

**EFFECTS OF IMPROVISED TEACHING MATERIAL ON SECONDARY SCHOOL  
BIOLOGY STUDENTS ACHIEVEMENT IN NIGER STATE**

**By**

**Salim Mu'azu**

**2013/1/45011BE**

**DEPARTMENT OF SCIENCE EDUCATION  
SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION  
FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**

**NOVEMBER, 2019**

# **CHAPTER ONE**

## **INTRODUCTION**

### **1.1 Background of the Study**

Science is the bedrock on which modern day technological breakthrough is hinged. Different authors according to their own understanding have defined Science. Igwe (2013) defined science as a systematic study of the nature of the behaviour of the material and physical universe through observation, experimentation, measurement and recording. In addition, Esu (2014) defined science as a systematic, precise, objective way to study the natural world.

Teaching and learning processes are very crucial at all levels of educational development. If well planned and directed, they are the keys to success and progress of an individual. Education system is explicitly based on the quest “what to teach” and how to teach”. What to teach means learning materials and how to teach implies teaching methodology. The quality of education largely depends upon the quality of teachers and the teaching learning resources available for the system. Today’s students are learning facts, skills and attitudes from pictures, television, recorded words, programmed lessons, and other media. Once technology enters the school building, dramatic renovations usually begin. With the technological magic touch, a simple school house turns into a systemized learning centre. In the instance where the students is the center of the attention, technology is catalyst for educational change. Media is the means for transmitting message. Media includes such things as prints, graphics, photography, audio communication, television, simulating games and computer (Erasmus, 2016). Therefore, best methods have to be used in order to enhance effective teaching and learning. Teaching aids according to Dike (2011) do not only increase the motivation of the teachers and learners; they add clarity to the topic taught and make learning more interesting. Permanent learning according

to Njoku ((2014) is the goal of education in that the learners should be able to retain what is taught Teaching aids make learning more permanent since they appeal to more than one sense.

Students should be given confidence to ask, inquire, explore and be creative and initiators. In fact an inquisitive mind is the beginning to lifelong learning that surely leads to success. But in recent year the superiority is shifted towards students. Teaching aids make a lesson or lecture more interesting and a memorable experience not only for students but for teachers as well as they play a vibrant role in focusing the attention of individual student towards the teacher or the topic. They appeal to the senses especially hearing and looking. It is not wrong to say that human senses are doorways to acquire knowledge, therefore, when something appeals to senses curiosity increases which lead to clear and concrete understanding of the concept. It was on the basis of the above observation that the study was carried out to determine the influence of Teaching aids in the teaching of Biology in secondary schools.

Ode and Omokaro (2012) revealed that learners retain most of what they hear, see and feel than what they merely hear. This concept bears credence to the old chines adage which says ‘what I hear I forget what, what I see I remember and what I I know Arnett (2010, as cited in Claiborne and Drewery, 2013). A visual instruction encourages the use of Teaching aids to make abstract ideas more concrete to the learners. Therefore, the teacher’s duty is to make learning live, not just something to remember but part of living experience. This can be done effectively by employing the use of audio-visual aids in teaching and learning of biology as a mean of imparting knowledge to learners. Educators have come to realize that the most effective teaching and learning take place when an individual has direct experience with the subject under study, in order word, learners learn best by doing.

In recent times, countries all over the world, especially the developing ones like Nigeria, are striving hard to develop technologically and scientifically, since the world is turning Scientific and all proper functioning of lives depend greatly on Science. According to Ogunleye (2006), Science is a dynamic human activity concerned with understanding the workings of our world. This understanding helps man to know more about the universe. Without the application of science, it would have been difficult for man to explore the other. Biology is one of the science subjects that senior secondary school students offer at the senior levels in the Nigerian secondary schools, (FRN, 2013). Biology is a very important science subject and a requirement for further learning of a number of science-related professional courses like medicine, agriculture, pharmacy, etc. In contemporary Nigeria, greater emphasis is placed on science and technological development. As a result, students are being encouraged to take up science-related subjects. Today, Biology pervades literally every field of human endeavour, and plays a fundamental role in educational advancement. This is seen in all the technological advancement in the world today, which is because of scientific investigations. However, the issue remains that in most secondary schools in Nigeria, there is high rate of failure in the subject.

Studies have shown that the use of instructional materials have improved achievement (George, 2008) and Nwagbo (2006). Instructional materials are wide varieties of equipment and materials use for teaching and learning by teachers to stimulate self-activity on the part of the students. The teaching of Biology without instructional materials may certainly result in poor academic achievement. Poor academic achievement in Biology could also be attributed to many factors such as, low interest of students in biology, inadequate motivation from teacher, poor incentives to biology teachers, lack of adequate supply of instructional material, lack of qualified teachers, and use of teacher centered instructional strategies, inadequate use of instructional materials and

use of abstract standardized materials. Among these factors, teacher's use of abstract standardized instructional strategy is considered as an important factor in this study.

This implies that the mastery of Biology concepts might not be fully achieved without the use of instructional resources that the students are abreast with. The teaching of Biology without instructional materials may certainly result in poor academic achievement. Folorunso (2013) observed that there is lack of adequate and appropriate instructional resources for effective teaching of Biology in schools. For Ibitoye and Fape (2011), the poor achievement in biology was traced to poor usage of instructional resources for biology teaching and learning, poor state of infrastructure facilities, large class size, poor teaching, use of faulty assessment practice, and inadequacy of quality teachers. According to Okebukola (2014), the poor state of laboratory facilities and inadequate use of instructional materials has constituted a cog in the wheel of students' achievement in Biology in the Senior School Examination. The verbal exposition does not promote skill acquisition, objectivity, and critical thinking abilities that will enable the child to function effectively in the society. However, there has been no consensus on the workability or otherwise of the use of Teaching aids in teaching and learning of numerous work done by researchers and authors of repute. On the contrary, there has been a surge in the number of people who feel worried about the negative aspects in the use of Teaching aids.

## **1.2 Statement of the Problem**

One of the main problems facing most secondary schools in the Nigerian society today is the relative decline in the academic achievements of the students especially in the sciences. The secondary schools in Niger State are no exception. The academic achievements of students in the sciences have been on the decline (Ajagun 2014) and being able to reach the desired goal can be

termed achievement. Most research findings in academic achievement in sciences are applicable to Biology as a science subject. As a result of advancement and development of modern technology varieties instructional materials can be used to make learning more vivid and effective. This means that students can perform better whenever they are taught with these instructional materials particularly Teaching aids as their comprehension and demonstration and co-operation are expected to enhance tremendously in teaching-learning process. Unfortunately, most of the biology teachers neglect the use of Teaching aids in teaching the subject probably, due to non-availability of the materials or lack of techniques for using them.

Mavida (2012) reiterated that the utilization of instructional materials such as teaching aids make students to participate effectively in the teaching and learning process, hence ending with quality education that enable them to suit in the current society in relation to technological changes. Generally, it is agreed that Teaching learning aids assist in the learning process and students find it easy to grasp the materials in classroom when Teaching learning aids are used. However, use or non-use of learning aids is not only problem in public secondary schools; material shortages, motivational inadequacy and poor learning environment were some of the problems.

However, the relationship between usage and non-usage of teaching aids and the teaching of Biology in schools have had not so far been established, despite other problems. It is against this backdrop that this study is aimed at finding out effect of application of Teaching aids in the teaching of Biology in secondary schools in Niger State.

### **1.3 Aim and Objectives**

The aim of the study was to examine the effects of improvised teaching aids in teaching of Biology in secondary schools. Specifically, the study will achieve the following objectives:

- i. The effect of improvised teaching aids on students' achievement in Biology compared to those taught using conventional teaching strategy.
- ii. Gender difference in Biology achievement of the students taught with improvised teaching aids.
- iii. Whether improvised teaching aids will improve students' retention in Biology compared to those taught using conventional teaching strategy.

#### **1.4 Research Questions**

- 1) What is the effect of improvised teaching aids on students' achievement in Biology?
- 2) Will there be any difference in the mean achievement score of male and female students taught with improvised teaching aids?
- 3) Whether improvised teaching aids will improve students' retention in Biology compared to those taught using conventional teaching strategy.

#### **1.5 Hypothesis**

The following hypotheses were formulated for the study and were tested at 0.5 level of significance.

H01: There is no significant difference in the mean achievement scores of students taught biology using Teaching aids and those taught without instructional materials.

H02: There is no significant difference in the mean achievement scores of male and female students taught biology using Teaching aids

## **1.6 Significance of the Study**

This study is significant to Biology teachers in Niger State in particular and in Nigeria in general. Teachers and would find this study relevant and useful in teaching and learning procedures. The use of improvised materials would help curriculum planners in the area of practical works. It will be helpful to examination bodies such as WAEC and NECO in setting examination questions with emphasis on area of practical works. Science equipment manufacturers and science book publishers etc. will find this study relevant in areas of science instructional materials production to schools. This study will be helpful for further research on retention.

## **1.7 Basic Assumptions**

The study has the following basic assumptions:

1. That Secondary schools in Niger State have adequate Teaching aids facilities for academic activities in schools.
2. That teachers are trained and encouraged to use Teaching aids in teaching biology
3. That secondary school teachers are familiar with the use of Teaching aids in teaching Biology.

## **1.8 Scope and Delimitation of the Study**

This study would have covered more schools and areas of Bosso LGA in Niger State but due to constraints time and material resources, it was confined to SS2 Biology students in Government Day Secondary School Bosso. The topics of research is effects of Teaching aids in learning Biological Concepts of Skeleton; Skeletal materials and Types of Skeleton



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Teaching Biology at Secondary School**

Biology is a science that studies living things; which involves plants and animals. If science is defined as the study of natural world, biology focuses on the systematic study of the living world. As a result of its importance, the subject Biology is one of the core subjects in senior secondary schools' curriculum in Nigeria. Biology is important in school curriculum and serves as a foundation to several courses and careers such as medicine, which included Ophthalmology, Morphology, and Anatomy, physiology, Hematology, Dentistry, Gynecology and so many related careers. Biology has a role to play in Agriculture, Environmental control, population control, pharmacy, Laboratory analysis and in some areas of biology such as Anatomy, Botany, Zoology, Biological Science, Genetics, Ecology and others. Biology enables one to become more aware of one's changing environment such as effect of drought on plants, explores it and adapt to it better. Abu (2011) explains that Biology is one of the most important subjects that should be taught meaningfully by creating awareness in the minds of the learners hence the use of instructional materials or concrete materials should be used to enhance effective learning.

#### **2.2 Instructional Materials for the Teaching of Biology**

Instructional materials are teaching aids or materials used to illustrate the teaching process and makes instruction more comprehensive to the learner. Instructional aids are devices or pieces of equipment, graphics or sound representation or illustration that helps pupils to learn. Yero (2013) mentioned four types of instructional aids, these are:

1. **Visual Aids:** - These include chalk board, posters, bulletin board, displayed models, motion pictures, slides, projected transparencies, flip chart and flannel boards. In fact they represent all the materials the eyes can focus and is used by the teacher or instructor in delivering the lesson to the pupils, it makes visual impression.
2. **Auditory Aids:** - These include record players, tape recorders and language laboratory and all that appeals to the sense of hearing.
3. **Teaching Aids:** - These include aids that make use of both sight and hearing such as sound motion, pictures, slide on sound and television.
4. **Simulation Devices:** - These include devices built to stimulate the action or function of the real thing. The essence of this type of aid is to develop feeling sensation and correct habits. Any subject can be taught more effectively through the appropriate use of teaching materials or aids. These teaching aids according to Yero(2000)possess some good qualities with regard to Biology teaching:-
  - It appeals to the senses
  - It has ability to attract and hold attention
  - It focuses attention on essential element to be learned at the proper time
  - It also stimulates interest of learners.

The use of instructional aid is important where the biology concept is abstract and unfamiliar to the consciences of the students, when the real object or phenomenon is invisible or highly expensive to be handled by every student. In a situation where the real specimen cannot be seen easily for instance in studying the skeletal system, the study of a close animal or human model is used to illustrate the structure or position and function of the phenomenon compared to their own

body. The teacher should be careful in selecting or preparing a teaching aid so that it would explain what it is meant for, viz it should be broad, clear, colorful and simple to understand.

In teaching Biology more effectively and meaningfully, the use of resource materials or teaching aids are effective but according to Abu (2013) mere use of the material does not guarantee effective communication or teaching. It is therefore the proper use, careful selection and skillful handling by the teacher that renders its usefulness in facilitating learning as indicated in the studies of Johnson (2011) and Eshiet (2016). A biology teacher can enrich his/her class with good use of teaching materials and good methods of delivering instructions. The importance of instructional materials in the teaching of biology in secondary schools is very vital. Ethiosu (2016) mentioned seven basic roles of using instructional materials as identified by (Buoro, 2016). These include:

- Extension of Human experience.
- Provision of meaningful information.
- Stimulation of interest
- Grouping of student's interest
- Overcoming physical limitations
- Stimulating problem
- Solving and providing diagnostic and remedial tools for the teachers in the teaching process.

Specimens are the real objects or things a teacher can use for effective teaching. For the teaching to make his/her work easier and learning more participatory and more real he/she should involve his pupils in the collection of specimen or objects for instance insects, plants and other similar things which will enable the learners to see, touch, smell and handle things physically that will give them real natural experience.

Instructional materials have great value in education. In this era of science and technology, the government of Nigeria is advocating the use and easy access for computer instruction (Minister of Education 2014). The ITC training i.e. instructional technology communication between teachers and students is for better development in science and technology. The modern and latest instructional aid in this 21<sup>st</sup> century is the use of instructional technology media such as making use of computer, television etc, which give access to other work and easy development. Onwuakpa and Nweke (2011) were of the view that the teaching of science, technology and mathematics can be enriched when suitable teaching aids are appropriately made use of. Therefore every STM teacher should consider and prepare materials needed for any lessons to be taught to students. The use of New Media makes processing of science, technology and mathematics faster and easier and consequently makes learning more effective and sufficient (Okwo 2012).

On the use of computer by STM teachers, Daris (2017) was reported to have saved time with the use of computer in her mathematics class and at the same time lesson became more professional and student centered. The use of computer in modern teaching makes it faster because facts and contents are stored and recalled; it generates lots of advantages such as self confidence in the part of students and also improves teaching and learning. According to Akude and Ofoefuma (2010) learners should embrace the use of resources to maximize learning. This would arouse student's interest and make education more productive and more meaningful. The use of teaching aids appeal to the sense and it stimulates learning and discovery. The use of teaching aids give way to different methods of teaching and learning such as project method, self-learning, discovery learning and others yet to be known. Teachers should therefore make use of teaching materials for impacting knowledge. Teaching without teaching materials would look

like a dancer without listening to musical instrument. Okpala (2010) reported that government indicated that efforts would be made, in providing some educational services such as counseling and educational resource centre amongst others and also maintained that teaching should be practical, exploratory and experimental in nature. Murphy (2012) expressed that assessing education means that teachers have to use ICT resources to appeal to the interest of younger learners and attract their interest. The quality of education is determined by the quality of teachers and the societal needs and the future which requires creativity and problem solving skills (Okwo 2012). It becomes imperative that teachers need to be innovative and develop inquiry skills as well as apply modern and innovative strategies to meet not only the demands of future society but according to Eya (2006) it serves as a key challenge for the development of the future of education in Nigeria through ICT emergence. Jegede et al (1992) mentioned some factors that are responsible for student's general poor achievements in science, technology and mathematics as poor laboratory facilities, inadequate number of learning facilities in school as against consistent increase in the number of students.

According to Bassey (2012) science is resource-intensive. Onasanya (2014) mentioned various kinds of model used in educational instruction such as mental model, theoretical model etc. concrete models are construct in the effort to understand the behavior of the physical world and in the summary of Onasanya and Adegbeya (2014) concrete models simplifies complex phenomena and also enhances students ability to communicate in science. Therefore models and charts also play the same role as concrete models in biology. Onyejemezi (2012) noted that if the science teacher does not have the knowledge and manipulative skills of using instructional materials in teaching, learners will find learning difficult. The study therefore investigates the effect of the use of instructional materials in the teaching of Biology.

### **2.3 The use of Indoor Laboratory in the Teaching of Biology**

A Laboratory is a room or a forum where science teachers and their students interact. The laboratory varies in dimension and equipment as a result of the funds available. As a science subject, biology tends to solve human problems and answer some guesses and hypotheses. Some of the features science is testing and experimenting are conveniently carried out in a laboratory. A well planned laboratory should be located away from the classroom, busy roads, hostels, dining rooms, game field and lucrative or relaxation centre. This is because the materials and equipment placed could be hazardous to health. Some laboratory activities require maximum concentration and as such need a quiet environment such as preparation of chemicals and testing of foods. In designing a biology laboratory the number of students that should be accommodated, the fund and materials required are put into consideration to avoid shortage and non-availability of resource. Biology is a science subject that involves physical, chemical, geographical, agricultural, medical and even economic phenomenon to mention a few. It is obvious that some of the concepts could be taught, bringing distant habitat nearer to the learners by displaying some specimens in the laboratory. Indoor laboratory is very important in the teaching of biology because it serves as showcase to some specimens which students can easily have view of; for example, in teaching some aquatic biome, an aquarium set up could serve the purpose. Charts; models are used in the laboratory to illustrate the real objects. It develops inquiry method of teaching. The use of instructional materials which emphasizes meaningful learning are mostly displayed and used in the laboratory. The use of indoor laboratory in the teaching of biology also has its short comings:-

In the view of the researcher the following assumption are made.

- It is obvious that with the emphasis on science, technology and mathematics (STM) more laboratories would be in existence.
- Teachers would teach with instructional materials
- Students would be familiar with the concept using material and creativity.
- Laboratory technologists would be assigned to care of the equipment and assist the biology teacher.

It is pertinent to note that in spite of the entire emphasis place on Science, Technology and Mathematics (STM) most schools lack the facilities required to make indoor laboratory a reality.

- There is no existing laboratory and where a room is provided to serve as such, it is automatically converted to a classroom thereby increasing the number of population of student without reasonable space to carry out science enquires and testing. Where it exists it is poorly equipped.
- There is no laboratory technologist; anyone assigned to the laboratory is re-assigned to other duties outside the laboratory.
- Most teachers lack incentives and are not motivated to use the materials and some that are interested lack fund to improvise.
- Most teachers are ignorant of creativity and so develop negative attitude towards improvisation (Iyang 1997, Egbegbdecha 1997Soyibulo, 1998 and).

The use of indoor laboratory in the teaching of biology enhances teaching and learning process in biology and increase creativity.

## **2.4 Improvised Teaching Aids for Biology**

Improvisation could be defined or explained from different perspectives. The process or the ability to replace what is not sufficient or unavailable could be seen as improvisation. According to National Teacher's Institute (2010), improvisation is defined as "the act of using alternative materials and resources due to lack or insufficient of some specific teaching aid to facilitate instruction". Akinmoyewa (2012) defines improvisation as the designing of a replica of something to make it function or play the role of the real thing using available materials. Balogun (1995) in Mohammed (2017) defines improvisation as an act of using alternative material or equipment obtainable from the local environment to design or constructed by the teacher or with the help of local person to facilitate instruction. Therefore improvisation is any object or thing that is provided to replace insufficient or unavailable materials for the benefits or facilitation of teaching and learning process.

The objectives of the National Policy on Education (FME2000) include;

- To enhance teaching and improve the competence of teachers,
- To make learning more meaningful for children,
- To reduce educational cost and to develop and promote an effective use of innovative materials in schools.

Iwuzor (2000) reported that the cost of effectively teaching science is so high that the materials may not be affordable for an adequately equipped laboratory and as such, the teaching and learning of science can never be improved if the teaching materials particularly the nonavailable ones that can be improvised are not properly used. One of the objectives of science education, in which biology depicts living concept, is the act of students acquiring adequate laboratory and field skills. To achieve this, students need to acquire physical contact and experience with real materials. With the introduction of Universal Basic Education (UBE) programme the population



of students have outgrown the facilities and equipment for instruction and are inadequate or insufficient, the teacher should know when to improvise, what to improvise and how to improvise (Olagunji 2014).

In the case of teaching skeletal system where the prepared model of the skeleton is expensive, insufficient or not available, the teacher can improvise by preparing real skeleton from a small mammal like rabbit; also involving student by asking them to source and provide some specimens. This helps to develop students' problem-solving skills. Olagunju (2010) reported that teachers develop diverse attitude towards improvisation. Sobulo (2011) as reported by Egbebecha (2014), reported that some teachers develop positive attitude, also some find it a difficult task, time consuming and expensive. Njoku (2010) pointed out the need for improvisation in science education since standard resources are usually in short supply. He is of the view that STM materials are needed in Nigerian schools in recent times because of depression in Nation's economy.

The overwhelming population of science students in recent times has seriously outnumbered the materials and equipment provided hence the withdrawal of accreditation of some higher institutions in the country. It has been observed, according to Mohammed (1991), Iyang (2017) that most Nigerian STM teachers have negative attitudes towards the use of improvised local equipment and materials for teaching but preferred the traditional chalk and talk method. This is attributed to inadequate training of STM teachers to creativity as a step to improvisation. According to Landa(2000) improvisation could be seen from two sides; as a substitute; when equipment is prepared in place of the expected and as a simulation. In this era of Universal Basic Education (UBE) enrolment and promulgation of Science, Technology and Mathematics (STM)programme there is great need for the use of instructional material and equipment and

where there is inadequacy of such the teachers of STM should endeavor to improvise, showing some level of creativity which will be imparted to the learners. It is on this that the study is focused. Improvisation of materials will help in teaching and learning process.

In many situations textbooks form the basis of the curriculum in language programs. Provided there is a good degree of fit between the textbook and the teaching context teachers use textbooks to provide the major source of input and direction to their teaching. Thus, does not necessarily mean that the teacher plays a secondary role in the teaching process since teachers normally improvise around their teaching materials, moving back and forth between book-based input and teacher-initiated input. Hence even though a teacher may teach the same lesson from a textbook many times, each time he or she teaches it becomes a different lesson due to the improvisations the teacher initiates during teaching. These may result from on-the-spot decisions relating to timing, affective factors, and responses to learner difficulties. Experienced teachers hence use textbooks flexibly as a teaching resource.

**Sometimes however adaptation may be required to reflect the needs of a specific teaching context. Various forms of adaptation are possible:**

- ***Adding material to address an examination requirement:*** sometimes supplementary material may need to be added to address the requirements of a specific institutional or other exam. For example the reading component of an institutional text may make use of multiple-choice questions rather than the kinds of comprehension tasks found in a course book, so extra material to practice using multiple-choice questions may be needed.

- ***Extending to provide additional practice:*** a book unit has a limited number of pages and at times the teacher may feel additional practice of grammar, vocabulary or skills is required and sources additional materials to supplement the book.
- ***Localizing:*** an activity in the book may be more effective if it is modified to reflect local issues and content rather than the content that is discussed in the coursebook. Localization also involves adapting or supplementing an activity to address the specific needs of a group of learners. For example pronunciation problems might reflect interference from the students' first language and these might not be covered in the book. Additional activities can be added to address problems specific to the learners.
- ***Modifying content:*** Content may need to be changed because it does not suit the target learners, perhaps because of the learners' age, gender, social background, occupation, religion or cultural background.
- ***Reorganizing content:*** A teacher may decide to reorganize the syllabus of the book, and arrange the units in what she or he considers a more suitable order. Or within a unit the teacher may decide not to follow the sequence of activities in the unit but to reorganize them for a particular reason.
- ***Modifying tasks:*** Exercises and activities may need to be changed to give them an additional focus. For example, a listening activity may focus only on listening for information, so it adapted so that students listen a second or third time for a different purpose. An activity may be extended to provide opportunities for more personalized practice. Or some exercises within a sequence may be dropped.

While in many cases a book may work perfectly well without the need for much adaptation, in some cases different levels of adaptation may be needed. Through the process of adaptation the

teacher personalize the text, making it a better teaching resource, and individualizes it for a particular group of learners. Normally this process takes place gradually as the teacher becomes more familiar with the book because the dimensions of the text that need adaptation may not be apparent until the book is tried out in the classroom.

#### **2.4.1 Improvisation serves the following purposes in the education system:**

It reduces the money spent on the purchase of equipment in educational institutions; ensures the realization of lesson objectives; helps in solving the problem of lack of equipment in educational institutions; gives room for a teacher to demonstrate his creative skills and gives room for the use of cheap local materials as alternatives to the expensive foreign ones (Olumorin, 2014). The researcher stated that improvisation encourages students towards the development of creative abilities; strengthen enquiry, discovery and investigative method in sciences; it provides a frame of reference on which students can key their attention during classroom activities; enables teacher to think of cheaper, better and faster methods of making teaching learning process easier for students; affords students the opportunity of becoming familiar with resources in their environment.

#### **2.4.2 Factors that affect the use of Instructional Resources**

Teachers have been found to have difficulties in selecting and using instructional materials for teaching. Part of the difficulties has been that teachers tend to teach the way they were taught in their training (NERCD, 2009). Consequently, teachers use the materials they were exposed to during their training. This habit is often difficult for teachers to change. Other reasons advanced for the inability of teachers to use instructional resources effectively include:

- Inability to identify/ locate resources;
- Inability to develop appropriate materials from local resources;
- Lack of school- based resource Centre; and
- For instructional materials development, selection and utilization and
- Lack of short term training to update teachers' knowledge and skill for instructional materials development, selection and utilization (NERDC, 2009).

In line with the stated reasons, the biology laboratories are to be equipped appropriately to make teaching and learning conducive. According to Nwakonobi & Igboabuchi (2010), biology laboratories are places where different types of experiments and researches concerning all disciplines of life sciences take place for skills acquisition.

However, these skills cannot be acquired in the absence of well-equipped biology laboratories to enhance effective teaching and learning which is geared towards empowering the students to become functionally and qualitatively, educated, productive, self-reliant, and sufficient and create enabling environment. All these are aimed at devising a proper opportunity to salvage the medium of instruction in the national educational system. It is against this background that the researcher decided to investigate the effect of students' produced- improvised instructional materials on the academic achievement of secondary schools students in biology examination.

### **2.4.3 Improvisation and Skills for Improvisation**

Generally, improvisation of instructional materials in science teaching particularly biology is an attempt to adapt and make use of local resources in the teaching/ learning process when the readymade materials are not available or are in short fall or not within the reach of the users. The

improvised instructional materials could be produced by the teacher and the students. According to Fajola (2008), improvisation in the context of biology can be defined as a process of using alternative resources for enhancing biology teaching in the absence or shortage of the real ones. The production of the alternative resources is initiated by the teacher and done either by him or the local craftsmen (e.g. the Carpenter, blacksmiths, welder, etc). The teacher may also use the students for improvising some of the needed materials or equipment's.

Improvisation in the view of Aremu (2012) is a technique of originating a totally new tool, instrument, materials, device or modifying existing ones for serving a particular purpose. Ahmed (2010) sees improvisation as the process of making equipment and materials by the teacher or by engaging the services of others in the absence of the real or manufactured ones. Wasagu (2010), described improvisation as the act of using alternative materials and resources to facilitate instruction whenever there is a lack of or shortage of some specific first hand teaching aid. When students are involved in the production of improvised instructional materials through their creative ability and imagination, it gives new concept of things outside the range of ordinary experience to the students and makes learning last longer in their memory. For a student to be able to improvise, he/she must be innovative, resourceful and creative in both thinking and manipulative skills (Igwe, 2013).

Fajola (2011) looked at improvisation from the level of creativity involved. These levels involve substitution and construction. Substitution in improvisation simply implies the techniques whereby a local material is used in place of a piece of equipment that is not available whereas construction involves making of a new instrument in place of the unavailable original one where substitution is not possible. It is expected that both substitution and construction of improvised

instructional materials will meet the demand for the real or original material with as high precision as time, money and other facilities and factors will permit.

According to Ehikioya (2011), the major reason for improvisation stems from the fact that educational funding is insufficient and in the recent years seriously dwindling. Educational authorities find it increasingly difficult to provide the schools with all they need for teaching and learning. Ahmed (2010), claimed that instructional resources ensure that the learners see, hear, feel, recognize and appreciate as they learn, utilizing almost all the five senses at the same time. Olagunjo (2010), however, asserted that improvisation provides a cognitive 'bridge' between students abstract and real experience of teaching and learning. According to Olagunjo (2016), when a teacher improvises, it enables him to re-think and research for cheaper, better, and faster methods of making the learning process easy and safe for both the students and the teachers.

Abolade (2014), maintained that improvisation of instructional materials provide direct experience with reality as well as encourage active participation and acquisition of skills especially where students are allowed to manipulate the materials. According to Abolade (2014), the attainment of affective and psychomotor domains is increased by improvisation. When students are motivated by their teacher to produce or source their own instructional materials, it greatly arouses the students' interest to learning and development of scientific attitude. Improvisation, therefore, enables students to exhibit their latent potentialities, improve their creativity and as well discover new things.

#### **2.4.5 Factors to be considered in planning improvisation**

There are certain factors to be considered when planning improvisation. They are:

- Who will be making the materials teacher, students, or both?
- The time, effort and skills required both by the teacher and by the students.
- The knowledge of the basics; the material could require the use of a range of scientific principles, applications and techniques and the teacher should fairly well be acquainted with them.
- The steps involved.
- The objectives and goals: the teacher needs to identify and focus on the ultimate objectives, which learning behavior he/she wants to inculcate in the students and if improvisation can achieve it.

Motivating and involvement level of the class especially if kids are to be involved in making it. The teacher needs to motivate the class, raise their curiosity and admire their creativity. There should be proper interaction and constant feedback.

- The teacher innovativeness, creativity and resourcefulness: to be considered also, are the teacher's management and co-ordination skills.
- Collection of materials and tools required sometimes, one might need to buy some tools and materials too, hence some monetary funding.
- The durability of the materials used.
- Working and storage space to make and store the materials. Also to be considered are when the materials (standardized materials) are easily and cheaply available, you may be better off buying them than improvising.



It is worthy to note that these definitions above presuppose that an improvised instructional material must necessarily serve the purpose for which it is intended. It is not just providing a piece of material or resource as substitute of what is not available.

## **2.5 Science Teaching Methods**

The concept of teaching method is viewed from different perspectives and defined in various ways. There are different methods of teaching science; there is no single best method of teaching science. The use of a particular method depends on the teacher and the situation in which a topic or concept is taught (STAN 1988), methods of teaching science is as old as sciences itself. Bruner (1960) is of the view that any topic in any subject could be taught to a child at any stage of development provided that the topic is “structured”, this means that the topic is presented in an intellectually honest form” and curriculum developers refer to such as spiral curriculum. A good science teacher should use variety of approaches and pick any that is appropriate in a given situation considering the varieties or differences in the learners and environment. There are many known and practiced methods which tend to satisfy the objectives of teaching science which include: -

- The production of much needed manpower e.g. economically and technologically.
- Acquisition of scientific knowledge
- Development of individual potential
- Acquisition of discovery approach
- The development of rational thought e.g. collating and developing scientific attitude in people.
- Explaining natural phenomena for general scientific literacy

Science and technology move a nation forward. Therefore, in this era of rapid technological development, scientific literacy is important for agricultural, medical, economic, industrial development and some that are yet to be discovered. The various methods in which science knowledge is impacted include the following:- Expository or traditional lecture method

- Discussion method
- Discovery/inquiry method
- Demonstration method
- Scientific/Laboratory approach/problem solving
- Project method (Active learning process)
- Simulation and gaming method
- Field trip method
- Information, communication technique

These different methods of impacting science knowledge can be classified under the mentioned headings: -

1. Learner centered method
2. Content focused
3. Interactive/Participatory method

Expository / Traditional Lecture Method: This method is also referred to as Instructional/Teachers center method. Here the teacher cast himself/herself in the role of being a master of the subject matter. The teacher is looked upon by the learners as an expert or an authority. The teacher does most of the talking, direct instruction sparingly, use the chalk board. Learners on the other hand are presumed to be passive and copious recipients of knowledge from the teacher. This method requires little or no

involvement of learners in the teaching process and enables teacher cover much of the syllabus but encourages rote learning in students.

This doesn't promote meaningful learning and it is as old as learning. Oyedokun (1998) describe expository as teacher telling while the learners passively listens.

### Discussion Method

The method is teacher/learner centered. It involves the teacher and learner interacting thereby discovering new ideas and facts by inquiry. The teacher becomes a resource rather than an authority. Discussion could be on individual bases i.e. student to student or class/group discussion also referred to as tutorial.

### Inquiry Method

Inquiry method is also referred to as problem solving method. Man is faced with everyday problem and in attempt to find solution to the problems inquiry approach is applied based on the situation. Bichi (1989) mention three types of inquiry as: -

- i. Guided inquiry
- ii. Modified free inquiry
- iii. Inquiry role approach

In guided inquiry the teacher poses a problem for the pupils to answer. The guidelines could be given as to solving the problem while the students make use of their initiative to tackle the problem.

Modified free inquiry involves the teacher formulating the problem while the students decide on the way and procedure to find solution to the problem. This method is

very suitable for secondary school students and is applicable in biology and most science classes. It is learners centered, the teacher/instructor is both teacher and learner at the same time. The teacher plays “dual role” according to the words of Lawrence Stenhouse.

#### Laboratory Method

Laboratory approach is a student centered activity oriented teaching strategy in which the teacher directs students through problem solving approach to discover answers to instructional topic. This is appropriate for science laboratory class. viz Biology laboratory class. In order to know what the facts of science are, they must be seen and handled directly on the laboratory tables. The text books and other books are not science but literature. Books are really poor literature at teaching science.

While the laboratory method is almost universally approved by science teachers everywhere, the text book method of teaching in classrooms prevails in schools to such an extent that laboratory work is incidental, inefficient and in many cases excluded all together. Laboratory teaching develops in the pupils the ability to interpret what he/she sees in the light of experience and makes him/her thus an observer later. Prof. Dewey has pointed out that the laboratory method has the advantage over the classroom teaching in as much as the achievements of an experiment entirely diverts the attention of the student from the thought that he/she is studying. In a classroom the teacher presents a statement from a textbook according to his conception and then efforts are made by the students to reproduce the statement in their own way. In the laboratory the students encounter the facts directly without the intermediate steps of the teacher. The latter is concerned in assisting the thorough exploration of facts. Laboratory method is doubtfully of value in the cultivation of the mind. It brings the teacher and the students in close contact and thus the teacher

influences the character of the students. In the laboratory the student is free to work in accordance with his/her own conception and there is no bondage of authority.

If teaching in a classroom forms the only continuous and logical feature of the course, the attitudes of students towards the laboratory work will be entirely false. Efforts should be made to reach some point of equilibrium between experimental work and the classroom teaching; in that case the students along with the first-hand knowledge in the laboratory may also take advantage of demonstration and lecture work by the teacher.

#### Demonstration Method

Demonstration is the process of teaching through example or experiment e.g. a science teacher may teach an idea by performing an experiment for students. A demonstration may be used to prove a fault through a combination of visual evidence and associated reasoning. This method allows student to personally relate to the presented information. Memorization of a lot of facts is detached without impersonal experience; whereas, the same information conveyed through demonstration becomes personally relatable.

This method is usually used for children in lower grades but is used in sciences especially biology. The demonstration can either be performed by the teacher or with the assistance of some students selected by the teacher. It can be live talking or live – silent in which films or taped materials are used. This can also be linked to ICT materials of recent times. It is evident that the study investigates the effect of instructional materials on academic achievements of student, but the teaching strategies play a vital role in achieving such goal.

## Information Communication Technology (ICT) and the teaching of Biology

In recent times when learning is being computerized, global communication has given birth to ICT learning and process learning. This method of teaching and learning is through the internet and making use of films and video tapes. The nature of science makes it imperative that there is need to interact with the students to create the desired learning impact necessary to arouse learners' interest and creativity, Mundi, Wakawa and Sule (2008). In science the use of many senses appeal more to the learners and makes learning more meaningful. The use of video tapped instructional materials appeals to the sense of sight and hearing respectively.

Instructional materials are usually self explanatory and save the energy the teacher would have used in talking. ICT instructional materials can be grouped according to the sense appealed to Instructional materials and are classified into:-

Hard (Equipment) and software (Consumable materials i.e. Audio – visual

(hearing/seeing) projected and none –projected (Imogie 1989; 2002, Mundi et al 2008). Gbodi and Laleye (2006) as in Mundi (2008) reported that students taught integrated science using video-taped instruction technique, performed significantly better than that using lecture method. Also the findings of Okeke (1999), Onyegaegbu (1999), Nweji (2000) in Gbodi et al (2006) revealed that video-taped instruction has the potential of enhancing the quality of science teaching, arouse student interest, clarify concepts and stimulate thinking. It also simplifies abstract concept.

There are other methods of teaching science but the most recent is the ICT though expensive but result oriented and global. Another name for this method is Computer Assisted Instruction (CAI). It was reported that computer has the capacity of exciting

students. (Jegede et al 1992) in Kehinde(1999). The use of instructional materials will reinforce the various teaching methods such as demonstration and discovery.

## **2.6 Academic Achievement in Biology**

Academic achievements of a student in a particular subject or course are determined by short or long term goals acquired. According to Oxford Advance Learners Dictionary, to achieve means “to succeed in reaching particular goal, status or standard especially by an effort for a longtime”. Achievement in Biology goes to emphasize the effort or skill put in to acquire or achieve success in Biology as a science subject.

Most research findings in achievement in science are also applicable to Biology as a science subject. The teaching of Biology as a science subject requires laboratory strategy and different pedagogical methods that will enhance meaningful teaching and learning of the subject. A lot of factors militating against the teaching and learning of sciences in which Biology is included have been discussed. The factors range from instructional materials, teaching strategy, gender disparity, ignorance and attitude of teachers, provision of instructional materials, and student’s behavior toward learning to facilities provided to mention but some of the factors. Considering the analysis of students’ achievements in recent WAEC examination and result, it poses a great concern to the nation that there is a great drop in achievement in most science subjects with Biology inclusive.

James, et al (2000) is of the view that biology stands out easy to teach and learn among other science subjects. This was due to availability of materials and teaching aids that are available in open fields. According to James et al (2000) one major reason why Biology has an advantage over other science subjects is the fact that Biology could be taught and verified within the walls of the school laboratory or even the open field. It was also reported that a

popular method of teaching Biology was to collect plants and animal materials for observation and dissection in the laboratory which is called “practical”. This instructional strategy according to the report does not allow active participation of students and thus does not contribute to scientific attitude of students. The inequity method of teaching was advocated for students where they solve problems by themselves. The indiscriminate use of the lecture method by science teachers which is attributed to the teacher’s academic level, contributes to seventy percent of the scientific information received by the pupils.(Awode 1984),Bichi (2002) and Paris (2014). This lecture method which is used indiscriminately by science teachers as noted by Bichi (2002), Paris (2014) is rather disturbing as the effectiveness of the method have been investigated by many researchers to be inferior and ineffective.

There is much failure in WAEC result in recent times; for example, for the past three years 2010 – 2012 the WAEC result have been reported to be poor, 39% pass in 2012 according to the director of WAEC and Minister of Education Hajiya Rukqyattu Rufai. Some of the factors for the failure mentioned were lack of adequate facilities and unqualified number of teachers unable to apply positive teaching strategies. Martin (1994) and Oyedokun (1998) as in the Bichi (2002),Adesoji and Arowosegbe (2004), investigated the effect of lecture methods and inquiry method and concluded that the lecture method was inferior to inquiry in terms of enhancing student’s achievement. James et al (2000) suggested that biological garden as a teaching strategy could motivate students.

It is an indication from modern findings that indoor and outdoor facilities and improvisation of materials are mere proposals which have not been fully implemented. Recent research findings have shown that most teachers of science do not use instructional materials properly



either as in result of ignorance or negative attitude of teachers towards improvisation and use of teaching aids. Abu (1998) pointed out that mere use of the materials do not guarantee effective communication or teaching but the proper use of, careful selection and skillful handling by the teacher that renders its usefulness in facilitating teaching and learning. In this study the effects of the use of instructional materials in teaching will be investigated.

## 2.7 Theories on Improvising Teaching Aids

### 2.7.1 Jerome Bruner's Learning Theory

Bruner introduced the concept of learning by discovery. Bruner is of the view that learning is effectively engaged in if the learner is given the opportunity to discover facts by him/herself. Bruner argues that mere presentation of information will not enhance effective solution of a problem. The theory stresses cognitive effectiveness. Because of this, some referred to Bruner's theory of learning as Bruner's theory of cognitive development. Bruner believed that learning by discovery begins when science teacher purposefully (i.e. intentionally) create (present) a problem and present it to the students by introducing some inconsistencies (i.e. contradictions) among source of information which are given in the process of instruction. According to Bruner such inconsistencies lead to intellectual discomfort that will stimulate (i.e. motivate) the students to initiate individual discoveries through cognitive restructuring (i.e. internal reorganization).

According to Bruner there are two forms of discovery processes which are:

**Assimilation:** This occurs when a student recognizes a new situation that is familiar to one of the elements in the existing structure of knowledge (i.e. cognitive structure) and he/she easily assimilates it.

**Accommodation:** This occurs when a new situation (i.e. a new knowledge) is incompatible to the existing structure of knowledge (i.e. cognitive structure) the learner first restructures (i.e. reorganizes) his/her cognitive framework (i.e. cognitive structure) in order to be able to accommodate the new knowledge.

Bruner believes that the students should find out information on their own using mental processes. The theory places great emphasis on the three types of human activity for learning i.e. the three information processing systems which are:

- Physical activity (motor activities) called Enactive representation.
- Imagery called Ionic representation.
- Symbolic activities

### **2.7.2 Piaget's Theory of learning**

Piaget's cognitive theory of learning refers to the stage theory of cognitive development. According to Piaget, children develop knowledge by inventing or constructing reality out of experience and thus mix their observation with their ideas about how the world works. Piaget observed that people of the same age level (especially children) have a similar line of reasoning. For instance, children of the same age level have similar line of reasoning or thinking. Children may make the same type of mistakes. They may have the same reasoning process. This indicates that cognition develops stage by stage. Piaget used the terms 'Assimilation' and 'Accommodation' to explain his views.

**Assimilation:** Assimilation means a process of interpreting actions or events in relation to one's schemas. This refers to a means of fitting reality into one's existing structures of knowledge. The term 'schemas', for Piaget, refers to a well-defined sequence of physical and mental actions.

## **2.8 Overview of Related Studies**

Biology has been listed a compulsory subject in the senior secondary school curriculum due to its importance in relation to scientific courses like Medicine, Zoology, Botany, Pharmacy, Biochemistry, Biotechnology among others. Biology as a science subject which affects the life of the learners directly and positively ought to be impacted using proper and adequate constructive strategies. Esiobu and Soyibo (2015) investigated the effects of instructional strategies on academic achievement in Biology. Nine (9) experimental classes and Nine (9) control classes were used. Both groups were exposed to the same curriculum materials, the experimented group taught using concept mapping achieved significantly better than the control group taught using traditional method. Bichi (2002) investigated the effect of problem solving strategy and enriched curriculum in evolution concept. Two groups; experimental group was taught using problem solving strategy with conventional curriculum and control group taught using traditional method were tested. The experimental group taught using problem solving instructional strategy performed significantly better than the control group taught using traditional strategy.

Instructional materials are materials that can be used to ensure or enhance effective teaching and learning. Biology is activity based and students centered and cannot be taught or learnt without material resources. According to Adeyemi (2008) student learn better through practical approach

with the use of material resources. The findings of the study on the effect of instructional mode on students knowledge of integrated science aligned with the conclusions of Okobia (2010), Akpochafo (2011), Arisi (2002) and Agboboroma (2015) who reported that the use of instructional modes/strategies significantly enhance the achievements of students in secondary schools. The finding therefore implies that the use of instructional strategies have positive effects on students academic achievements. Onasanya *et al* (2011) reported in their study on the effect of improvised and standard instructional material on secondary school student's academic achievements in physics, that standard instructional materials used in the experimental group had positive effect on the student's achievements. Finding of Etukudo (2010) Fagbemi and Ibidapo (2011), as well as Folorunso, and Nwosu, (2016) indicated that teaching with improvised materials generally improve students academic achievement in Biology.

Information communication technology (ICT) is a modern instruction technology which according to Mansell and Wehn (2011) offers the potential of strengthening the capacities of the population in developing countries and will in turn strengthen the science and technology base of the countries. Okwo (1998) opined that the use of new media makes processing of science, technology and mathematics (STM) faster and easier and makes learning effective, efficient and fun. The use of instrumental materials is a vital instrument to the teaching of biology and science. Onyejemezi (2002) opined that if a science teacher teaches and does not have the knowledge and manipulative skills of using instructional material in teaching, the learners will find learning difficult.

Oriade, (2011) noted that most secondary school teachers in Toro, L.G.A of Bauchi State still teach most biology concepts without the use of instructional materials. It is also evident that teachers lack the zeal to improvise some of the materials. According to Eniayeju et al (2000)

only a significant proportion of STM teachers are not taking advantage of the suggested activities and instructional materials given in STM curriculum when lesson are being prepared. In the researcher's view, they still practice "chalk and talk" traditional method. This method, according to Martin (2014)Oyedokun (2012) proved inferior in enhancing students' achievement (Bichi 2012)Akele and Usman (2013) Eniayeju (2015) reported that modern STM teaching and learning stir up students' participation in practical, careful selected and skillful use of teaching materials make facts and information better retained and learning more meaningful.

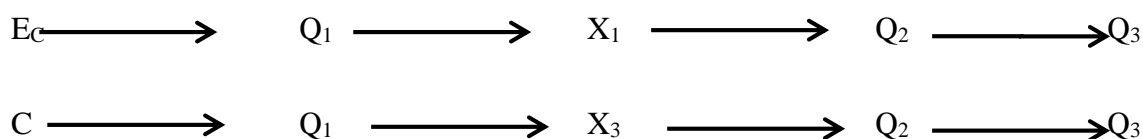
## **CHAPTER THREE**

### **3.0 RESEARCH METHODOLOGY**

#### **3.1 Research Design**

The research design adopted was quasi-experimental. Quasi experimental design consists of treatment group and control group, since the classes existed as intact groups. Pre-tests were used to determine the equality of the two groups. A pre-test, post-test and delayed post-test was also administered to both experimental and control groups. There are three experimental groups. For teaching aids and control group. Both, groups were subjected to student Biology practicals.

### 3.1.1 Research Design Layout



Where

$E_c$  = Experimental (those taught using teaching aids)

$C$  = Control (those taught using conventional learning)

$Q_1$  = Pre-test (Test given before treatment)

$Q_2$  = Post-test (Test given after treatment)

$Q_3$  = Post-post test (Test given after post-test)

## 3.2 Population of the Study

The population of this study was made up of SSII students of government senior secondary schools in Bosso. The target population was SSII students with total population of 645 students of which 331 are males and 314 are females for 2018/ 2019 section.

### **3.3 Sample and Sampling Technique**

The study employ simple random sampling techniques in selecting. The sampling size for this study was 180 (one hundred and eighty) senior secondary school students (SSII) with the cooperative teaching aids of 57 students, 38 males and 19 females and the control group was 60 students. Teaching aids was used for experimental group while the conventional learning strategy for the control group.

### **3.4 Research Instrument**

The instrument for data collection is Biology practices test

#### **3.4.1 Treatment Instrument**

The treatment instruments to be used are:

Teaching aids was used on the experimental group and

Conventional Teaching strategy to be used on the control group.

### **3.5 Validity of Research Instrument**

The Biology practical test was validated by an expert in science education department, Federal University of Technology, Minna, and two Biology teachers from secondary schools, Minna. Suggestions were made on the simplicity and clarity of language used the questions were modified at the end of the validation process.

### **3.6 Method of Data Collection**

The researcher visited the schools used for the study to seek permission from the school authorities. After the permission has been granted, the researcher introduced to the member of

staff (especially Biology Teachers), the researcher gave orientation about the research work the researcher intends to carry out in their school. Then, a pre-test was administered to both the experimental and control groups within the same period. Teaching commences after the scripts and the inventory in each of the school are returned. The teaching last for four weeks, at the end of the treatment period; the post-test was administered to the groups. Two weeks after the post-test is administered and collected, the post-post-test was also administered and collected for final analysis.

### **3.8 Method of Data Analysis**

Data collected were analyzed using mean, standard deviation to answer research questions while hypothesis one to eight were tested at 0.05 level of significance using analysis of variance (ANOVA).

## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSION**

**Research Question one:** What is the difference in the mean achievement scores of the students taught with teaching aids compared to those taught using conventional teaching strategy?



**Table 4.1: Mean and Standard Deviation of Scores of Experimental and Control Group**

Groups	N	Pretest		Posttest		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Teaching Aids	63	25.65	8.97	69.08	11.34	43.43
Conventional learning strategy	60	25.77	8.38	50.22	9.41	24.45

Table 4.1 shows the mean and standard deviation of the mean achievement scores of experimental group and control group in pretest and posttest. The result revealed that mean and standard deviation scores of the pretest and posttest experimental group are  $\bar{X}$  =25.65, SD = 8.97 and  $\bar{X}$  = 69.08, SD = 11.34 respectively. This gives a mean gain of the control group are  $\bar{X}$  = 25.77, SD = 8.38 and  $\bar{X}$  =50.22, SD = 9.41 respectively and gives a mean score of 24.45 in favour of the posttest. The result also revealed that experimental group and control group had mean gain of 52.63 and 24.45 respectively, and with the experimental group having the highest mean gain of 52.63.

The result also revealed that the control group had mean gain of 24.45 with the experimental group having the highest mean gain of 43.43.

Research Question Two: Will there be any difference in the mean achievement score of male and female students taught with improvised teaching aids?

**Table 4.2: Mean and standard deviation of pretest and posttest scores of male and female Mastery Strategy)**

Groups	N	Pretest	Posttest	Mean Gain
--------	---	---------	----------	-----------

		$\bar{X}$	SD	$\bar{X}$	SD	
Male	35	21.52	6.92	69.13	12.14	47.61
Female	28	30.83	8.63	69.03	10.47	38.2

Table 4.2 shows the mean and standard deviation of the pretest and posttest scores of male and female experimental group. From the result, it can be seen that mean score of the pretest and posttest score of the male are  $\bar{X}$  =21.52, SD = 6.92 and  $\bar{X}$  = 69.13, SD =12.14. The mean gain is 47.61 in favour of the male posttest achievement score. Similarly, the mean and standard deviation of pretest and posttest score of female are  $\bar{X}$  = 30.83, SD = 8.63 and  $\bar{X}$  = 69.03, SD = 10.47, the mean gain is 38.2 in favour of the female posttest score. Also the result reveals the difference of 9.41 between the posttest mean gains score of male and female in favour of the male.

Research Question Three: Whether improvised teaching aids will improve students' retention in Biology compared to those taught using conventional teaching strategy?

**Table 4.3: Mean and Standard Deviation of Posttest and Retention Scores of Experimental and Control Group**

Groups	N	Posttest		Retention test		Mean Gain
		$\bar{X}$	SD	$\bar{X}$	SD	
Teaching Aids	63	69.08	11.34	70.56	9.81	1.48
Conventional learning strategy	60	50.22	9.41	51.23	10.80	1.01

Table 4.3 revealed the mean and standard deviation scores of the posttest and retention test experimental group are  $\bar{X}$  = 69.08, SD = 11.34 and  $\bar{X}$  = 70.56, SD = 9.81 respectively. The result revealed that mean and standard deviation scores of the posttest and retention test experimental group are  $\bar{X}$  = 78.68, SD = 13.36 and  $\bar{X}$  = 79.09, SD = 10.55 respectively. This gives a mean gain of 1.48 in favour of the retention test. On the other hand, the mean and standard deviation of the

posttest test and retention test of the control group are  $\bar{X} = 50.22$ , SD = 9.41 and  $\bar{X} = 51.23$ , SD = 10.80 respectively and gives a mean gain score of 1.01 in favour of the posttest.

**Table 4.4: Summary of analysis of variance (ANCOVA) comparison on the mean achievement scores of the experimental and control group taught Biology using teaching aids**

Groups	Sum of Squares	Df	Mean Square	F	Sig
Teaching aids	10934.320	1	10934.32	100.11	0.00
Within groups	13215.815	121	109.22		
Conventional	11492.073	1	11492.073	108.10	0.00
Within groups	12863.192	121	106.307		

Table 4.4 shows the results of the analysis of variance on achievement of students who taught Biology using teaching aids and conventional teaching. As shown in (Table 4.4) revealed  $F(1, 121) = 100.1$   $p=0.00$ . With  $P < 0.05$ , the null hypothesis ( $H_{01}$ ) was rejected. Therefore, students taught Biology using teaching aids compared to those taught using conventional teaching strategy. The mean standard deviation for each of the groups are (MLS)  $\bar{X}=63.08$ , SD= 11.34 and CTS  $\bar{X}=50.22$ , SD =9.41 with this finding, the student who use teaching aids have the highest mean. The results revealed  $F(1, 121) = 108.10$   $p=0.00$ . With  $p < 0.05$ , the null hypothesis was rejected. Therefore, there was significant difference in the mean retention scores of students taught Biology using teaching aids and those taught using conventional teaching strategy.

Hypothesis Two: There is no significant difference between Biology achievement scores of male and female Students taught Biology using teaching aids.

**Table 4.5: Summary of Analysis of Variance (ANOVA) of Achievement of Male and Female Students Taught Biology using teaching aids.**

Groups	Sum of Squares	Df	Mean Square	F	Sig
Between groups	0.145	1	0.145	0.00	0.97
Within groups	7981.229	61	130.840		
Total	7981.374	62			

Table 4.5 shows the results of the analysis of variance on achievement of male and female students taught biology using teaching aids and conventional teaching as shown in (Table 4.5) revealed  $F(1, 58) = 0.00$   $P = 0.97$  With  $P > 0.05$  the null hypothesis was accepted. Therefore, there was no significant difference in the mean achievement scores of male and female taught using teaching aids.

Hypothesis Three: There is no significant difference whether improvised teaching aids will improve students' retention in Biology compared to those taught using conventional teaching strategy.

**Table 4.6: Summary of analysis of variance (ANOVA) comparison of the mean achievement scores of the experimental and control group taught Biology using teaching aids**

Groups	Sum of Squares	Df	Mean Square	F	Sig
Teaching aids	23670.941	1	23670.941	212.61	0.00
Within groups	12803.041	115	111.331		
Control	22687.241	1	22687.241	198.73	0.00
Within groups	13128.530	115	114.161		
Total	36473.956	116			

Table 4.6 shows the results of the analysis of variance on whether improvised teaching aids will improve students' retention in Biology compared to those taught using conventional teaching strategy. As shown in (Table 4.6) revealed  $F(1, 115) = 212.61$   $p=0.00$ . With  $P < 0.05$ , the null hypothesis was rejected. Therefore, there was significant difference in the mean achievement scores of students who taught using teaching aids and those taught using conventional learning strategy. The mean and standard deviation for each of the groups are (CLS)  $\bar{X}=78.68$   $SD=11.62$  and (CTS)  $\bar{X}=50.22$ ,  $SD=9.41$  with this finding, the students who used teaching aids have the highest achievement mean.

### **4.3 Summary Findings of the study**

The findings for this study were:

1. Students taught Biology using teaching aids performed significantly better than those taught using conventional method.
2. There was no significant difference in the achievement of male and female students taught biology using teaching aids.
3. Students taught biology using teaching aids had retention better than those taught using Lecture Method (LM).

## **CHAPTER FIVE**

### **5.0 CONCLUSION AND RECOMMENDATIONS**

#### **5.1 Conclusion**

- (i) The use of teaching aids strategies was favoured to be effective for teaching biology students.
- (ii) Teaching aids can improve students' achievement more than other instructional delivery medium such as lecture method.

- (iii) Teaching aids can improve students' retention more than other instructional delivery medium such as lecture method.
- (iv) Teaching aids can give equal learning opportunities to both male and female in biology.
- (v) Teaching aids can give both male and female students equal opportunities in learn Biology
- (vi) Teaching aids can improve the retention level of both male and female students taught biology.

## **5.2 Recommendations**

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

- (i) Teaching aids should be encouraged in schools for teaching of biology.
- (ii) Students should be trained on the use of teaching aids that can bring better results in teaching and learning of biology.
- (iii) Biology and other science education courses in particular should be taught in such a way that students can see, feel and practise what have been taught on their own.
- (iv) Workshop, seminars, symposia and conferences should be organized periodically to acquaint new biology teachers with recent research findings that would lead to effective and meaningful teaching and learning.



## REFERENCES

- Agabi, C. O. (2010). *Prudential approach to resource management in Nigerian education: A theoretical perspective*. International Journal of Scientific Research in Education.
- Ayot, H. O, and Patel, M. M. (1987). *Instructional methods*. Nairobi: Kenyatta University.
- Barasa, M. (2009). *Factors influencing implimentation of the integrated English in public secondary schools in Kanduyi Division, Bungoma South District: An Unpublished Med Research Project*. University of Nairobi.
- Blamires, H. (1991). *A history of literary criticism*. London: the Macmillan press Limited.
- Brown, J. W. and Thornton, J. (1971). *College teaching: A systematic approach*: McGraw HillBook Company Incl.
- Buhere K. (2013) To teach in high school, graduates must resit K.C.S.E. *The Standard* p. 21. August 27<sup>th</sup>.
- Clark, R. E (2008). *Media will never influence learning*:  
[www.usq.edu.au/.../resource/clark/media](http://www.usq.edu.au/.../resource/clark/media).
- Cook, V. (1991). *Second language learning and language teaching*: London. Edward Arnold Publishers.
- Copper, H. (1969). *Aids to teaching and learning*. London: Oxford University Press.
- District Education Board, *Bungoma North district KCSE results analysis reports 2009 and 2010*.
- Davies, A. and Elder, C. (2008). *Computer assisted language learning: The Handbook of Applied Linguistics*. 21<sup>st</sup> January.  
(Internet:<http://onlinelibrary.wiley.com/doi/10.1002/9780470757000.ch/summary>)
- Dick, W. and Carey, J. O. (2001). *The systematic design of instruction*. New York: Longman Publishers.
- Douglass, H. (1964). *The high school curriculum*. USA: Ronald Press Company.
- Ellis, R. (1992). *Instructed language learning*. London: Oxford University Press.
- Farrant, J.S. (1964). *Principles and practice of education*. England: Longman Group UK Limited.
- Fleming, M. L. and Levie, W. H. (1993). *Instructional message design: Principles from the behavioural and cognitive sciences (2<sup>nd</sup> Ed)*. Englewood Cliffs, N.J: Educational Technology Publications.
- Gardner, R. C. (1985). *Social psychology and second language learning: the role of attitudes and learning*. London: Edward Arnold Publishers Ltd.



- Gathumbi, A. W. (2010). *Primary teacher education in jeopardy: Pre-service teachers' under-achievement in attainment of desired English competency levels in review of higher education and self-learning*. Houston, USA, 18<sup>th</sup>-20<sup>th</sup> April.
- Gathumbi, A. W. and Musembe, S. E. (2005). *Principles and techniques in language*. The Jomo Kenyatta Foundation. Enterprice Road Industrial Area.
- Gathumbi A. W. (2008). *Benchmarks for English language education practitioners*. Nairobi: Phoenix Publishers.
- Haymore J. (1997). *Teaching with technology: Creating student-centred classrooms*. New York: Teachers College Press.
- Henrich, R. (1990). *Instructional Media*. Singapore: Macmillan Publishing Co.
- Holden, J. and Westfall, P. (2005). *An Instructional media selection guide for distant learning*. (Internet: <http://www.usdla.org/assets/pdf-files/AIMS...>).
- Kamunge, (1988). *The Kenya presidential working party on the education and manpower development for the next decade and beyond*: Nairobi: Government Printer.
- Kemp, J. (1985). *Planning and producing audio-visual materials*. Pennsylvania: Chandler Publishing Company.
- Kerr, K. J. (Ed). (1996). *Technology and the future of schooling. Ninety-fifth yearbook of the national society for the study of education, part 2*. Chicago: National Society for the Study of Education.
- Kimemia, J. N. (2001). *Kiswahili: the dilemma of developing the national language*: Egerton University Press.
- Kimui, W. (1990). *A study of availability and use of learning and teaching resources in PTCs in Kenya*. Nairobi: Unpublished PhD Thesis. KU.
- Kinyanjui, L. (1997). *Availability and utilization of instructional material in teaching and learning physical education in some selected teachers' colleges in Kenya*: An unpublished M Ed. Thesis.
- Kothari, C. R. (2004). *Research methodology: Methods and techniques (2<sup>nd</sup>ed)*: New Age International (P) Limited.
- Llurda, E. (2004). *Teachers and English as an international language*. International Journal of Applied Linguistics.14(3), 314-323. London: Le Wei.
- Macharia, L. M. (2013) *Impact of the integrated English curriculum on student performance in Kikuyu district, Kiambu County, Kenya*. An Unpublished PGDE Research Project Submitted in UoN.
- Merrill, M. D. (1983). *Component Display Theory, (Ed): Instructional design theories and model*: Hillsdale, N.J. Erlbaum Associates.
- Merrill, M. D. (1994). *Instructional Design Theory*. Englewood Cliffs, N.J: Educational Technology Publications.

- Mogambi, H. (2011). *Teachers to blame for poor performance*. Daily Nation p.14. Jan. 6<sup>th</sup>.
- Muniu, R. K. (1986). *An evaluation of the effectiveness of PE curriculum in diploma colleges*. Nairobi. Kenyatta University: An unpublished MEd Thesis.
- Mutua, R. W and Namaswa, G. (1992). *Educational planning*. Nairobi: Educational Research and Publications.
- Nachmias, C. and Nachmias, D. (1996). *Research methods in the social sciences, 5<sup>th</sup> Ed.* New York: St Martin's Press.
- Nderitu, J. K. (1992). *Training in production and use of resources in selected Nairobi Lower primary schools*: An unpublished MEd Thesis.
- Newby, T. J. (2000). *Instructional technology for teaching and learning: Designing instruction, integrating computer and using media. 2<sup>nd</sup> ed.* Upper Saddle River, NJ.
- Nwadiupo, N. (1997) *Educational research*. Emugu: Forth Dimension Publishing Co., LTD.
- Okwara, M. O. (2012). *A study of factors related to achievement in written composition among secondary school students in Busia district*. (Unpublished masters' thesis), Kenyatta University, Nairobi.
- Ryanga, C.W.A. (2002). *Reading and writing: The connection to personal, social and economic development*. International Journal of the school of humanities and social sciences. 2 (1) 106-119. Retrived from Waveney Olembo (ed) Chemchemi.
- Sweller, J. (2005). *Implications of the Cognitive Load Theory for multimedia learning (Ed)*. New York: Cambridge University Press.
- Wittich, A. W and Schuler, C. F. (1962). *Audio visual materials: Their nature and use*. New York: Harper and Row Publishing Company.