sch. Medile	Medile	111	-	111
32	Govt. Girls Sec Sch.D/kudu	D/kudu	-	61	61
33	Govt. Sec Sch. Danmaliki	Sheka	125	-	125
34	Govt. Sec Sch. Jaoji	Jaoji	120	-	120
35	Govt. Sec Sch. Kumbotso	Kumbotso	180	-	180
36	Govt. Sec Sch. Panshekara kayi	Panshekara	160	-	160
	TOTAL		3362	1783	5145

Source: Kano State Senior Secondary School Management Board (2015)

3.4 Sample and Sampling Techniques

For the purpose of this study, a stratified random sampling technique was used to select the sample due to gender difference in senior secondary schools in Kano. Four schools were sampled out using balloting method involving picking from a container, two

are female schools and two are male schools since all schools are either male or female only. The subjects from these four schools were pre-tested with (EPT) in order to determine the equivalence of their academic performance. The selection of the actual students who served as subject for the study from each school was done through the following steps:

Step i. The raw schools academic scores of SS two Biology students for two terms were collected and examined from the schools as suggested by Lowenstein (2002) and David (2007). They all agreed that there is a high correlation between standardized teacher made test and intelligence/ability of a learner. All below average students whose score 40-49 were collected and served as proposed slow learners as recommended by Yusaha'u (2012).

Step ii. Students that score 40-49 were to undergo I Q test by using a formula IQ = $\frac{MA}{CA} \times 100$

Where

MA = Mental age

CA = Chronological age

Therefore, any students who's IQ is 75-89 were consider as slow learners as recommended by Shaw (2010), Malik (2012) and Sultan (2012). All the classified slow learners from those schools were asked to pick one paper from the container, if the identify slow learners' are above 30. The 30 pieces of paper contain YES and the remaining papers contain NO. Both papers contain YES and NO are crumpled and dropped into container and the identified slow learners picked randomly so all the students that picked YES were used as one school sample. This method was applied to four schools that were used as sample for this research. The sample of 120 students were used which is in line with the central limit theory that recommends minimum of 30 samples as variable for the experimental research (Tukman 1975). Thus, 120 samples were considered appropriate for the research study as pointed out by Sambo, (2008).

Table 3.2: Sample for the Study

S/N	Group	School	Male	Female	Total
1	Experimental	GSS Tanagar	30		30
2	Control	GSS Mariri	30		30
3	Experimental	GGSS Yargaya		30	30
4	Control	GGSS Danladi Nasidi		30	30
Total			60	60	120

3.5 Topics Selected for the Study

Three ecology topics were chosen for this study and the selected topics had not been taught to study groups. The topics chosen are hereunder listed in table 3.3 the three topics chosen to be taught are from biology curriculum and textbooks used in secondary schools (modern biology and STAN biology)

The selected topics are: functioning ecosystem, habitat and population ecology. The researcher taught the experimental and control groups these concepts respectively. Ecology is an aspect of biology syllabus that secondary schools students must study at SS II. These topics were selected due to the following reasons.

1. It is consider abstract in nature and difficult to understand which has resulted in poor performance among secondary schools students (Danmole & Femi 2004, WAEC, 2006).
2. because of their link to the environment in ecological studies and also the direct influence on human social life.

Cooperative learning strategy enriched with analogy was used to teach such concepts and make the students more interested about ecology concepts.

3.6 Instrumentation

In this research, one (1) instrument was used, that is Ecology Performance Test (EPT) which was designed to test basic recall, comprehension and application of ecology concepts. These were used as pre-test, post-test and postpost-test. Some of the test items

were adopted from WAEC Biology Examination past questions papers (2000-2014). The performance test is made up of 30 multiple choice items which is base on the topics selected for this study and were found relevant for the study. Multiple choice items were used because it has a wide coverage of the contents and also has no bias in scoring.

The topics are:

(i) Functioning Ecosystem

(ii) Aquatic and Terrestrial Habitat

(iii) Ecology of population

Specification of test items which reflected topics used in the study and the test items which reflect the cognitive levels based on Blooms Taxonomy (1986) for the cognitive domain is presented in Table 3.3

Table 3.3: Specification of Test Items based on Blooms Taxonomy of Cognitive Domain

S/N	Content	Weight	Knowl	Compr.	Appl.	Analysis	Synthesis	Eval	Total
1	Functional Ecosystem	40	5	3	2	1	1	1	13
2	Aquatic and Terrestrial Habitat	35	3	3	1	1	1	1	10
3	Ecology of population	25	3	2	-	1	1	-	7
	Total	100	11	8	8	3	3	2	30

Source: Adapted from Obeka (2009).

3.6.1 Validation of the Instrument (EPT)

The Ecology Performance Test (EPT) was validated by three panels of science educators who are well experienced in test construction in Science Education Department, A.B.U. Zaria. All of these Science Educators are senior lecturers with the minimum

qualification of PhD and one Biology teacher with the minimum qualification of BSC biology with five years working experience. These panels assessed the suitability of the test items in order to ascertain whether or not the test items are related to the objectives of the study. Then the evaluation of the instrument, also suggested that the content of the test is appropriate.

3.6.2 Pilot Testing

The instrument, ecology performance test (EPT) was pilot tested among SS II slow learners Biology students of government secondary school yankatsari chosen from Dawakin kudu education zone. The purpose of the pilot study is to ascertain the feasibility and reliability co-efficient of the instrument through trial run. The test-rested method was used in the school, the test items was administered twice at intervals of two weeks.

EPT were administered, the data was generated and analyzed in order to determine the characteristics of the test items of (EPT) and the reliability coefficient of EPT. The result of the pilot test was used to:

(i) Asses the clarity of the items of EPT.

(ii) Calculate the reliability co-efficient of EPT.

The facility index and difficulty index was also determine using the scores of the slow learner students.

3.6.3 Reliability of the Instruments

The reliability coefficient of test is the consistency with which the test is repeatedly measure what is intend to measure. Reliability coefficient of a test was determined by test-retest method with interval of two weeks. The first test was administered and after two weeks interval, (EPT) was also given for second test which is retest. Scores was obtained from the pilot study and was used to determine the reliability coefficient of the (EPT). Pearson Product Moment Correlation Coefficient Statistics (PPMCC) formula was used to

analyze data. A reliability coefficient of (r= 0.84) was established. Details of the calculation are represented in appendix H.

3.6.4 Item Analysis

Item analysis was carried out on the data generated from the pilot study in order to determine the item difficulty index and the item discrimination index. According Sambo (2008) the items difficulty index is the percentage of the students that got an item right over the total number of students that attempted the item and it is determined by using the formula:

$$\mathbf{FI} = \frac{\boldsymbol{R}}{\boldsymbol{T}} \boldsymbol{x}\ \mathbf{100}$$

Where FI = facility Index

R = Number of students who answer the items correctly

T = Total number of students tested.

However, in the normal research literature, item with index between 40 - 70% are accepted (Sambo 2008). In this study, items with facility index of 40 - 70% were accepted. And items with facility index below or higher than 40 - 70 % were changed and modified for being too difficult or too simple. Details were shown in Appendix F.

The discrimination index of each item of (EPT) was calculated using scores of the top twenty seven percent (27%) and bottom twenty seven percent (27%) of the total respondents. This was calculated using the formula given by Furst (1958), and used by Sambo, (2008) which is:

$$\mathbf{DI} = \frac{\boldsymbol{RU - RL}}{\boldsymbol{T}}$$

Where:

DI= Discrimination Index

RU -Number among upper 27% who responded correctly to the item.

RL = Number among lower 27% who responded wrongly to the item.

T= number of respondents in each of the lower 27%

According to Sambo (2008) the discrimination index which ranges between 0.40 and 0.70 is regarded as moderately positive and is accepted. The ranges of 0.40 to 0.70 were chosen for the present study. And item which did not fall within the accepted range of 0.40 and 0.70 were rejected. This was used in selecting the final items of the ecology performance test (EPT). However, these questions 4, 6, 8, 19, 21, and 22 were modified because they have discrimination index of 0-0.3 which shows they are difficult. 30 questions were used for this study and appendix I contains details of the table of items.

3.7 Administration of Treatment

The research, involved (SSII) slow learners Biology students which lasted for six weeks. The following administration procedures were followed in order to collect the appropriate data.

- Exposure of experimental group (treatment)
- Training of research assistants
- Orientation of the cooperative class
- Exposure of control group to lecture method (control)
- Exposure of study subjects to post-test.
- Exposure of study subjects to post-post-test.

3.7.1 Administration of Treatment to Experimental Group

The instructional procedure for the experimental group was based on the adopted flow chart of the cooperative learning strategy model from Johnson (1975), Olorukooba (2001), Dyel (2011) and enriched with analogy as earlier described in chapter two of this study. Before the subjects went into the classroom for each lesson, materials needed for the activities for the lesson were placed on the table. The cooperative learning instructional

package containing explanation of concepts and activities that lead to the cooperative teamwork was provided to the subjects.

The instructional procedure for the experimental group was based of Adapted flow chart of the cooperative learning strategy model from Johnson (1975) which was used by Olorukooba (2001) and Dyel (2011). This model of teaching encourages the use of classroom groups of four or five members. Students worked on a common assignment based on the used of barnstorming activity and submit a group report of their result. During each lesson, the researcher goes round the class in order to encourage group members to help those have difficulties in understanding and explain any area of difficulty if the group members fail to help the group. Details of the instructional procedure of the treatment as contained in the adopted flow chart of cooperative learning strategy enriched with analogy model are shown in figure 3.1. The flow chart of this cooperative learning enriched with analogy model has the following steps, these stages are as follows:-

Step 1: - in this step students were in their different group that is each student went to his groups as instructed by the researcher.

Step 2: -This is the introduction step where the researcher introduced and explains the topics,

behavioural objectives of the lesson and how to make comparison between known and unknown domain to the students.

Step 3: - in this step the researcher give the study materials and activity worksheet to each group.

Step 4: -Most of the activities in this flow chart took place in this step, because subgroup members worked together on the activities fallowing the instruction on the activity worksheet to complete the activities, and each student in the group has a role to play. These are:-

Role A: - Reader/checker read the instruction for performing the activities to group and ensured all group members understand the instruction.

Role B:-Questi0ner/Gate keeper will ask the researcher questions noted by the group members and ensure that every member participate in the activities.

Role C: -Name- Reminder/prober, assist group members to remember and address each other by name and encourage his group members.

Role D: -Recorder assimilates the group reasoning and restates its approach in arriving at a sound conclusion and record the group members.

Step 5:-The activity worksheet were collected from the subgroup and score by the researcher.

Step 6:- Whole class discussion of the result of the activities by the researcher with the Students were took place in this stage.

Step 7:- In this step, the evaluation and conclusion of the lesson and review of cooperative learning skills used during the lesson was take place.

Step 8: - In this step the researcher returned activity worksheet to the study subjects for encouragement of the group members. Details for this skill used in cooperative learning enriched with analogy will found in figure 3:1.

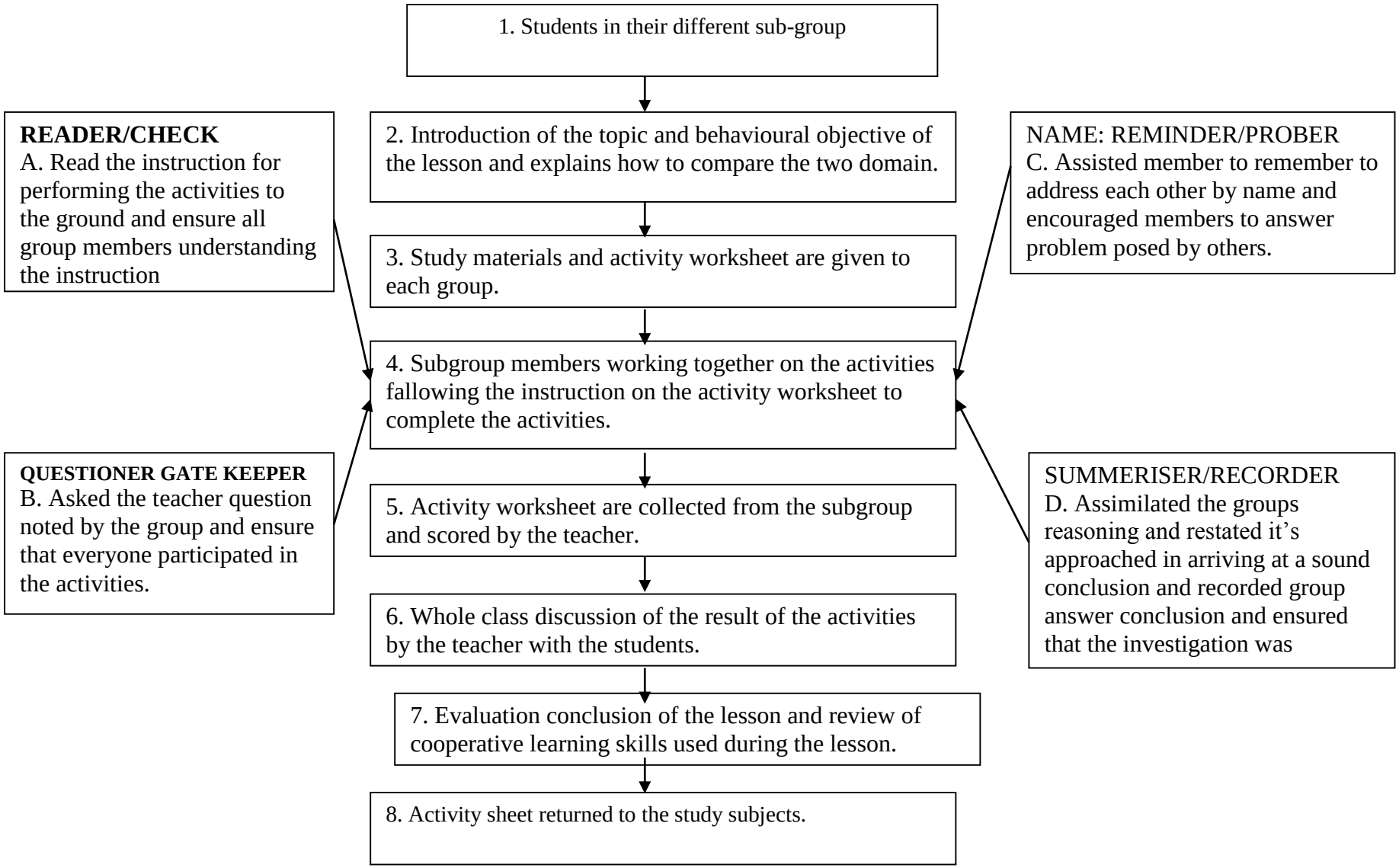


Figure 3.1: A Follow chart of enriched cooperative learning strategy model with analogy
Source: Adapted from Olorukooba (2001)

3.7.2 Training of Research Assistant

The researcher trained two research assistants for a period of four days by the researchers who explained to them the use of cooperative teaching, practical demonstration by the researcher on how to conduct cooperative learning strategy enriched with Analogy and how they can infuse analogy in cooperative based lesson and what the students are required to do. Instructional lesson for the experimental group is by the adopted Johnson (1975) model and used by Olorukooba (2001). They were also introduced to the type of activities which are expected from students during cooperative learning instructional lesson. These are emphasizing the importance of helping each other, encouraging all members to participate actively in activities and encouraging them to common agreement about idea that would be submitted for the group.

3.7.3 Orientation of Cooperative Learning Enriched with Analogy

The purpose of orientation is to inform the subjects in the experimental group about the specific kinds of the activities in cooperative learning process and cooperative learning skills, such as the use of name when addressing group members; contribution of ideas and suggestion; encouragement of the contribution of ideas verbally and non-verbally among others that would encourage cooperative among the subjects.

3.7.4 Teaching the Control Group

The researcher taught subjects in the control group with the traditional lecture method during normal class period. However, the key words and important point was written on the board and subjects copied in their notes books. (After completed the period of six weeks, test was given to the subjects by researcher and his assistant and enough time was given to them.

3.8 Data Collection Procedure

After completed of six weeks treatment by the researcher, the (EPT) was given to both experimental group and control group, the test instrument which contained 30 multiple choice items with option from A – E response option. Each question that answered correctly is 1 mark which gives a total of 30 marks respectively. The subjects were allowed for 60 minutes for the post-test. The subjects' responses in the post-test were collected and scored using marking scheme. The result from post-test for the two groups (experimental and control) were recorded separately and was used for the analysis.

After two weeks, the researcher and his assistance administered the same (EPT) to the students of both group (experimental and control) in order to determined the retention ability of both group of subjects. The results were recorded separately and were used for analysis.

3.9 Procedure for Data Analysis

The data for this study were collected and used to answer the research question in section 1.4 of chapter one and was used to test the hypotheses stated in section 1.5 of chapter one. The probability level of $P \leq 0.05$ was set for retaining or rejecting the stated hypothesis.

The research questions are:

1. What is the mean difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method?
2. What is the difference between mean scores of slow learners in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy?

3. Is there any change in slow learners' mean retention scores after been taught ecology concepts using cooperative learning enriched with analogy?
4. Is there any difference in the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy?

All the above researched question were answered using mean and standard deviation

The stated hypotheses are:

Ho_1: There is no significant difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method.

The differences between the mean scores of slow learners taught using cooperative learning enriched with analogy and those taught using lecture method was analysed using t-test statistical tool.

Ho_2: There is no significant difference between the mean scores of slow learners' in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy?

The differences between the mean scores of slow learners in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy was analysed using t-test statistical tool.

Ho_3: There is no significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method.

The differences in retention mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method was analysed using t-test statistical tool.

H_{o4}:- There is no significance difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy.

The differences between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy.

CHAPTER FOUR

ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The analysis, results of the data collected and their discussion were presented in this chapter. The data collected were analyses using the statistical package for social Science (SPSS) and the results were presented according to the sequence of the research questions and hypotheses that guided the study. The Level of significance adopted for rejecting or retaining the stated null hypothesis was at $p \leq 0.05$ Level of significance

4.2 Data Analysis and Result Presentation

This section presents the result and interpretation of data collected from the study subject.

4.2.1 Answering the Research Questions

Research Questions 1: What is the difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught with lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result was presented in Table 1.

Table 4.1: Mean and Standard Deviation of the Performances for the Experimental and Control Groups

Group	N	$\overline{X}$	SD	Mean Difference
Experimental Group	60	22.35	4.16	
				9.82
Control Group	60	12.53	1.48	

Table 4.1 shows mean and standard deviations of the academic performance of slow learners in experimental and control groups. From the result obtained, the students in experimental group that taught using cooperative learning enriched with analogy have mean scores of (22.35) and students in control group that taught using lecture method have

mean score of (12.53). These give a mean deference of 9.82 in favour of experimental group. This indicated that, there has been a positive effect of cooperative learning enriched with analogy than the traditional lecture method.

Research Question2: What is the difference between the mean scores of the slow learners' in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result was presented in Table 2.

Table 4.2: Mean and Standard Deviation of the Pre test and Post test Scores for Experimental Group

Group	N	$\overline{X}$	SD	Mean Difference
Pre-test Exp. Group	60	7.18	2.73	
				15.17
Post-test Exp. Group	60	22.35	4.16	

Table 4.2 shows mean and standard deviations of the performance scores for slow learners pretest and post test that were taught ecology concepts using cooperative learning enriched with analogy. The mean scores of pre test experimental group are (7.18) while the slow learners exposed to cooperative learning enriched with analogy and their post test score are (22.35) respectively. This gives a mean difference of 15.17 in favour of posttest, this indicate that there has been a positive effect of cooperative learning enriched with analogy.

Research Question 3: Is there any change in slow learners' mean retention scores that taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result was presented in Table 3.

Table 4.3: Mean and Standard Deviation of the Postpost-test Score for the Experimental and Control Groups

Group	N	$\overline{X}$	SD	Mean Difference
Experimental Group	60	22.42	3.41	
				10.34
Control Group	60	12.08	1.38	

Result in Table 4.3 shows mean and standard deviations of the postpost-test scores of slow learners in the experimental and control groups. From the result obtained, slow learners in the experimental group that taught ecology concepts using cooperative learning enriched with analogy have mean score of (22.42) while slow learners of the control group that taught ecology concepts using lecture method have mean score of (12.08) respectively. This gives a mean difference of 10.34 in favours' of students in the experimental group. This indicates that that there was high positive effect of cooperative learning enriched with analogy than their counterparts in the control group.

Research Question 4: Is there any difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy?

Descriptive statistics of mean and standard deviation were used to answer this research question and the summary of the result was presented in Table 4

Table 4.4 Mean and Standard Deviation of Posttest Scores of Male and Female Students Taught Ecology Concepts using Cooperative Learning Enriched with Analogy

Group	N	$\overline{X}$	SD	Mean Difference
Male	30	21.50	4.45	
				1.70
Female	30	23.20	3.74	

Table 4.4 showed the mean scores of male and female slow learners taught Ecology concepts using cooperative learning enriched with analogy. The table revealed that the

female slow learners have the mean score of (23.20) while the male has a mean score of (21.50). It observed the mean difference between the male and female is 1.70. This shows that slight difference exist in the performance of male and female students, therefore cooperative learning enriched with analogy so is gender friendly.

4.2.2 Testing the Null Hypotheses

The following hypotheses were formulated for testing at $P \leq 0.05$ level of significance:

Ho_1: There is no significant difference between the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method.

To test this hypothesis, post-test data were generated through Ecology Performance Test (EPT) which was subject to paired t-test statistic to determine the significance difference on the slow learners' academic performance of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. The summary of the analysis was shown in table 4.5.

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

Group	N	$\overline{X}$	SD	df	t-cal.	t-crit	p-value
Experimental Group	60	22.35	4.16				
				118	16.61	1.98	0.000
Control Group	60	12.53	1.48				

Significance at $P \leq 0.05$ Level of significance

Table 4.5 reveals that, the p-value (.000) is less than the 0.05 level of confidence and the t-calculated is (16.67) which are greater than the t-crit (1.98). Since P- value is less than the alpha value = 0.05 level of significance, it is the evident that, there is significant difference in the performance of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. Therefore base of this finding the null hypothesis which stated that, there is no significant difference between

the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method is therefore rejected.

Ho_2: There is no significant difference between the mean scores of slow learners' in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy?

To test this hypothesis, pre –test and posttest data were generated through Ecology Performance Test (EPT) were subject to paired t-test statistic to determine the significance difference on the slow learners' academic performance of the pre-test and post-test of the experimental group. The summary of the analysis was shown in table 4.6

Table 4.6: Paired Sample t-test for Difference in the Slow Learners' Performance of pre-test and Post-test for the Experimental Group

Group	N	$\overline{X}$	SD	df	t-cal.	t-crit	p-value
Experimental Group	60	7.18	2.78				
				118	28.79	1.98	0.000
Control Group	60	22.35	4.16				

Significance at $P \leq 0.05$ Level of significance

Table 4.6 reveals that, the p-value (.000) is less than the 0.05 level of confidence. The t-calculated (28.79) is greater than the t-crit (1.98). Since P- value is less than the alpha value = 0.05 level of significance, it is the evident that, there is significant difference in the mean scores of slow learners before and after taught ecology concepts using cooperative learning enriched with analogy. So base of this finding the null hypothesis which states that, there is no significant difference between the mean score of slow learners' before and after taught ecology concepts using cooperative learning enriched with analogy is therefore rejected.

Ho_3: There is no significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method

To test this hypothesis, postpost-test data were generated through Ecology Performance Test (EPT) was subject to t-test statistic to determine the significance deference on the slow learners' retention ability of the experimental and control group. The summary of the analysis was shown in table 4.7

Table 4.7: Independent t-test for Difference in Retention Ability of the Experimental and Control Groups

Group	N	$\overline{X}$	SD	df	t-cal.	t-crit	p-value
Post post-test Experimental	60	22.42	3.41				
				118	21.78	1.98	0.000
Post post-test Control Group	60	12.08	1.38				

Significance at $P \leq 0.05$ Level of significance

Table 4.7 shows that, the p-value (0.000), t-critical (1.98) and t- calculated (21.77) was observed at df=118. Since P- value is less than the alpha value = 0.05 level of significance, it is the evident that, there is significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. Base of this result, the hypothesis which states that, there is no significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method is therefore rejected.

Ho_4: There is no significant difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy.

To test this hypothesis, post-test data were generated through Ecology Performance Test (EPT) was subject to t-test statistical tool to determine the significance deference of male and female slow learners 'of the experimental group. The summary of the analysis was shown in table 4.8

Table 4.8: Result of t-test Analysis of the Posttest Mean Scores of male and female Students in the Experimental Groups

Group	N	$\overline{X}$	SD	df	t-cal.	t-crit	p-value	Remark

Male	30	21.50	4.44					
				58	16.61	2.02	0.114	Not. Sig.
Female	30	23.20	3.74					

Not Significance at P> 0.05 Level of significance

Table 4.8 shows that, the p-value (0.114), t- calculated (1.60) and t-critical (2.02) was observed at df=58. Since P- value is greater than the alpha value = 0.05 level of significance, it is the evident that, there is no significant difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy. Base of this result, the hypothesis which states that, there is no significant difference between the mean scores of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy is hereby accepted and retained.

4.3 Summary of Findings

In this study, the following findings were made:

i. There is a significant difference between the mean scores of slow learners taught ecology concept using cooperative learning enriched with analogy and those taught using lecture method. Since P- value is less than the alpha value = 0.05 level of significance. This indicate that experimental group taught ecology concepts using cooperative learning strategy enriched with analogy achieved higher than control group that taught ecology concepts using lecture method. This shows that, there was high positive impact of cooperative learning enriched with analogy than their counterparts in the control group.

ii. There is significant difference between the mean scores of slow learners' in the experimental group before and after taught ecology concepts using cooperative learning enriched with analogy. Since P- value is less than the alpha value = 0.05 level of significance. This finding indicates that slow learners perform better after

they have taught ecology concept using cooperative learning enriched with analogy. This shows that, there was high positive impact of cooperative learning enriched with analogy.

iii. There is significant difference between the mean retention scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. Since P- value is less than the alpha value = 0.05 level of significance. This indicate that experimental group taught ecology concepts using cooperative learning enriched with analogy retained higher than control group that taught with lecture method. This shows that, there was high positive impact of cooperative learning enriched with analogy than their counterparts in the control group.

iv. There is no significant difference between the mean scores of the male and female slow learners taught ecology concepts using cooperative learning enriched with analogy. This indicates that female slow learners' performance did not differ significantly from the female performance. This shows that, cooperative learning enriched with analogy is gender friendly.

4.4 Discussions

This study investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary schools ecology slow learners in Dawakin Kudu Education Zone, Kano State Nigeria. The experimental group taught ecology concepts using cooperative learning enriched with analogy while the control group taught ecology concepts using lecture method. All the two groups were pre-tested, post-tested and postpost tested in order to measure the slow learners' retention ability, academic performance and Gender difference of the experimental group who were taught ecology concept using cooperative learning strategy enriched with analogy.

From the finding in Table 4.5 revealed that, there is significant difference in the mean scores of slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. Experimental group performed significantly well and achieved higher than those taught using lecture method. The significant difference found between the two groups is likely due to the used of cooperative learning enriched with analogy on the experimental group. If the treatment administered has no impact, the two groups were expected to perform equally. Since the experimental group performed significantly better. This indicates that, there was positive impact of cooperative learning enriched with analogy in teaching slow learners because it enhanced their performance at senior secondary schools level of education. This result is in support of Ajaja and Eravwoke, (2010) as it reaffirms that, ability of cooperative learning when used as an instructional strategy brings about significant improvement in student's achievement in science subjects. Also the finding is in agreement with the finding of Olorukooba, (2001), Mohammadi and Salimzadeh (2009), Dyel (2011) which separately reported that, the achievement of students exposed to cooperative learning were better than their counterparts exposed to conventional lecture method.

From the finding in Table 4.6 revealed that, there is significant difference in the mean scores of slow learners before and after taught ecology concepts using cooperative learning enriched with analogy. This result is in support of Arthy, (2012) as it reaffirms that, cooperative learning when used as an instructional strategy brings about significant improvement in student's achievement in science subjects. Also the finding is in agreement with the finding of Odorh, (2013), revealed the positive effect of cooperative learning strategy on the achievement and retention among science students

From the finding in Table 4.7 revealed that, slow learners in the experimental group who were taught ecology concepts using cooperative learning enriched with analogy had

significantly higher retention ability than those taught using conventional lecture method. The significant difference found between the two groups is likely due to used of cooperative learning enriched with analogy on the experimental group. If the treatment administered has no impact, may be the two groups are expected to retain equally. This indicated that, using cooperative learning enriched with analogy in teaching slow learners enhanced their retention ability at senior secondary school level. This finding agrees with the finding of Bichi (2002) who observed that understanding and retention is product of meaningful learning: when teaching is effective and meaningful to the students, retention will improve. Similarly, Olorukooba, (2001), Mehra and Thakur (2008), Gupta & Pasrija (2012) separately revealed the positive effect of cooperative learning strategy on the achievement and retention among science students.

From the finding in Table 4.6 revealed the gender related differences on academic performance of male and female slow learners taught ecology concepts using cooperative learning enriched with analogy. The post-test result of testing hypothesis four shows there is statistically no significance difference between post-test mean scores of male and female slow learners. This indicate that, the level of academic performance in ecology concepts of male and female slow learners exposed to cooperative learning enriched with analogy is relatively the same. This finding agrees with the finding Yusuf and Afolabi (2010) reported that, gender had no effect on academic performance of students in computer-assisted cooperative learning. Garduno (2011) on the other hand reported that, no statistically significant differences in achievement or self-efficacy in seventh and eighth-grade students in mathematics in single-or-mixed-gender groups. The finding of this study disagrees or is in contrast with the finding of Kajuru and kaura,(2010) that have found out in their study they conducted in two primary schools that boys had an upper hand over their girls counterparts when they experimented using constructivist teaching strategy to teach pupils.

Also Gupta and Ahuja (2014) reported that Boys performed better than girls after being exposed to experimental treatment, which is in accordance with the common truth that boys are more cooperative in nature.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary schools ecology slow learners in Dawakin kudu Education Zone, Kano state, Nigeria. In the previous chapter, data obtained for this study was analyzed in relation to four null hypotheses were outlined to guide the study. The results were subsequently discussed. This chapter is presented as follows:

5.2 Summary of the Study

5.3 Major Findings

5.4 Conclusion

5.5 Contribution to Knowledge

5.6 Recommendations

5.7 Limitations of the study

5.7 Suggestions for Further Study

5.2 Summary for the Study

The study investigated the impact of cooperative learning enriched with analogy on retention and performance among secondary schools ecology slow learners in Dawakin kudu Educational Zone Kano State. The main variables investigated were retention, performance and gender in ecology concepts using cooperative learning enriched with analogy and conventional lecture method. The population of the study consists of all the 5145 SSII students (3364 males and 1783 females) of the 36 public senior secondary schools located in Dawakin kudu Educational Zone, Kano State. Stratified random sampling technique was used to select the sample due to gender difference in senior

secondary schools in Kano. Four schools were sampled, two were female schools and two were males' schools.

The study subjects comprise of 60 male and 60 female totally 120 SS II Biology Slow learners drawn from four sampled schools of Dawakin kudu Educational Zone Kano State. The subjects were selected through the following steps: All below average students whose scored 40-49 for two terms were collected and served as propose slow learners and Students whose score 40-49 were to undergo I Q test by using a formula IQ = $\frac{MA}{CA}$ ×100 . Therefore, all students who's IQ is 75-89 were consider as slow learners and served in this study.

The instruments used for the study were Ecology Performance Test (EPT) which comprises of thirty (30) items drawn from West African Examination Council (WAEC) past objective questions of years 2000 to 2015. These instruments were pilot tested and determine the reliability which were r = 0.84 respectively. The instruments were used for data collection and data obtained were analyzed using t-test. The results obtained were presented and subsequently discussed as the summary of the major findings in the sub-section 5.3.

5.3 Summary of the Major Findings

i. There is significance difference in the mean scores of students taught ecology concepts using cooperative learning enriched with analogy and their counterparts control groups who were taught the same concepts using lecture method. The experimental group Performance is significantly high than those in the control groups. The null hypothesis is rejected.

ii. There is significant difference between the slow learners' performance before and after taught ecology concepts using cooperative learning enriched with analogy. The null hypothesis is rejected.

iii. There is significant difference in retention ability between slow learners taught ecology concepts using cooperative learning enriched with analogy and those taught using lecture method. The slow learners taught ecology concepts using cooperative learning enriched with analogy retain better than those taught the same concepts using lecture method. Therefore, the null hypothesis was rejected

iv. There is no significance difference in the mean scores of male and female students taught ecology concepts using cooperative learning enriched with analogy. The male and female slow learners' performance did not differ significantly. However, cooperative learning enriched with analogy is gender friendly. Therefore, the null hypothesis is accepted

v. Lecture method appears to be less effective in teaching ecology concept as they tend to negatively affect the slow learners academic performance and retention ability.

5.4 Conclusion

Base on the findings from this study, the following conclusions were made;

- Slow learners taught ecology concepts using cooperative learning enriched with analogy perform better than thus taught using lecture method.
- Slow learners taught ecology concepts using cooperative learning enriched with analogy exhibit high level of retention ability in ecology concepts than those taught using lecture method.
- Male slow learners taught ecology concepts using cooperative learning enriched with analogy did not differ significantly from their female counterpart.

5.5 Contributions to Knowledge

Based on the findings, the following contributions to knowledge are:

i. the researcher established that, cooperative learning enriched with analogy improved retention of slow learners in ecology concept and leading to better performance.

ii. The researcher develop cooperative learning enriched with analogy model as a guide for teaching slow learners ecology concepts. This instructional strategy was found to be gender friendly since both male and female slow learners performed relatively equal

iii. The findings of this study added new information to the existing literature which can be use by curriculum planner in science education.

iv. Cooperative learning enriched with analogy was used in ecology concept in Dawakin Kudu Education Zone which is relatively new area

5.6 Recommendations

The following recommendations was made base on the findings:

- Cooperative learning enriched with analogy should be use in the teaching ecology concepts at senior secondary school level.
- Science teachers should consider different ability level in the class when choosing method or strategy so as to cater for different ability groups in the class.
- Cooperative learning enriched with analogy is gender friendly; it should be encourage among male and female students at secondary school level.
- Seminars, workshops should be organised by senior secondary school management board so as to train science teachers on how to use cooperative learning enriched with analogy in teaching biology and other science subjects.

- Professional associations like Science Teachers Association (STAN), Mathematics Association of Nigeria (MAN) and research centres like Nigerian Educational and Research Development Council (NERDC) should incorporate cooperative learning enriched with analogy in their science curriculum at the primary, junior and senior secondary schools levels to encourage the use of the of cooperative learning-enriched with analogy

5.7 Limitations of the Study

This study has some limitations, which include the following;

- The study is restricted to only four secondary schools in Dawakin Educational Zone Kano State as such generalization of the study is narrow.
- A sample size of only 120 SS2 slow learners in biology was used in this study. It may be possible that when larger sample size is used the result will not be the same.
- The study topics were limited to functioning ecosystem, habitat and ecology of populations

5.8 Suggestions for Further Studies

i. Similar studies should be conducted in ecology concepts at senior secondary level to find out the impacts of cooperative learning enriched with analogy and conventional lecture method on retention and performance among students of varied ability levels.

ii. Similar studies should also be carried out in other science subjects' areas at secondary

iii. schools level, such as chemistry, mathematics, integrated science, physics, to see what the result will be.

iv. This type of study could also be carried out in other difficult Biology topics such as: genetics, evolution, microbiology, etc

v. Studies on cooperative learning enriched with analogy could be carried out in other levels of education such as primary school, junior secondary, polytechnics, colleges of education etc.

vi. It should be carried out on all ability groups in order to compare how effective it is in raising the performance of slow learners

REFERENCES

Abdullahi, A. (1982). *Science Teaching in Nigeria*. Ilorin, Atto Press Ltd., Nigeria

Abimbola, I.O. (2002). *Basic Philosophy of Science for University Students,* Osogbo: Olatunbosun Publishers.

Abimbola, I.O. and Mustapha, M.T. (2002). The Use of Analogies in Communicating Difficult Science Concepts to Secondary School Students. *Journal of Nigeria Teacher Today,* 1(8), 279-289

addition and Subtraction Skils at Primary School level. *Journal of Studies in Science and Mathematics Education* 1(1), 141-146.

Adeyemi, A.B. (2008). Effects of Cooperative Learning and Problem Solving Strategies on Junior Secondary School Student's Achievement in Social Studies. *Electronic Journal of Research in Educational Psychology*, 6(3):691-708.

Ado, I.B. and Akinbobola, A.O. (2009). Teaching Simple Interest Using Constructivist Approach. *Journal of Issues on Mathematics 12 (1&2), 47-52.*

Aina, M.E. (2009). *General Teaching Method*: Lagos National Open University of Nigeria. www.noun.edu.ng

Ajaja, O.P. (2013) Which Strategy Best Suits Biology Teaching? Lecturing, Concept Mapping, Cooperative Learning or Learning Cycle. *Electronic Journal of Science Education,* 1(17), 1-37.

Ajaja, O.P. and Eravwoke, O. U. (2010). Effects of Cooperative Learning Strategy on Junior Secondary School Students Achievement in Integrated Science. *Electronic Journal of Science Education, 14(1), 1- 18.*

Ajaja, O.P., and Eravwoke, U.O. (2012). Effects of 5E learning Cycle on Student's Achievement in Biology and Chemistry. *Cypriot Journals of Educational Sciences,* 7(3), 244 – 262.

Akbar, N., Hluk, O. and Badrin, B. (2013). Effectiveness of Analogy on Students Understanding of Chemical Equilibrium. *Western Anatolia Journal of Educational Science*, 4(15), 525-534.

Akinbobola, A.O. and Afolabi, F (2009). Constructivist Problem Based Learning Technique and the Academic Achievement of Physics Student with Low Ability Level in Nigerian Secondary Schools. *Eurasian Journal of Physics & Chemistry Education,* 1(4), 55-61.

Akinobola, A.O. and Falashade, A. (2007). Constructivist Problem-Based Learning Techniques and the Academic Achievement of Physics Student in Nigerian Secondary School. *Journal of Physics and Chemistry Education* 1(1), 45-51

Akubuilo, D.U. (2004). The Effect of Problem-Solving Instructional Strategy on Student Achievement and Retention in Biology with the Respect of Location in Enugu State. *Journal of Science Teacher Association of Nigeria,* 39(1&2), 94-100.

Amarachi, C and Bello U. (2013). Paper Presented on the Behaviourism and Constructivism Paradigms in Science Education Curriculum. Development of Science and Mathematics Education, A.B.U., Zaria

Ameh R., Daniel S.O and Akuss M. (207). Effect of Demonstration Methods on Secondary School Students' Acquisition of Process Skill in Physics. *Electronic Journal of Science Education,* 12 (2), 1-18

Apolonio, A. P. (2010). Teaching Model Optimization Effects on Slow Learners' Comprehension and Attitude in Physics. Unpublished Master's Thesis, University of the Philippines, Diliman, Quezon City.

Arthy U.S. (2012). Effectiveness of Small Group Interaction Techniques in Enhancing Practical Biology Skills. Electronic *Journal of Research in Science and Technical Education, 6(3), 691-708.*

Beli, A.D (2007). *Science, Technology and Society.* Saadatu Rimi College of Education Kumbotso Campus. Kano state. Dandabino Publisher Ltd.

Benny, N.M. (2014). *The Importance of Identifying and Helping Slow Learners*. Retrieved from http;//ben716.hubpages.com/hub/identifying-helping Slow Learners. 2/12/2014.

Bhatt, M. (2009). Are the Teaching Practices in Mainstream Classrooms having Children with Special Needs Inclusive? Reflections in Indian context. Annual Report of 2008-09. Setup Developmental Intervention Centre, Ahmadabad, India.

Bichi, S.S. (2002). Effect of Problem-Solving Strategy and Enriched Curriculum on Student Achievement in Evolution Concepts among Secondary Schools Student. Unpublished. Ph. D. Dissertation Submitted to Science Education A.B.U., Zaria.

Bichi, S.S. (2008). Effect on Gender on Historically Enriched Curriculum on Academic Achievement in Evolution Concepts Among Senior Secondary School. Published *Seminar paper in Science Education Department A.B.U. Zaria.*

Bruner J S (1966). *Toward a Theory of Instruction* Cambridge, MA: The Belknap Press of Harvard University Press

Bruner, J. (1960). *The Process of Education.* Cambridge, MA: Harvard University Press

Bruner, J. S. and Ross, G. (1978). The Role of Tutoring in Problem Solving. *Journal of Child Psychiatry and Psychology*, 17(2), 89-100.

Bukunola, A. J. and Idowu, O. D. (2012). Effectiveness of Cooperative Learning Strategies on Nigerian Junior Secondary Students' Academic Achievement in Basic Science. *British Journal of Education, Society & Behavioural Science.* 2 (3), 307-325.

Chauhan, S. (2011). Slow Learners Psychology and Their Educational Programmes. *International Journal o f Multidisciplinary Research.* 1(8) 279-289

Chew, F.T. (2004). Use of Analogy to teach general Biology to non-Biology Major. http;//www.edt.sg.Link/mar2004/tm3.Danmote.B.Tond.

Chianson, M.M., Kurumeh, M.S., and Obida, J.A. (2010). Effect of Cooperative Learning Strategy on Students' Retention in Circle Geometry in Secondary Schools in Benue State, Nigeria. *American Journal of Scientific and Industrial Research,* 2(1):33-36

Colorin, C. (2004). Cooperative Learning Strategies. American Federation of Teachers. AFT. C10. Conference Association of Nigeria. 73-77.

Dambana, B.T. (2011). Effects of Science – Technology –Society Instructional Strategy on Academic Performance in Selected Genetic Concepts Among NCE Students among NCE Students. Published Ph.D Dissertation. A.B.U., Zaria.

Danmole, B.T. and Femi A. (2004), Effect of Concept Mapping Technique on Senior Secondary School Students Achievement and Retention of Ecology. *Journal of the Science Teachers Association of Nigeria. 39, (1&2) 32 – 38.*

David, L. (2010). Understanding and Helping the Slow Learner. Retrieved from http:/www.clubtheo .com/momdad/html/dlslow.html 22/11/2014

David, S.O. (2007). Effect of an Activity-Based Teaching Method on the Academic Achievement of Slow Learners in Chemistry at Senior Secondary Level. Unpublished M.ed Thesis Submitted to Science Education ABU Zaria.

Dincer, S. (2011). Exploring the Impacts of Analogy on Computer Hard Ware. *Online Journal of Educational Technology,* 10(2):113-121.

Doymus, K. (2008). Teaching Chemical Bonding through Jigsaw Cooperative Learning. *Research in Science & Technological Education,* 26(1), 47-57.

Doymus, K., Karacop, A., and Simsek, U. (2010). Effects of Jigsaw and Animation Techniques on Students' Understanding of Concepts and Subjects in Electrochemistry. *Journal of Educational Technology Research and Development, 58(6) 671-691.*

Dyel, B.D (2011). Effects of Cooperative Learning and Lecture Methods on the Performance and Attitude of JSS Integrated Science Students in Large Classes. Unpublished M.ed Thesis Submitted to Science Education ABU Zaria.

Eiks, I. (2005). Experiences and Reflection about Teaching Atomic Structure in a Jigsaw Classroom in Lower Secondary Schools Chemistry Lessons. *Journal of chemistry Education,* 82(2):313-319.

Ezenwosu, S.U. and Loretta, N.N. (2013). Efficacy of Peer Tutoring and Gender on Students' Achievement in Biology. *International Journal of Scientific & Engineering Research,* 4(12), 944-950

Faryadi, Q. (2007). Enlightening Advantages of Cooperative Learning. Retrieved. fromwww.eric.ed.gov/ERICWebPortal/recordDetail?accno. November 21 2009.

Federal Republic of Nigeria (2013). *National Policy on Education*. Federal Ministry of Education . 4th edition Lagos.

Felder, R. M. (2006). A Longitudinal Study of Engineering Student Performance and Retention. Instructional Methods and Student Responses to Them. *Journal of Engineering Education.* 84, 361–367,

Gilles, R.M (2006). Teachers' and Students' Verbal Behaviours During Cooperative Small Group Learning. *British Journal of Educational Psychology,* 76(2), 271-287.

Glynn, S. M. (2007). *The Teaching-with-Analogies Model*. Retrieved on August 10, 2010 from www.nsta.org/publications/news/story.asp

Glynn, S.M. (1991). *Explaining Science Concepts:* A Teaching with Analogy Model. In S.M. Glynn, R.H. Yeany, & B.K. Britton (Eds): *The Psychology of Learning*, 219-240.

Graham, D.C. (2005). Cooperative Learning Methods and Middle Schools Student. Ph.D Thesis. Capella University.

Griffin, D. (1978). *Slow Learner: A Break in the Circle: A Practical guide of Teacher in Secondary Schools*. Audover: Chapel River Press.

Gupta M, and Ahuja, J (2014). Effect of Cooperative Learning Strategy (Circ) on English Reading Comprehension Achievement of Seventh Graders in Relation to their Gender. *International Educational E-Journal*, {Quarterly}, ISSN 2277-2456, (3), 14-27

Gupta, M. and Pasrija, P. (2012). Effectiveness of Cooperative Learning Strategy (STAD) on the Mathematical Achievement and Retention among Graders in Relation to their Intelligence, the Educational. *Journal of Humanities and Social Science,* 2(1), 19-34.

Holyoak, K.J., Novick,. L. and Metz., E.R. (1994). Component Processes in Analogical Transfer: Mapping, Pattern Completion and Adaptation. Advances in Connectionist and Neural Computation Theory. *Analogical Connections* (2), 113-180.

Hussaini, M.A. (2002). Functional Science and Technology Education for Nigerian Policy Makers. 43rd STAN Conference Proceedings.

Hussein, S. J. (2009). Social and Educational Determinants of Child Mental Health: Effects of Neighbourhood, Family, and School Characteristics in a Sample of Pakistani Primary School Children. *Journal of Pakistan Psychiatric Society,* 6(2), 90-97.

International Council for Science (2002). Series on Science for Sustainable development NO.5 Science Education and Capacity Building for Sustainable at http://www.lcu.org/library WSSD-Rep/vol15.PdF

Isfatul, Y. (2012). The Implementation of Cooperative Integrated Reading and Composition Technique to Teach Reading Narrative Text at Eleventh Grade of MA Unggulan Tulangan Sidoarfa. Thesis Submitted to English Department, Tarbiya Faculty of Tarbiya, Institute of Islamic Studies.

Ishaq, U. (2014). Effects of Collaborative Learning Strategy on Academic Achievement Among Senior Secondary School Biology Students in Gwale Education Zone, Kano State, Nigeria. Seminar presentation at Science Education Department ABU Zaria.

Iwuozu, O.U. (2014). Jigsaw Instructional Approach as Determinants of Creative Trait Developments and Academic Achievement among Senior Secondary School Chemistry Students in Giwa Educational Zone, Kaduna State, Nigeria. Seminar Presentation at Science Education Department ABU Zaria

Jiya, A. Lawal, F.K and Olorukooba S.B, (2012). Effect of the use of Analogy Teaching Strategy on Academic Performance in Evolution Concept among N.C.E. Biology Student *Journal of Research in Curriculum and teaching*. 6 (1), 484-492.

Johnson, D. and Johnson, R. (1975). *Learning Together and alone Cooperation*, Competation and Individualisation in Social Psychology of Education Theory and Research. London, Hemisphere Publishing Cooperation.

Johnson, D. and Johnson, R. (1990). Cooperative Learning and Performance. In *Sharan* (ed) *Cooperative Learning; theory and Research* pp.23-37 New York: Praager Press

Johnson, D. W., and Johnson, R. T. (2008). *Social Interdependence Theory and Cooperative Learning*: The Teacher's Role. In R. M. Gillies, A. Ashman & J. Terwel (Eds.), Teacher's Role in Implementing Cooperative Learning in the Classroom (pp. 9-37). New York, U.S.A: Springer.

Johnson, D. W., and Johnson, R. T. (2009). An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning. *Educational Researcher*, 38(5), 365-379.

Kajuru,Y.K and Kaura, A. (2010). Effect of Constructivist Teaching Strategy in Gender in of

Kerlinger, F.N. (1973). Foundation of Behavioural Research, London Holt Rinehart and Wiston.

Khan, S.M. (2008). Effect of Conceptual Change Instructional Strategy in Remediation Identified Misconceptions held by student in Biology. Unpublished PhD Dissertation, Science Education. A.B.U., Zaria.

Kilic, D. (2008). The Effects of the Jigsaw Technique on Learning the Concepts of the Principles and Methods of Teaching. *World Applied Sciences Journal*, 4(1), 109-114.

Kolawole, D.O. and Jekayinfa, A.A (2008). Perspectives on History of Education in Nigeria.
www.unilorin.edu.ng/publications/jekayinoluwa/JAMBANDNABTEB.doc.
Retrieved on January, 20 2012

Kolawole, E. B. (2007). Effects of Competitive and Cooperative Learning Strategies

Kundu, C.L and Tutoo, N.N (2002). *Educational Psychology*. Sterling Publishers: New Delhi.

Lakpini, M. A.(2012). Effects of Conceptual Change Instructional Strategy on Biology Performance of Low and Average Secondary School Students In Giwa Educational Zone . *Journal of Studies in Science and Mathematics Education: 2(1)47-56*

Lescano, A.A. (2008). The remedial English project. English teaching forum, 33(4) Retrieved 20 January (2009). From http://eca.state.gov./Forum/Vol.5/Vol 133/no4/p40.htm.

Lowenstein, D. (2003). Understanding and Helping the Slow Learner. Retrieved from http://www.clubtheo.com/momdad/html/dlslow.html

Mahnax, K. (2012). The Effect of Jigsaw Technique on the Learner's Reading Achievement. *The Case of English* L2 4(3), 974-984.

Malik,N.I(2012). Effect of Academic Interventions on the Developmental Skills of Slow Learners. *Pakistan Journal of Psychological Research*,27 (1), 135-151.

Maloof J, and White, V.K.B (2005). Team Study Training in the College Biology Laboratory. *Journal of Biology Education*, 39(3), 120-124.

Mari, J. S.(1994). The Understanding of Science Process and it's Relationship to Performance in Integrated Science. Unpublished M.Ed Thesis of Faculty of Education A.B.U., Zaria.

Mason, L. and Sorzio, P. (1996). Analogical Reasoning in Restructuring Scientific Knowledge. *European Journal of Psychology of Education*, 2(11), 3-23

Mehra, V. and Thakur, K. (2008). Effects of Cooperative Learning on Achievement and Retention in Mathematics of Seventh Graders with different Cognitive Styles. *Indian Educational Review*, 44:5-31.

Melihan, U.and Sirri, A. (2011). The Effect of Cooperative Learning Method on the Students' Success and Recall Levels of the 8th Grade Students Learning in Permutation and Probability Subject. *Journal of Education Faculty*, 1(2), 1-16.

Mohammadi, M and Salimzadeh, R. (2009). The Effect of Cooperative Learning Strategy Training on Reading Comprehension and Motivation of English Student Paper Presented at 7th International Conference TCLLSI, Yazd, Iran.

Moyer R.H, Hackett J.K, and Everett S.A (2007). *Teaching Science as Investigation: Modeling inquiry through learning cycle lessons*. New Jersey: Pearson Merrill? Prentice Hall.

Naseriazar,A. Özmen, H. and Badriant, A. (2011). Effectiviness of Analogies on Students' Understanding of Chemical Equilibrium. *Western Anatolia Journal of Educational Science.* 42(10), 525-532

Njoku, Z. C (2007). Engendering Learning Equity in Science and Technology Classrooms for Sustainable Development. Proceedings of the 50th Anniversary Conference of Science Teachers Association of Nigeria. Heinemann Educational Books (Nig) Plc.24-31

Novak, J.D and Canas, A.J. (2008). The Theory Underlying Concept Maps and How to Construct them. Florida Institute for Human and machine Cognition 2008

Nuhoglu H. and Yalcin N.(2006). The Effectiveness of Learning Cycle Models to Increase Students Achievements in Physics Laboratory.*Turkish Journal of Science Education:* 3(2), 28-30

Nwafor, O.M. (2007). Educational Innovation; Process and Product Enugu; Magnet Business Enterprises.

Nwagbo, C. (1999). Effects of Guided Discovery and Expository Teaching Methods on Attitude Towards Biology of Students of Different Levels of Scientific Literacy. *Journal of Science Teachers Association of Nigeria,* 34(1&2):66-73.

Nwagbo, C. (2001). Level of Scientific Literacy of Secondary School Science Student: Implication of Sustainable Development in Nigeria. Proceeding of the 43rd Annual Conference ssociation of Nigeria. 73-77.

Nworgu, L.N. (2006). *Modern Techniques of Teaching Biology*: A Paper Prepared for National Open University.

Nworgu, L.N. and Otum, V.V. (2013). Effect of Guided Inquiry with Analogy Instructional Strategy on Students Acquisition of Science Process Skills. Depertment of Science Education, University of Nigeria, Nsukka – Enugu State, Nigeria. *Journal of Education and Practice* 4(27):35-41.

Nwosh, A.A. (2003). Constructivism as an Innovative Model for Science Teaching: Importance and Extent of Use in Secondary Schools. *Journal of Science Teachers Association of Nigeria.* 38 (1&2):78-87.

Nzewi, N., Onyegegbu, N. and Nworgu (2009). *Biology Method*, National Open University of Nigeria.

Odoh,C.O. (2013). Effect of Cooperative Instructional Strategy on Students Achievement in Senior Secondary Chemistry. *Journal of Research in Curriculum and Teaching.*7(1), 583-589.

Okigbo, E.C. (2010). Comparative Effectiveness of Mathematical Game and Instructional Analogy as Advance Organizers on Students Achievement and Interest in Mathematics Published PhD Dissertation. Nnamdi Azikiwe University Awka.

Okoro, C.A. (2002). Bringing Science Classrooms into Games; Integrated Innovations in Science, Technology and Mathematics Education for Sustainable Development in the 21st Century.42nd STAN *Annual Conference Proceedings* 115 – 126.

Olajide J.O. (2012). Relationship between Wait-Time and Socio- Cultural Factors in Science Instruction in a Non- Western Environment of Kaduna State. *Journal of Studies in Science and Mathematics Education,* 2(1), 23-30

Olatoye, R.A. (2002). A Causal Model of School Factors as Determinants of Science Achievement in Lagos State Secondary Schools. An Unpublished PhD Dissertation. University of Ibadan, Ibadan.

Olorukooba, S.B. (2001). The Relative Effectiveness of Cooperative Instructional Strategy and Traditional Method on Performance of Senior Secondary School Chemistry Student. Unpublished Ph.D Thesis A.B.U., Zaria.

Olorukooba, S.B., Lawal, F.K. and Jiya, A. (2012). Effect of Teaching with Analogy on Academic Achievement and Retention of Evolution Concepts among Male and Female NCE Biology Students. *Journal of Studies in Science and Mathematics Education.* 2(1), 81-91

On Academic Performance of Nigerian Students in Mathematics. Educational Research Review, 3 (1), 33-37.

Osobonye, G.T. (2002). Nigerian Secondary School Laboratories and the Goals of Science Education: An Appraisal. 43rd *Annual Conference Proceedings of Science Teachers Association of Nigeria. 160-164*

Oyedekum, C.A. (1998). Effect of a Conceptual Change Model on Student Achievement, Retention and Attitude to Biology Concepts. Unpublished Ph.D Dissertation. A.B.U. Zaria.

Oyedekum, M.R. (2002). Identification of Difficult Topics in the Senior Secondary School Certificate Biology Syllabus as Perceived by Student. *The Nigerian Teachers Today,* 10(1), 110-120.

Parveen, Q., Mohamood, T. and Arif, M. (2011). Effect of Cooperative Learning on Academic Achievement of 8 Grade Students in the Subject of Social Studies. *International Journal of Academic Research,* 3(1), 1-5.

Prince, M. (2004). Does Active Learning Work? A Review of the Research. *Journal of Engineering Education.* 93(3), 223-231.

Pujar, L. L. and Gaonkar, V. (2008). Instructional Strategies to Accelerate Science Learning Among Slow Learners. *Karnataka Journal of Agricultural Science*, 21(4), 553-556.

Richland, L.E., Holyoak, K.J. and Stigler J.W. (2004). Analogy use in Eighth-Grade Mathematics Classrooms. *Cognition and Instruction*, 20(1), 37-60.

Ruhl, T.S. (2003). Analogies Coming out Ears: Altoona Family Physicians Residing of Altoona Hospital Centre for Medicine http://www.altoonaFb.org/ Special analogies.htm. last accessed 28 June,(2003).

Şahin A.(2010). Effects of Jigsaw II Technique on Academic Achievement and Attitudes to Written Expression Course. *Karnataka Journal of Agricultural Science*, 5(12), 777-787.

Sambo, A.A. (2008). *Research Methods in Education*. Stirling-Horden Publishers Nigeria LTD Gaf Building, 110-112 Oyo Road, Orogun, off University of Ibadan, Oyo State, Nigeria

Sani, H.M. (2006). Effect of Analogy on Conceptual Understanding of Chemical Equilibrium among Secondary School Students in Minna Municipal, Niger State. *Journal of Science Education and Allied Research.* 2(1), 46-51.

Sharma H. and Sharma S.(May-2008). Effect of Cooperative Learning in Interpersonal Relationship of Elementary School Students. *Educational Research Review*, 7 (9) 10-11

Shaw, S. R. (2008). An Educational Programming frame Work for a Subset of Students with Diverse Learning needs: Borderline intellectual Functioning Interventions in *School and Clinic*, 43(5), 291-299.

Shaw, S., Grimes, D. and Bulman, J. (2005). Educating Slow Learner: are Charter Schools the Last, Best Hope for their Educational Success. *The Charter Schools Resources Journal*, 1(1) Retrieved 20 January 2009 from http://www.ehhs.amich.edu.

Şimşek, U. (2013). Effects of Cooperative Learning Methods on Social Studies Undergraduate Students' Achievement in Political science. Energy Education Science and Technology Part B: *Journal of Social and Educational Studies.* 5 (1), 619-632.

Slavin, R. E. (2010). *Co-operative Learning:* what makes group work In H. Dumont, D. Istance, and F. Benavides (Eds.), The Nature of Learning: Using Research to Inspire Practice (pp. 161–178). Paris: OECD.

Slavin, R. E. (2011). Instruction Based on Cooperative Learning. In R. Mayer (Ed.), *Handbook of Research on Learning and Instruction*. London: Taylor and Francis.

Slavin, R.E. (2009). *Cooperative Learning*. In G. McCulloch and D. Crook (Eds.) International Encyclopedia of Education. Abington, UK: Routledge.

Slavin, R.L. (2008). *Cooperative Learning*: Theory, Research and Practice 2nd edition.

Smiths B.O. (2011). Definition of Teaching. Retrieved from www.phy.ilstu-du/pte/310content/teachteam/teaching

Souvignier, E. and Kronenberger, J. (2007). Cooperative Learning in Third Graders' Jigsaw Groups for Mathematics and Science with and Without Questioning Training. *British Journal of Educational Psychology*, 77:755-771

Ston, R.H. (1999). *New Biology for Senior Secondary School.* Lagos: Longman Publishing Company.Technique and the Academic Achievement of Physics Student with Low Ability. University Press Ibadan Nigeria. *Journals of Studies in Science and Mathematics Education*, 1, 55-61.

Sultan A. R. (2012). How to Help Slow Learners on Academic Achievements. Retrieved from http://www.shawpsyc h.com/slowlearners.htm 2/4/14

Tran, V. D. (2013). Effects of Students Teams Achievement Division (STAD) on Academic Achievement and Attitudes of Grade 9th Secondary School Students Towards Mathematics. *International Journal of Science*, 2, 1–15

Treagust, D. F. (1993). The Evolution of an Approach for using Analogies in Teaching and Learning Science. *Research in Science Education.* 23, 293–301.

Treagust, D. F., Harrison, A. G. and Venville, G. J.,(1998). Teaching Science Effectively With Analogies: An Approach for Preservice and Inservice Teacher Education. *Journal of Science Teacher Education,* 9 (2), 85 – 101.

Tuckman, B.W. (1975). *Measuring Education Outcomes*. Harcourt Brace Hovawick, New York.

Usman, I.A. (2000). The Relationship Between Students' Performances in Practical Activities and their Academic Achievement Integrated Science Using NISTEP Mode of Teaching. Unpublished Ph.D Dissertation Faculty of Education, Ahmadu Bello University, Zaria.

Usman, I.A. (2008). Using Selected Method of Teaching in Enhancing Slow Learner Academic Performance among Junior Secondary School Integrated Science.

Van Bavel, J., Xiao, Y.J. and Cunningham, W.A. (2012). Evaluation is a Dynamic Process. Moving Beyond dual System Models. Social and Personality Psychology Compass, 6(6), 438-454.Wadsworth Engage Learning.

Venville, G. J., and Treagust, D. F. (1997). *Analogies in Biology Education*: A contentious issue. The American Biology Teacher. 59, 282–287.

Viann, E. (2004). Gender Difference and the Effects of Cooperative Learning in College Level Mathematics. Unpublished PhD Thesis, Curtin University of Technology.

Vygotsky, L.S. (1978). Mind in Society. Cambridge, M.A: Harvard University Press.

WAEC (2010, 2011, 2012, 2013 & 2014). Chief Examiner Report (Nigeria) S.S.C.E. May/June Examination.

Whitley, B.E. (2010). The Psychology of Prejudice & Discrimination . United States:

Williamson, J. (2k012). The "Slow Learner" as a Mediated Construct. *Canadian Journal of Disability Studies*,1(3):85-98.

Yael S. ,Sharan S.and Shlomo S.(1989). Group Investigation Expands Cooperative Learning. *Educational Leadership*, 47(4):17–21.

Yamarik, S. (2010). Does cooperative Learning Improve Student Learning Outcomes? *Journal of Economic Education*, 25(1), 259–277.

Yilmaz S. Eryilmaz A. and Geban O. (2010). Assessing the Impact of Bridging Analogies in Mechanics. *Journal of Science and Mathematics*.106(6), 220-230

Yolele, T.W. (2004). That we may Learn Better: an Inaugural Lecture Delivered at University Press Ibadan Nigeria. *Journals of Studies in Science and Mathematics Education.* 1(3):43-51

Yushau, U.M.A. (2012). Teaching Slow Learners in Mathematics: Yugal Remediation Model as Alternative Method. Science Education Research, 13 (2), 108-123.

Yusuf, M. O. and Afolabi, A. O. (2010). Effects of Computer Assisted Instruction (CAI) on Secondary School Students' Performance in Biology. *The Turkish Online Journal of Educational Technology.* 9 (1) Retrieved on the 15th January, 2010 from http://www.tojet.edu.com

Yusuf, M. O., Gambari, A.I. and Olumorin, C. O. (2012). Effectiveness of Computer-Supported Cooperative Learning Strategies in Learning Physics. *International Journal of Social Science and Education,* 2(2), 94-109.

Zeitoun, H.H. (1984). Teaching Scientific Analogies: A Proposed Model. *Research in Science and Technology Education*, 2, 107-125.

APPENDIX A

Ecology Performance Test (EPT)

INSTRUCTION: ANSWER ALL QUESTIONS, ALL QUESTIONS CARRY EQUAL MARKS

TIME: 60 MINUTES

(1) Ecology simply means the study of----------

(a) The properties of a habitat

(b) Interrelationship between organism and their environment

(c) Several species of plants and animals

(d) Interrelationship between plants and animals.

(e) Study of desert

(2) Which of the following factors is not associated with aquatic habitat?

(a) Temperature

(b) Light intensity

(c) Humidity

(d) Turbidity

(e) Wave action

(3) Which among the following statement is not correct about food chain?

(a) All food chain start with green plant

(b) Food chain involve relationship among organism

(c) Shorter food chain indicate more effective utilization of energy than longer ones

(d) There is no energy loss in food chain

(e) All food chain have primary consumers.

(4) Which among the following is the most important characteristics on arid land?

(a) high temperature during the day

(c) few animals

(d) scarcity of water

(e) poor vegetation

(5) Freshwater is a body of water which

(a) Contains no suspended matter

(b) Is good of drinking

(c) Contains no significant amount of salt

(d) Has not been stored for a long period of time

(e) is good for irrigation

(6) A food chain can be described as a

(a) Complex feeding relationship in a community to another

(b) Complex pattern of food production in a community

(c) Group of many populations competing for the same type of food

(d) Group of organism belonging to the same tropic level.

(e) All of the above

(7) Which of the following represent the correct order of a possible food chain?

(a) Crustacean → diatom → fish → man

(b) Fish → Crustacean → man → diatom

(c) Man → fish → crustacean → diatom

(d) Diatom → crustacean → fish → man

(e) Man → diatom → fish → crustacean

(8) In a food chain the position occupied by an organism is called

(a) The tropic level

(b) Energy level

(c) The feeding level

(d) The habitat level

(e) Niche

(9) Which of the following is an a biotic factor which affects a population?

(a) Predator

(b) Parasite

(c) Consumer

(d) Producer

(e) Temperature

(10) The entire habits and habitat of an organism can be describes as its

(a) Ecological community

(b) Ecological niche

(c) Habitat factors

(d) Biotic factors

(e) A biotic factors

(11) Which of the following is a biotic factor?

(a) Predator

(b) Rainfall

(c) Cropping

(d) Grazing

(e) Migration.

(12) Which of the following is the correct sequence for energy transfer and nutrient cycling among living thing in an ecosystem?

(a) Consumer → producer → decomposers

(b) Producers → decomposers → consumers

(c) Decomposers → producers' → consumer

(d) Producers → consumer → decomposition

(e) Consumers → decomposer → producers

(13) Which of this organism is a herbivore?

(a) Tadpole

(b) Phytoplankton

(c) King fisher

(d) Small fish

(e) Big fish.

(14) Which of the following organism is producer?

(a) Spirogyra

(b) Mucor

(c) Rhizopus

(d) Yeast

(e) Cat.

(15) Which of the following situation is most likely to bring about overcrowding of a species of animals

(a) Absence of territorial behavior

(b) Food shortage

(c) Emigration

(d) Dispersal of young ones

(16) The term ecosystem refers to

(a) Different group of green plants in a habitat

(b) Living members of a habitat

(c) Living organism interacting with the physical environment

(d) Members of particular plants and animals living in a habitat.

(e) All of the above

(17) In an ecosystem the organism which changes light energy into stored chemical energy is called_____

(a) Consumer

(b) Decomposer

(c) Producer

(d) Carnivore.

(e) Mammalian

(18) Organism that feed essentially on plants within an ecosystem may be referred to as----------

(a) Carnivores

(b) Herbivores

(c) Saprophytes

(d) Omnivores.

(e) Consumer

(19) A climax community is characterized by

(a) Continuous change in appearance

(b) Rapid changes in species composition

(c) Stability in appearance and species composition

(d) Absence of grasses but presence of trees.

(e) Continuous change in colour

(20) Which of the following physical factors is likely to affect the distribution of plants in a pond?

(a) Light

(b) Wind

(c) Humidity

(d) Temperature.

(e) Water

(21) Succession is best described as----------

a) A process whereby different organisms systematically colonize a barren habitat until a stable community is formed.
b) A process whereby animals occupies a barren habitat until a suitable habitat is formed
c) The replacement of weaker plants and animals by the stronger ones
d) A process whereby plant occupies a barren habitat until a suitable habitat is formed
e) The replacement of weaker animals by the stronger ones

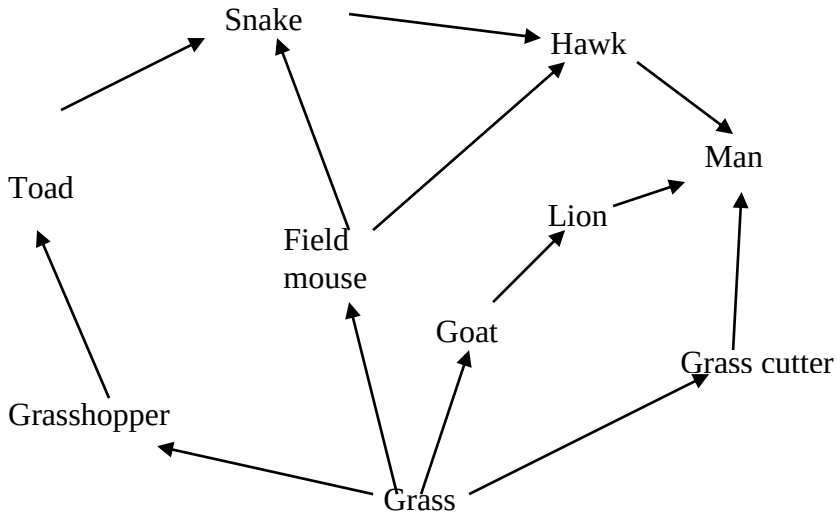
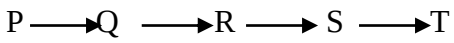


Figure 2: Feeding Relationship (food web)

22. The best title for the diagram in figure 2 is----------
(a) Terrestrial food web
(b) Terrestrial food chain
(c) Aquatic food web
(d) Aquatic food chain.
(e) All of the above

23. How many food chains are in the above diagram?
(a) Three
(b) Four
(c) Five
(d) Six.
(e) Seven

Study the diagram of food chain shown below to answer question 24 and 25



24. The organism designated P in the food chain above is normally sustain energy from
    (a) Sunlight
    (b) Carbohydrates
    (c) Green plants
    (d) Minerals salt.
    (e) Animals
25. Which of the following statements best describe the organism designated R? it
    (a) Feed on S
    (b) is primary consumer
    (c) is a producer as well as consumer
    (d) is a secondary consumer.
    (e) Tertiary consumer
26. Pick out the one that does not belong to the group in the following ecological terms
    (a) Habitat
    (b) Trophic level
    (c) Niche
    (d) Variation
    (e) Food chain
27. Summarize the following components of an ecosystem soil, light, temperature, bacteria and fungi.
    (a) Trophic level
    (b) Living and non living components of the environment
    (c)Functioning and non functioning components of the environment
    (d) Energy flow in the ecosystem
    (d)The soils tend to be sandy
    (e) all of the above
28. Mountain, abandoned farm land, rock are grouped together as
    (a) Ecosystem
    (b) Marine habitat
    (c) Aquatic habitat

(d) Terrestrial habitat

(e) All of the above

29. Which of the followings can not be found in ponds

(a) Scorpion

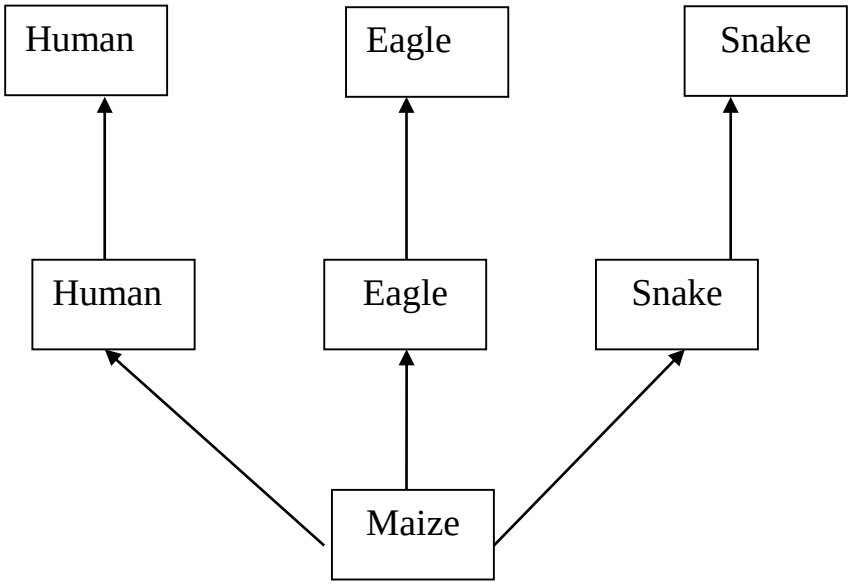
(b) Spirogyra

(c) Mosquitoes

(d) Water lettuce

(e) None of the above

Study the diagram showing three food chains, use it to answer question 30.



30. Which of the followings are consumers in these food chain

(a) Maize and rabbit

(b) chicken, rats and maize

(c) Eagle, maize and snake

(d) Human, eagle and snake

(e) maize, Eagle and Eagle,

APPENDIX B

Making Scheme for Ecology Performance Test (EPT)

1	B	16	C
2	C	17	C
3	D	18	B
4	D	19	D
5	C	20	A
6	A	21	D
7	D	22	A
8	A	23	C
9	E	24	A
10	B	25	D
11	B	26	A
12	D	27	B
13	B	28	C
14	A	29	A
15	B	30	D

1 MARK EACH 1X30 =30

APPENDIX C

Ecology Performance Test (EPT) Answer Sheet

SECTION A: PERSONAL DATA

Name of School _____

Class _____

Gender: Male ( ) Female ( )

SECTION B: ACHIEVEMENT TEST

Instructions:

Read the questions carefully and Answer all the questions. Select one from the five options as your answer to the question and shade the later ABCD and E that correspond to your answer. All question carry equal marks.

Time Allowed: 40 minutes

1.	=A=	=B=	=C=	=D=	=E=	16.	=A=	=B=	=C=	=D=	=E=
2.	=A=	=B=	=C=	=D=	=E=	17	=A=	=B=	=C=	=D=	=E=
3.	=A=	=B=	=C=	=D=	=E=	18	=A=	=B=	=C=	=D=	=E=
4.	=A=	=B=	=C=	=D=	=E=	19	=A=	=B=	=C=	=D=	=E=
5.	=A=	=B=	=C=	=D=	=E=	20	=A=	=B=	=C=	=D=	=E=
6.	=A=	=B=	=C=	=D=	=E=	21	=A=	=B=	=C=	=D=	=E=
7.	=A=	=B=	=C=	=D=	=E=	22	=A=	=B=	=C=	=D=	=E=
8.	=A=	=B=	=C=	=D=	=E=	23	=A=	=B=	=C=	=D=	=E=
9.	=A=	=B=	=C=	=D=	=E=	24	=A=	=B=	=C=	=D=	=E=
10.	=A=	=B=	=C=	=D=	=E=	25	=A=	=B=	=C=	=D=	=E=
11	=A=	=B=	=C=	=D=	=E=	26	=A=	=B=	=C=	=D=	=E=
12	=A=	=B=	=C=	=D=	=E=	27	=A=	=B=	=C=	=D=	=E=
13	=A=	=B=	=C=	=D=	=E=	28	=A=	=B=	=C=	=D=	=E=
14	=A=	=B=	=C=	=D=	=E=	29	=A=	=B=	=C=	=D=	=E=
15	=A=	=B=	=C=	=D=	=E=	30	=A=	=B=	=C=	=D=	=E=

APPENDIX D

Lesson Plans for Experimental Groups

Lesson I: Week One

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: Ecosystem

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional Resources /Material: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

i. Define ecosystem

ii. State two components of ecosystem

iii. List examples of biotic and a biotic components

Previous knowledge: Students have some knowledge on how to interact with non living thing in their community.

Step I: Teacher activities

Introduction: The researcher introduces the lesson by writing the topic on the board and also ask students some of the following questions:

(i) What is an ecosystem?

(ii) Mention the two components of an ecosystem

Presentation: The researcher will organise the lesson through the following steps:

- 30 Students in the experimental group was be assigned in to 6 groups of 5 students each and a leader will be chosen for each group. Material for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.
- The researcher introduces the activities and guides the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

I: the use of name when addressing the group members;

II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- Specific roles are given to each member of the group to ensure individual accountability.

I: Team leader makes certain all group members understand roles, instruction and work;

II: Questioner should ask the instructor questions that are posed by the group;

III: Gate keeper makes sure that, every one participates in the activity;

IV: Group listener gives verbal and non verbal acknowledgement of contribution of others;

V: Summarizer periodically summarized the materials so that group members can cheek it.

Step II: Students Activities

- Each group leader will read out the activities for the group as presented:

Activity 1: Discussion on the meaning of ecosystem

Materials: The researcher provides charts and photographs of different ecosystem to each group during the activity.

- The students in their groups will be taken to school garden which is familiar to them and observe the entire living and non living organism found in the school garden.
- The researcher ask students to observe the photograph of different habitat and discus on how natural living unit and non living organism interact to form a stale system in which a cyclic interchange of material take place between the living and non living component and compare it with familial school garden.
- Record the entire living component found in the photograph of an ecosystem.
- State the non living component found in the photograph of an ecosystem.
- Answers to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with

unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.

- Researcher will go round and encourage the students' to participate actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher will evaluate the lesson by asking the student some of the following question:

i. What is ecosystem?

ii. State two components of ecosystem

iii. List examples of biotic component

Conclusion: The researcher concluded the lesson by briefly summarising the main point in the lesson i.e. what Ecosystem is? type of Ecosystem. The researcher will also be going round the class and observed the groups. The researcher will inform the student that the next topic is on habitat.

Assignment: Students are asked to construct the possible food chain found in the ecosystem

Lesson II: Week Two

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: Food chain

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional Resources /Material: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

i. Define food chain

ii. List examples of organisms' fount in producer, consumers and decomposers

iii. Construct the possible food chains that can be found in ecosystem

Previous knowledge: Students have some knowledge on ecosystem from our previous class.

Step I: Teacher activities

Introduction: The researcher introduces the lesson by writing the topic on the board and also ask students some of the following questions:

(i) What is food chain?

(ii) Mention the one organisms' fount in producer, consumers and decomposers

Presentation: The researcher will organise the lesson through the following steps:

- 30 students in the experimental group will be assigned in to 6 groups of 5 students each, and a leader will be chosen for each group. Material for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.
- The researcher will introduce the activities and guide the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

  I: the use of name when addressing the group members;

  II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- Specific roles are given to each member of the group to ensure individual accountability.

I: Team leader makes certain all group members understand roles, instruction and work;

II: Questioner should ask the instructor questions that are posed by the group;

III: Gate keeper makes sure that, every one participates in the activity;

IV: Group listener gives verbal and non verbal acknowledgement of contribution of others;

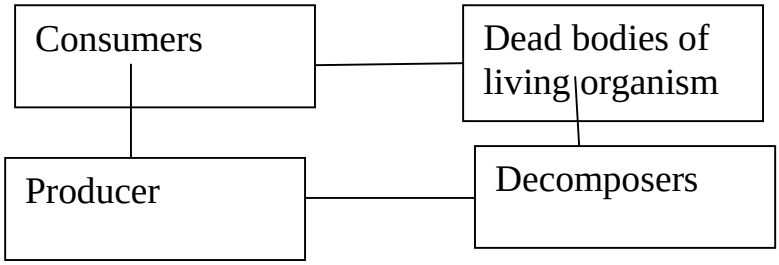
V: Summarizer periodically summarized the materials so that group members can cheek it.

- Each group leader will read out the activities for the group as presented:

Step II: Students Activities

Activity 2: **Discussion on relationship between producers, consumer and decomposers.**

- You are provided with Figure 1
- Carefully examine the scheme in Figure 1and compare it with feeding relationship in our communities and indicate the directions of the arrows



Relationship between Producer, Consumer, and Decomposers'

- The adjoining lines between the boxes are arrows.

(i) Indicate the direction of the arrows.

(ii) Give examples of organisms in each box

(iii) Where does this relationship normally exist?

(iv) defined food chain

- Answers to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.
- Researcher will go round and encourage the students' to participate actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher will evaluate the lesson by asking the student some of the following question:

i What is food chain?

ii. State two organisms' fount in producer, consumers and decomposers

iii. Construct the possible food chains that can be found in an ecosystem

Conclusion: The researcher will conclude the lesson by briefly summarising the main point in the lesson i.e. what food chain is? Outline some organisms' fount in producer, consumers and decomposers. The researcher will also be going round the class and observed the groups. The researcher will inform the student that the next topic is on habitat.

Assignment: Students are asked to construct the possible food chain found in the ecosystem

Lesson III: Week Three

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: Habitat

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional Material: Chats, pictures, Thermometer, wind vane, hydrometer and light meter.

Behavioural Objectives: By the end of the lesson, students should be able to;

(ii) Define habitat

(ii) Mention two type of habitat

(iii) list three a biotic factors

Previous knowledge: the students have learnt about the ecosystem from our previous class.

Step I: Teacher activities

Introduction: The researcher will introduce the lesson by writing the topic on the board and ask students some of the following questions:

(i) What is a habitat?

(ii) State two type of habitat

(iii) List two organisms that are found in aquatic habitat.

Presentation: The researcher will organise the lesson through the following steps:

- 30 students in the experimental group will be assigned in to 6 groups of 5 students each, and a leader will be chosen for each group. Material for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.
- The researcher will introduce the activities and guide the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

  I: the use of name when addressing the group members;

II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- Specific roles are given to each member of the groups to ensure individual accountability.

I: Team leader makes certain all group members understand roles, instruction and work;

II: Questioner should ask the instructor questions that are posed by the group;

III: Gate keeper makes sure that, every one participates in the activity;

IV: Group listener gives verbal and non verbal acknowledgement of contribution of others;

V: Summarizer periodically summarized the materials so that group members can cheek it.

- Each group leader will read the activities for the group as presented:

Step II :Students Activities

Activity 3: to study habitat

- You are provided with the pictures of the following organisms; rat, housefly, lion tadpole, moss, spirogyra and shark that are found from different habitat.
- Carefully examine each organism and compare them with domestics animals e.g. goat, cat, etc and
- Complete the table below by filling the habitant of each organism when compared with your familiar organism you know.

NO	Organism	Precise habitat
1	Millet	

2	Tadpole	
3	Lion	
4	Housefly	
5	Spirogyra	
6	Rat	
7	Shark	

Activity 4: measurement of physical ecological factors.

- Students in their group will be taken out to school compound
- You are provided with the thermometer, wind vane, hydrometer and light meter.
- Use the above material carefully to measure and record ecological factors in the habitat including temperature, wind direction, relative humidity and light intensity.
- Answer to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.
- Researcher will go round and encourages the students to contribute actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher will evaluate the lesson by asking the students some of the fallowing question:

(i) What is habitat?

(ii) What are the two type of habitat?

(ii) list three a biotic factors

Conclusion: The researcher will conclude the lesson by explaining to the students briefly the

main point in the lesson i.e. what they have learn such as what habitat is, type of habitat. The researcher should also be going round the class and observed the group. The researcher informed the students that the next topic is on aquatic habitat.

Assignment: Students are asked to read more on ecological factors

Lesson IV: Week Four

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: Aquatic habitat

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional Material: charts and photographs, pencil and drawing paper will be provided to each group by the researcher.

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Explain freshwater

(ii) list some of organisms found in freshwater

(iii) Construct the possible food chain that can be found freshwater habitat.

Previous knowledge: The students have learnt habitat from the previous lesson.

Step I: **Teacher activities**

Introduction: The researcher will introduces the lesson by writing the topic on the board and ask students some of the following questions:

(i) What is freshwater?

(ii) list three organisms that found in freshwater habitat

Presentation: The researcher will organise the lesson through the following steps:

- 30 students in the experimental group will be assigned in to 6

groups of 5 students each, and a leader will be chosen for each group. Material for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.

- The researcher will introduce the activities and guide the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

I: the use of name when addressing the group members;

II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- Specific roles are given to each member of the group to ensure individual accountability.

I: Team leader makes certain all group members understand roles, instruction and work;

II: Questioner should ask the instructor questions that are posed by the group;

III: Gate keeper makes sure that, every one participates in the activity;

IV: Group listener gives verbal and non verbal acknowledgement of contribution of others;

V: Summarizer periodically summarized the materials so that group members can cheek it.

- Each group leader will read the activities for the group as presented:

Step II :Students Activities

Activity 5: Discussion on fresh water habitat

- In your group, you will be taken to trip by the researcher to a pond
- Carefully observed the fresh water habitat (pond)
- Record all plant and animals found in the fresh water habitat.
- Construct the possible freshwater food chain based on organism present in the pond.

- Answer to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.

- Researcher goes round and encourages the students to contribute actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher will evaluate the lesson by asking the students some of the following questions:

(i) What is freshwater?

(ii) Mention two organisms that found in freshwater.

(iii) Construct the possible food chain that can be found in the pond

Conclusion: The researcher conclude the lesson by explaining to the students briefly the main point in the lesson i.e. what they have learn such as what is freshwater is, type of freshwater, mention some organisms found in freshwater habitat. The teacher should also be going round the class and observed the group. The researcher informed the students that the next topic is terrestrial habitat.

Assignment: The students should read more on other type of freshwater habitat; list 5 living organisms that can be found in each type of freshwater habitat.

Lesson V: Week five

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: terrestrial habitat

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional Material: charts and photographs, pencil and drawing paper are provided to each group by the researcher

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Define terrestrial habitat

(ii) list four kinds of terrestrial habitat

(ii) state two characteristics of terrestrial habitat.

Previous knowledge: the students have learnt about the aquatic habitat from our previous class.

Step I:Teacher activities

Introduction: The researcher introduces the lesson by writing the topic on the board and ask students some of the following questions:

(i) What is terrestrial habitat?

(ii) List four kinds of terrestrial habitat

(ii) State some of the characteristics of different kind of terrestrial habitat

Presentation: The researcher organised the lesson through the following steps:

- 30 students in the experimental group will be assigned in to 6 groups of 5 students each, and a leader will be chosen for each group. Materials for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.
- The researcher will introduce the activities and guide the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

  I: the use of name when addressing the group members;

II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- Specific roles are given to each member of the group to ensure individual accountability.

I. Team leader makes certain all groups members understand roles, instruction and work;
II. Questioner should ask the instructor questions that are posed by the group;
III. Gate keeper makes sure that, every one participates in the activity;
IV. Group listener gives verbal and non verbal acknowledgement of contribution of others;
V. Summarizer periodically summarized the materials so that group members can cheek it.

Each group leader will read the activities for the group as presented:

Step II :Students Activities

Activity 6: To study a terrestrial habitat

Materials: long measuring tape, pencil and drawing paper are provided to each group by the researcher

- In your group, you will be taken to school garden by the researcher
- Sketch a map of the school garden and put in landmark.
- Carefully observe the area at regular intervals over a period of time.
- Record the plants and animals observed in the area; note animals nest, ant heaps, termite mounds, earthworm cast;
- list the possible food sources such as flower, leaves, insects and water sources.
- Construct the possible food chain.

Activity 7: Observing charts and photographs of different world biomes

- you are provided with charts and photographs of different world biomes
- Carefully observed the charts and photograph of different world biomes
- Identify and record the characteristic features of each biome
- Make a list of the major characteristic of each biome.

- Answer to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.
- Researcher goes round and encourages the students to contribute actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher evaluate the lesson by asking the students some of the fallowing question:

(i) What is terrestrial habitat?

(ii) list four kinds of terrestrial habitat

(iii) state some of the characteristics of different kind of terrestrial habitat.

Conclusion: The researcher conclude the lesson by explaining to the students briefly the main point in the lesson i.e. what they have learn such as terrestrial habitat,. types of terrestrial habitat and its characteristic. The researcher should also be going round the class and observed the group. The researcher informed the students that the next topic is on ecological succession.

Assignment: Students are asked to construct the possible food chain found in the grassland ecosystem

Lesson VI: Week Six

Class: SS2

Group: Experimental

Time: Double period (80 minutes)

Subject: Biology

Topic: Ecology of population

Number of students in class: 30 Students

Average Age: 16 years

Gender: male and female

Instructional materials : students, meter rulers, and chart will be used for the study

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Define Overcrowding

(ii) State the factors that may course overcrowding

(iii) Mention the effect of overcrowding.

Previous knowledge: the students have learnt about terrestrial habitat from our previous lesson.

Step: I Teacher activities

Introduction: The researcher will introduces the lesson by writing the topic on the board and also ask students the following questions:

(i) What is overcrowding

(ii) Mention factors that cause overcrowding

(iii) What are the effects of overcrowding?

Presentation: The researcher will organise the lesson through the following steps:

- 30 students in the experimental group will be assigned in to 6 groups of 5 students each, and a leader will be chosen for each group. Material for the lesson will be distributed to each group leader who will ensure that, everyone in the group participate in the activities and discussion.
- The researcher will introduce the activities and guide the students on how to make comparison between familiar and unfamiliar domains. The researcher also emphasize the need for each groups to work cooperatively as a team and what is expected to do in the enriched cooperative learning lesson are;

  I: the use of name when addressing the group members;

II: contribution of idea's and suggestion;

III: encouragement of the contribution of ideas verbally and none verbally;

IV: checking understanding of others;

V: keeping the group in order;

VI: active listening skills;

VII: Ability to summarize;

VIII: Ability to paraphrase;

IX: group decision making;

X: acknowledge contribution verbally and none verbally.

- specific roles are given to each member of the group to ensure individual accountability.
  I. Team leader makes certain all group members understand roles, instruction and work;
  II. Questioner should ask the instructor questions that are posed by the group;
  III. Gate keeper makes sure that, every one participates in the activity;
  IV. Group listener gives verbal and non verbal acknowledgement of contribution of others;
  V. Summarizer periodically summarized the materials so that group members can cheek it.
- Each group leader will read the activities for the group as presented:

Step II: Students Activities

Activity 8: illustrate overcrowding

- You are provided with the meter rulers, pencil and plane sheet.
- You are to determine the area of your classroom (length x width = area)
- You are to counts the number of students in the class
- Students determine the space available to each of them thus

  $$\frac{\text{Space per student area of classroom}}{\text{Number of student in the class}}$$
- Allow students from another class to come in to the classroom to join the students already in that classroom
- You are to determine the space available to each students and when the students of two classes are in one classroom

Answer the following question.

a. Is the space available to each students is the same when they are in one classroom and when two classes were in the same classroom?
b. How did the students react to the conditions when the number of students in the class room increased?
c. List some of the students reaction that you can observed
d. What cause overcrowding?

- Answer to the above activity will be through discussing, brainstorming, asking group member questions and comparing the familiar phenomena (source) with unfamiliar phenomena for the students to deduce their authentic view on their own. Throughout the period, students actively listen to the view of others and discuss their view freely with the group members in order to maximize interaction in the cooperative learning.
- Researcher will go round and encourages the students to contribute actively for the entire success of the group.
- All completed activities for each group will be collected from group leader and marked by the researcher.

Evaluations: The researcher will evaluate the lesson by asking the student some of the fallowing question:

(i) What is overcrowding?
(ii) List two effect of overcrowding
(iii) What are the factors that course overcrowdings?

Conclusion: The researcher conclude the lesson by explaining to the student briefly the main point in the lesson i.e. what they have learn such as what overcrowding is, effect of overcrowding and factors that couse overcrowding. The teacher should also be going round the class and observed the group.

Assignments: Students are ask to write on adaptation to avoid overcrowding

APPENDIX E

Lesson Plans for Control Groups

Lesson I: Week one

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: Ecosystem

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional resources: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

i. Define Ecosystem

ii. State two components of an ecosystem

iii. List example of biotic and a biotic component

Introduction: The researcher will introduce the lesson by writing the topic on the board and also ask students some of the following questions:

(i) What is an ecosystem?

(ii) Mention the two components of an ecosystem

(iii) List example of biotic component

Presentation: The researcher will present the lesson through the following steps:

Step (i): The researcher will define and explain that; ecosystem is defined as a natural unit of living and non living things which interact to form a stable system in which a cyclic interchange of materials take place between the living and non living component examples of ecosystem are lake, a forest, a farm land, a stream or large pond.

Step (ii): The researcher will explain the component of an ecosystem which can be divided in to two: living (biotic) and non living (abiotic) components. The living part of an ecosystem is known as biotic component. It is composed of the entire living organism in the environment, often called the biotic community. In biotic community includes population of

- Food producer, i.e., autotrophs like green plant, procophytes, and bacteria.

- Food consumer i.e. hetotrophs such as animals, protozoa and some bacteria.
- Decomposers, i.e. saprophytes like fungi and some bacteria

The non living part of an ecosystem is it's abiotic component, it consist of abiotic resources which is what organism need in order to stay alive e.g. sunlight, carbon dioxide, water, nitrogen etc while the biotic condition those are the factors that affect the behaviour, growth and breeding patterns of an organism.

Step iii: The researcher will explain the food relationship where all living organism must obtain energy from their environment in order to remain alive. We can see that through the following food relationship of feeding pathways.

Trophic level: In a food chain or web, each stage in the chain or web is called a trophic (feeding) level in the food chain.

Guinea grass – grasshopper – toad – snake – hawk

There are five trophic level. Guinea grass is first trophic level, grasshopper is the second trophic level toad is the third, snake is the fourth and hawk is fifth trophic level.

Step iv: The researcher will give chance to the students to ask questions if they have and the researcher should answer their questions respectively.

Evaluation: The researcher will evaluate the lesson by asking the student some of the following question.

i. What is ecosystem
ii. what are the two components of an ecosystem
iii. Mention three examples of biotic and a biotic component.

Conclusion: The researcher will conclude the lesson by explaining to the student briefly the main point of the lesson that is, what is ecosystem and it's component, how energy is transferred from trophic level to another. The researcher will also be going round the class and observed thus that are not copying the note and finally the researcher inform the student that the next topic will be on habitat.

Assignment: Researcher should ask students to read on habitat

Lesson 2: Week two

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: Food chai

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional resources: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

i. Define food chain

ii. List examples of organisms' fount in producer, consumers and decomposers

iii. Construct the possible food chains that can be found in ecosystem

Previous knowledge: Students have some knowledge on ecosystem from our previous class.

Introduction: The researcher will introduce the lesson by writing the topic on the board and also ask students some of the following questions:

(i) What is food chain?

(ii) Mention the one organisms' found in producer, consumers and decomposers

Presentation: The researcher will present the lesson through the following steps:

Step (i): The researcher will define and explain that; food chain as a sequence of transfer of

food energy from one organism to another in an ecological community. A food chain begins with a producer, usually a green plant or alga that creates its own food through photosynthesis. In the typical predatory food chain Producers are eaten by primary consumers (herbivores) which are eaten by secondary consumers (carnivores), some of which may in turn be eaten by tertiary consumers (the top carnivores in the chain). Many species of animals in an ecological community feed on both plants and animals and thus play multiple roles in the chain.

Step (ii): The researcher will explain the stages of food chain. A food chains step wise transfer of energy in the form of food.

- Food producer, i.e., autotrophs like green plant, procophytes, and bacteria.

- Food consumer i.e. hetotrophs such as animals, protozoa and some bacteria.
- Decomposers, i.e. saprophytes like fungi and some bacteria

Step III: researcher will explain the food relationship where all living organism must obtain nutrient from their environment in order to remain alive. We can see that through the following food relationship of feeding pathways.

Example the grasshopper feed on plants, such as guinea grass. A toad eats the grasshopper. A snake eats the toad and hawks eat the snake. The above feeding relationship can be represented as:

Guinea grass – grasshopper – toad – snake – hawk

Step iv: The researcher will give chance to the students to ask questions if they have and the

researcher should answer their questions respectively.

Evaluations: The researcher will evaluate the lesson by asking the student some of the following question:

i What is food chain?

ii. State two organisms' fount in producer, consumers and decomposers

iii. Construct the possible food chains that can be found in an ecosystem

Conclusion: The researcher will conclude the lesson by explaining to the students briefly the

main point of the lesson that is, what is food chain and it's component, how feeding relationship among the organism. The researcher will also be going round the class and observed thus that are not copying the note and finally the researcher inform the student that the next topic will be on habitat.

Assignment: Researcher should ask students to read on habitat

Lesson 3: Week Three

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: Habitat

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional resources: charts and textbooks will be used during the lesson.

Behavioural Objectives: By the end of the lesson, students should be able to;

(ii) Define habitat

(ii) Mention two type of habitat

(iii) define aquatic habitat

Pervious Knowledge: The students have learnt the ecosystem from the previous lesson.

Introduction: The researcher will introduce the lesson by writing the topic on the board and

ask students some of the following questions:

(iv) What is a habitat?

(v) State two type of habitat

(vi) List two organisms that are found in aquatic habitat.

Presentation: The researcher will present the lesson through the fallowing steps:

Step (i): The researcher will define an explain habitat of an organisms. Habitat is the natural Environment in which organism normally lives.

Step (ii): The researcher will state the type of habitat which are:

(i) Aquatic habitat which consist largely of water. Examples of organisms that can be found in this habitat are: fish, frog, water lily, and crocodile etc.

(ii) terrestrial habitat which consist largely of land. Examples of organisms that can be found in this habitat are: man, goat, rat, cat, snake e.t.c

Step (iii) The researcher will state the type of aquatic habitat on the board as

(i) fresh water habitats

(ii) marine or salt water habitat and

(ii) estuarine or brackish –water habitat

Step (iv): The researcher will give chance to the students to ask question if they have and the researcher will answer their question respectively.

Evaluation: The researcher will evaluate the lesson by asking the students some of the following question.

(i) What is habitat?

(ii) Mention two type of habitat

(iii) Mention three type of aquatic habitat.

Conclusion: The researcher conclude the lesson by summarising the main the point that is definition of habitat, type of habitat and the researcher will inform the students that the next topic is on the freshwater habitat.

Lesson 4: Week Four

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: Aquatic habitat

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional materials: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Define freshwater habitat

(ii) list some of organisms found in freshwater

(iii) Construct the possible food chain that can be found in freshwater.

Previous Knowledge: The students have learnt habitat from the previous lesson.

Introduction: The researcher will introduces the lesson by writing the topic on the board and

also ask students some of the following questions:

(i) What is freshwater?

(ii) List three organisms that can be found in freshwater habitat

(iii) Can you construct food chain from freshwater habitat?

Presentation: the researcher will present the lesson through the fallowing steps:

Step i: The researcher will explain freshwater habitat: freshwater is naturally occurring water on earth's surface in ice caps, pond, river and stream, underground water and underground streams. Fresh water is generally characterized by having low concentration of dissolved salts.

The main different between freshwater and sea water is the concentration of minerals salts in them. These salts come mainly from the atmosphere and the soil. Freshwater organisms have be adaptation to cope with the entry of excess water in to their bodies from the surroundings. There are two type of freshwater habitat namely:

1. Lentic water which is does flow and calm and some time called standing bodies of fresh such as ponds and lakes.

2. Lotic freshwater flowing over land such as spring, streams, and rivers.

Both habitats have a littoral zone and benthic zone. The surface waters are rich in both producer and consumers. The differ region of the water body contain less organisms; mainly consumer and decomposers. Each freshwater habitat will contain typical species which are affected by a biotic factor such as temperature, degree of water movement, oxygen content, degree of turbidity etc.

Step ii: The researcher will draw a typical freshwater habitat on the board and explain some of its characteristics.

Step iii: The researcher will give chance for the students to ask question and the researcher will answer their question through students teacher interaction.

Evaluation: The researcher will evaluate the lesson by asking the students some of the following question.

(i) What is freshwater?

(ii) Mention two organisms that found in freshwater

(iii) Construct the possible food chain that can be found in freshwater

Conclusion: The researcher conclude the lesson by explaining to the students briefly that What freshwater habitat is? Researcher should be going round the class in order to observe those that are not copying the note. Researcher informed the students that the next topic is terrestrial habitat.

Assignment: List 5 living organism that found in freshwater habitat and it's possible food web

Lesson 5: Week five

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: terrestrial habitat

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional resources: charts and photographs of different ecosystem

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Define terrestrial habitat

(ii) list four kinds of terrestrial habitat

(ii) state some of the characteristics of different kind of terrestrial habitat.

Previous Knowledge: The students have a little knowledge on terrestrial habitat from our previous lesson.

Introduction: The researcher will introduces the lesson by writing the topic on the board and ask students some of the following questions:

(i) What is terrestrial habitat?

(ii) List four kinds of terrestrial habitat

(iii) State some of the characteristics of different kind of terrestrial habitat

Presentation: the researcher will present the lesson through the fallowing steps:

Step (i): The researcher explains to the student that terrestrial habitat is land habitats. Habitats of different kinds present different problem to living. Life is bleared to have started in water and in due course, organism that where suitably adopted moved on to land. There are four kinds of terrestrial habitat marsh, forest, savannah and arid land.

Step(ii): the researcher explain to the students that, marsh is a lowland habitat which is Flooded at all times and in which grasses and shrubs grows. In many ways a transitional habitat between the aquatic and terrestrials marshes are usually formed near rivers other bodies of water, such as lagoons.

Type of Marshes

Marshes may be either saltwater or freshwater marsh.

(i) the water that floods the land near the estuaries, creeks and lagoons is a mix of fresh and saltwater, hence the marshes are called saltwater marshes.

(2) Freshwater marshes occur inland, just beyond the limits of the saltwater marshes and beyond the areas influenced by tides.

The researcher explain to the students that characteristics of ecosystem are

(i) the habitat is a lowland

(ii) the ground is over flooded most of the time

(iii) the soil is wet, soft and water logged

(iv) the bodies of water usually contain much decaying organic matter, animals that found in marshes are toad, mud fish water lettuce aquatic fern etc.

Step iii: The researcher will explain to the students that, forest is a plant community in which trees species are dominate. The main forest biomes include the tropical rainforest, the temperate deciduous forest and the coniferous forest. Animals found in the forest are monkey, grass cutter, lion, chimpanzee, rat, rabbits, antelope etc.

Step iv: the researcher explain to the students that savannah is a plant community in which Grass species are dominated, but trees and shrubs may also be present. In Nigeria there are different types of savannah such as:

(i) South guinea savannah: This is characterised with very tall grass,h scattered trees and shrubs.

(ii) Northern guinea savannah: This type of savannah is characterised by the pressure of short grasses and some characteristics trees such as Isobadina doka the rain fall is low (500m – 300m per annum)

(iii) Sahel savannah: This type of savannah occurs in Nigeria, only on the eastern part of Borne state around lake chard. It is characteristic by a poor vegetation of short grass and small trees.The animals found in this habitat are rat, squirrels, deer, grass cutter adulteress snails etc

Step v: The researcher will explain to the students that arid lands are those areas in which water is very difficult to obtain.

Type of Arid Land: There are two main types of arid lands namely:

(a) Hot arid lands which are hot desert and semi-desert

(b) The cold arid lands, which are the cold deserts or tundra.

Evaluation: The researcher will evaluate the lesson by asking the student some of the following question.

(i) What is terrestrial habitat?

(ii) what are the four kind of terrestrial habitat?

(iii) Mention three animals found in savannah land.

Conclusion: The researcher concludes the lesson by summarizing the main point such as, type of terrestrial habitat, characteristic of terrestrial habitat. The teacher will inform the students that, the next topic is overcrowding

Lesson 6: Week Six

Class : SS2

Group: Control

Time: Double period (80 minutes)

Subject: Biology

Topic: overcrowding

Number of students in class: 30

Average Age: 16years

Gender: male and female

Instructional materials: charts and the students

Behavioural Objectives: By the end of the lesson, students should be able to;

(i) Define Overcrowding

(ii) State the factors that may cause overcrowding

(iii) Mention the effects of overcrowding

Previous Knowledge: the students have an idea on overcrowding from their community.

Introduction: The researcher will introduces the lesson by writing the topic on the board and also ask students the following questions:

(iii) What is overcrowding

(iv) Mention factors that cause overcrowding

(iii) What are the effects of overcrowding?

Presentation: the researcher will present the lesson through the following steps:

STEP ii: The researcher explain to the students that overcrowding is defined as a situation which occurs when a population in a given habitat increases beyond such as space and food are not enough to support all the individuals in the population.

STEP II: The researcher states and explain to the students that factors that may cause Overcrowding are:

- Increase in birth rate (Nationality)
- Increase in food supply
- Decrease in death rate mortality
- Immigration
- Lack of dispersal
- Social habits
- Inadequate space

STEP III: The researcher will states and explain to the students that, the effect of Overcrowding such as

- shortage of space
- Competition
- Anti – Social Behaviour
- Spread of diseases
- Preying on each other
- Death of organism

Evaluation: The researcher will evaluate the lesson by asking the students some of the following Questions:

(i) What is overcrowding?

(ii) List two effects of overcrowding

(iii) What are the factors that cause overcrowdings?

Conclusion: The researcher conclude the lesson by explaining to the students briefly the main point in the lesson i.e. what is overcrowding, effects of overcrowding and its courses. The researcher should also be going round the class and observed those that are not copying note in their note book.

Appendix F

Scores of Pre Test, Post Test and Postpost-Test of Both Experiment And Control groups

S/no.	Experiment group			Control group		
	Pre test,	post-test	postpost test	Pre test,	post-test	postpost test
1.	7	22	21	8	13	12
2.	9	20	22	9	12	13
3.	9	25	23	7	12	11
4.	9	26	25	6	13	11
5.	10	24	25	9	14	14
6.	7	24	24	9	14	12
7.	12	27	26	7	12	14
8.	8	25	20	10	13	12
9.	8	26	23	6	12	12
10.	7	26	24	9	13	13
11.	6	29	27	10	14	11
12.	9	27	25	11	14	11
13.	9	26	27	8	12	13
14.	6	25	24	9	12	13
15.	7	28	25	3	10	9
16.	3	26	26	1	8	11
17.	7	26	26	8	14	12
18.	7	23	25	5	12	11
19.	9	18	23	3	11	10
20.	10	24	26	8	14	14
21.	12	22	25	7	13	12
22.	9	25	25	10	12	11
23.	8	22	23	8	12	10
24.	9	18	20	6	13	13
25.	9	17	17	7	14	14
26.	10	15	18	7	14	14
27.	6	25	23	5	10	10
28.	10	19	17	5	8	8
29.	10	20	21	6	9	9
30.	1	16	15	10	13	13
31.	10	18	19	10	14	13
32.	4	22	22	4	12	12
33.	6	25	26	6	14	12
34.	6	26	25	6	12	13
35.	12	20	23	5	13	14
36.	10	19	18	7	13	11
37.	6	15	19	9	14	12
38.	6	27	25	1	10	11
39.	5	22	23	4	12	13

40.	8	25	25	10	14	13
41.	8	26	23	6	12	11
42.	4	16	17	9	12	13
43.	4	18	18	11	14	13
44.	2	15	20	6	12	13
45.	8	27	26	5	12	13
46.	6	26	25	10	13	14
47.	9	25	25	9	13	12
48.	12	28	26	7	14	12
49.	5	19	20	8	13	12
50.	7	25	24	8	12	13
51.	8	26	25	6	14	13
52.	6	20	22	9	15	13
53.	7	23	23	8	12	11
54.	5	24	25	7	13	10
55.	5	18	17	8	14	11
56.	4	15	18	7	12	13
57.	9	26	26	9	12	14
58.	5	20	20	8	11	12
59.	1	15	14	7	14	12
60.	0	14	15	9	13	13

APPENDIX G

Intelligence Quotient (IQ) Test

Instruction: Answer All Questions, All Questions Carry Equal Marks

Time: 40 min.

1. Which one of the five is least like the other four?

(a) Dog [ ] (b) Mouse [ ] (c) Lion [ ] (d) Shake [ ] (e) Elephant [ ]

2 Which number should come next in the series?

1-1-2-3-5-8-13

(a) 8 [ ] (b) 13 [ ] (c) 21 [ ] (d) 26 [ ] (e) 31 [ ]

3. Which one of the five choices makes the best comparison?

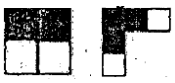
PEACH is to HCAEP as 46251 is to:

(a) 25641 [ ] (b) 26451[ ] (c) 12654 [ ] (d) 51462[ ] (e) 15264 [ ]

4. Mary, who is sixteen years old, is four times as old as her brother. How did will Mary be when she is twice as old as her brother?

(a) 20 [ ] (b) 24 [ ] (c) 25 [ ] (d) 26 [ ] (e) 28 [ ]

5. Which la shape would be made if the two sections are fitted together?



(a)  (b)  (c)  (d) 

6. Which one of the numbers does not belong in the following series?

2 - 3 - 6 - 7 - 8 - 14 - 15 - 30

(a) THREE [ ] (b) SEVEN [ ] (c) EIGHT [ ] (d) FIFTEEN [ ] (e) THIRTY [ ]

7. Which one of the five choices makes the best comparison?

Finger is to Hand as Leaf is to:

(a) Twig [ ] (b) Tree [ ] (c) Branch [ ] (d) Blossom [ ] (e) Bark [ ]

8. If you rearrange the letters "CIFAIPC" you would have the name of a (n):

(a) City [ ] (b) Animal [ ] (c) (Ocean [ ](e) River [ ] (e) Country [ ]

9. Choose the number that is 1/4 of 1/2 of 1/5 of 200:

(a) 2[ ] (b) 0[ ] (c) 10[ ] (d) 25[ ] (e) 50[ ]

10. John needs 13 bottles of water from the store. John can only carry 3 at a time. What's the minimum number of trips John needs to make to the store?

(a) 3[ ] (b) 4[ ] (c) 4 ½ [ ] (d) 5 [ ]

11. If all Bloops are Razzies and all Razzies are Lazzies, all Bloops are definitely Lazzies?

(a) True [ ] (b) False [ ]

12. Choose the word most similar to "Trustworthy":

(a) Resolute [ ] (b) Tenacity [ ] (c) Relevant (d) [ ] Insolent[ ] (e) Reliable [ ]

13. If you' rearrange the letters "LNGEDNA" you have the name of a(n):

(a) Animal [ ] (b) Country [ ] (c) State [ ] (d) City [ ] (e) Ocean [ ]

14. Which one of the numbers does not belong in the following series?

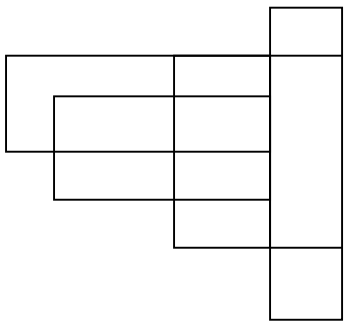
1-2-5- 10- 13-26-29-48

(a) 0 [ ] (b) 5 [ ] (c) 26[ ] (d) 29[ ] (e) 48[ ]

15. Ralph likes 25 but not 24; he likes 400 but not 300; he likes 144 but not 145. Which does he like:

(a)10[ ] (b) 50[ ] (c)124[ ] (d) 200[ ] (e) 1600[ ]

16. How many four-sided figures appear in the diagram below?'



(a) 10[ ] (b) 16[ ] (c) 22[ ] (d) 25[ ] (e) 28

17. What is the missing number in the sequence shown below?

1-8-27-?-125-216

(a) 36[ ] (b) 45[ ] (c) 46[ ] (d) 64[ ] (e) 99[ ]

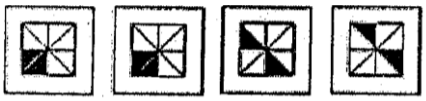
18. Which one of the following things is the least like the others?

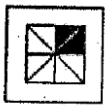
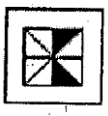
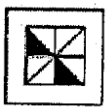
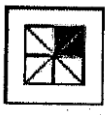
(a) Poem [ ] (b) Novel [ ] (c) Painting [ ] (d) Statue [ ] (e) Flower [ ]

19. Which of the figures below the line of drawings best completes the series?

(a)  (b)  (c)  (d) 

20. Which of the figures below the line of drawings best completes the series?



(a)  (b)  (c)  (d)  (e) 

Appendix H

Descriptive statistics and correlation for Reliability

```
CORRELATIONS
  /VARIABLES=TEST RETEST
  /PRINT=TWOTAIL NOSIG
  /STATISTICS DESCRIPTIVES XPROD
  /MISSING=PAIRWISE.
```

Correlations

```
[DataSet2] C:\Users\Mal  Yahuza\Desktop\RESEULT SCORES FOR RELIABILITY GSSYANKATSARE.s
```

Descriptive Statistics

	Mean	Std. Deviation	N
TEST	3.5000	1.35824	30
RETEST	3.1667	1.46413	30

Correlations

		TEST	RETEST
TEST	Pearson Correlation	1	.841**
	Sig. (2-tailed)		.000
	Sum of Squares and Cross-products	53.500	48.500
	Covariance	1.845	1.672
	N	30	30
RETEST	Pearson Correlation	.841**	1
	Sig. (2-tailed)	.000	
	Sum of Squares and Cross-products	48.500	62.167
	Covariance	1.672	2.144
	N	30	30

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix I

Item Analysis

Appendix F Iterm Difficulty Index and Discrimination Index

sn	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	total
1	1	0	0	1	0	0	1	0	1	0	0	0	1	1	0	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	15
2	0	0	1	0	1	0	1	0	0	0	1	1	1	1	0	0	1	1	0	0	0	1	0	0	0	1	1	1	1	1	14
3	1	1	1	0	0	1	0	1	0	1	1	0	0	0	1	1	0	1	1	1	0	0	1	1	0	0	1	1	0	0	13
4	1	0	1	0	1	0	1	0	0	0	0	1	1	1	1	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	11
5	1	0	1	0	1	0	0	0	1	0	1	0	1	0	0	1	1	1	0	0	0	0	0	1	1	1	1	0	0	1	12
6	1	1	0	1	0	0	1	0	1	0	0	0	1	1	0	1	1	1	0	0	0	1	0	1	0	1	0	1	1	1	14
7	1	1	1	0	1	0	0	1	1	0	0	0	1	1	0	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	16
8	1	1	1	1	1	0	1	1	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	20
9	1	0	1	0	1	0	1	0	0	0	0	1	0	0	1	1	0	1	0	1	0	1	1	1	1	1	0	1	1	0	14
10	0	0	0	1	0	1	0	0	1	1	1	1	0	1	1	1	1	1	0	1	0	1	1	0	0	0	1	1	0	1	17
11	1	0	1	0	1	1	0	0	0	0	0	1	1	0	1	1	1	1	0	0	1	0	1	1	0	1	1	1	0	1	15
12	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	1	1	0	0	21
13	0	0	1	0	1	0	1	0	0	0	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	0	1	1	1	1	19
14	1	0	1	0	1	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1	1	23
15	1	1	0	0	1	1	1	0	0	1	0	1	0	1	1	0	1	1	1	1	0	1	1	0	0	1	0	0	1	1	18
16	1	0	0	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	0	0	1	0	1	1	1	1	1	1	1	19
17	1	0	1	0	1	1	0	0	0	0	0	1	1	1	0	1	1	1	0	1	1	0	1	1	0	1	0	0	1	1	17
18	1	1	1	0	1	1	1	0	1	0	1	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1	1	0	18
19	0	0	0	0	1	1	1	0	1	1	1	1	1	0	1	0	1	1	1	1	0	1	1	0	1	1	1	1	0	1	20
20	0	1	1	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	0	1	1	1	1	0	1	1	0	1	21
21	1	1	0	0	1	1	1	0	1	1	0	1	0	1	1	0	1	1	1	1	0	0	1	0	0	1	1	0	1	0	18
22	1	1	1	0	0	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	0	1	1	1	1	1	0	0	1	1	22
23	1	1	0	0	1	1	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	21
24	1	1	0	1	1	1	1	1	1	1	0	1	1	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	1	1	22
25	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	1	0	0	1	1	0	1	1	1	0	1	0	1	1	23
26	0	1	1	1	1	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1	0	1	1	1	0	0	1	1	1	0	20
27	1	1	1	1	1	1	0	1	0	0	1	1	1	1	0	1	0	1	1	1	0	1	0	0	1	1	1	1	0	1	21
28	0	1	1	0	0	1	0	1	1	1	1	0	1	1	1	1	1	0	0	1	0	1	1	0	0	1	0	0	1	1	18
29	0	1	1	1	1	1	1	0	0	1	0	0	1	1	1	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	19
30	1	1	1	0	0	1	1	1	0	0	0	0	0	1	1	0	0	1	0	1	0	1	1	1	1	0	1	0	1	1	17
	21	17	21	10	23	19	21	12	17	17	16	18	20	22	19	17	21	24	12	21	6	22	22	22	16	20	22	18	19	22	
DI	**53**	**43**	**53**	**25**	**58**	**48**	**53**	**30**	**43**	**43**	**40**	**45**	**50**	**55**	**48**	**43**	**53**	**60**	**30**	**53**	**15**	**55**	**55**	**55**	**40**	**50**	**55**	45	**53**	**22**	
	9	4	8	4	7	3	6	3	5	3	4	5	7	6	6	9	9	11	3	5	1	7	5	9	4	6	7	6	8	6	
	1	2	2	1	1	2	2	1	0	1	0	0	1	2	2	1	1	2	1	1	0	2	2	2	1	2	2	2	1	2	
	8	2	6	3	6	1	4	2	5	2	4	5	6	4	4	8	8	9	2	4	1	5	3	7	3	4	5	4	8	4	
ID	**0.6**	**0.4**	**0.5**	**0.3**	**0.5**	**0.1**	**0.4**	**0.2**	**0.5**	**0.4**	**0.4**	**0.5**	**0.5**	**0.4**	**0.4**	**0.7**	**0.7**	**0.8**	**0.2**	**0.4**	**0.1**	**0.5**	**0.5**	**0.6**	**0.4**	0.4	**0.5**	**0.4**	**1**	**1**	

DI ITEM DIFFICULTY
ID ITEM DISCRIMINATION

APPENDIX J

An introductory Letter to Access Research Data

DEPARTMENT OF SCIENCE EDUCATION
AHMADU BELLO UNIVERSITY ZARIA

Vice Chancellor: ***Professor Abdullahi Mustapha*** *B.Sc(Hons)Pharm(ABU), Ph.D(London) FPSN*
Head of Department: ***Dr. Mamman Musa*** *B.Ed, M.Ed, Ph.D (ABU, FMAN, FANE, DAC.*

Your Ref:
Our Ref: DSE/R/I/Vol.1 ***Date:*** 3rd June, 2015

The Director General
Kano State Senior
Secondary School
Management Board

Dear Sir/Madam,

AN INTRODUCTORY LETTER TO ACCESS RESEARCH DATA

This is to introduce the bearer, Mudassir Yau Sani, with registration number M.Ed/Educ/40143/12-13, as one of our Science Education students who is conducting a research on the topic: Impact of cooperative learning enriched with analogy on achievement and retention among secondary school Ecology slow learners in Kano, Nigeria

Please accept our sincere thanks in advance for your kind action.

Yours faithfully,

H.O.D.
Science Education

Dr. Mamman Musa
Head, Science Education Department

KANO STATE SENIOR SECONDARY SCHOOLS MANAGEMENT BOARD

CIDAN MALAMAI

No. 1 Lawan Danbazau Link behind Bank of the North Headquarters, Kano.

☎: 064-318855, 669420, 661948, 667884, 667869

Our Ref: KSSSMB/ADM/101 Your Ref: _____ Date 18/06/2015

The Zonal Education Officer,

Dawakin Kudu Zonal
Education Office, Kano.

LETTER OF INTRODUCTION

The bearer of this letter is a researcher from AHMADU BELLO UNIVERSITY ZARIA, DEPARTMENT OF SCIENCE EDUCATION.

He is conducting a research on IMPACT OF COOPERATIVE LEARNING ENRICHED WITH ANALOGY ON ACHIEVEMENT AND RETENTION AMONG S.S. BIOLOGY SLOW LEARNERS IN KANO. in your zone. You are expected to give him/her all the necessary assistance to facilitate his research because of the importance the Board attaches to research work.

The Board appreciates your usual co-operation.

Best regards.

Shuaibu Kassim Abubakar
CEO – Publication/Documentation
For *Director General*

A/ Principals of the Affected Schools
Pls comply with the above directives and accord the researcher with maximum co-operation
ZEO 25/06/15