EFFECTS OF INSTRUCTIONAL MATERIALS ON ACHIEVEMENT AND RETENTION OF BIOLOGY CONCEPTS AMONG SECONDARY SCHOOL STUDENTS IN DELTA STATE, NIGERIA.

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DECLARATION

I hereby declare that this thesis "Effect of Instructional Materials on Achievement and Retention of Biology Concepts among Secondary School Students in Delta State, Nigeria" is written by me and that it is a record of my own research work. It has not been presented in any previous application for a higher degree. All quotations are indicated by quotation marks or indentations and the source of information are specifically acknowledged by means of references.

Victoria Ozoemezinem ENOHUEAN — Date

Sign

CERTIFICATION

This thesis entitled "Effect of Instructional Materials on the Academic Achievement and Retention of Biology Concepts among Secondary School Students in Ika Delta State Nigeria by **Victoria Ozoemezinem ENOHUEAN** meets the regulation governing the award of the degree of Master of Education (M.ED) in science education of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to all teachers, those teaching science subjects in Nigeria, especially Biology.

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ABBREVIATIONS

UBE - Universal Basic Education

UPE - Universal Primary Education

WAEC	-	West African Examinations Council
ICT	-	Information Communication Technology
UNESCO	-	United Nations Educational, Scientific and Cultural Organization
STM	-	Science, Technology and Mathematics
NPE	-	National Policy on Education
V.T.I	-	Video-taped Instruction
BAT	-	Biology Achievement Test
PPMC	-	Pearson Product Moment Correlation Coefficient
E.G	-	Experimental Group
C.G	-	Control Group
NECO	-	National Examination Council
STAN	-	Science Teacher's Association of Nigeria
I.M	-	Instructional Materials

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ABSTRACT

This study investigated effects of instructional materials on the academic achievement and retention of SS 2 biology students in Delta State. The study sample consisted of 86 SS2 biology students randomly selected from a population of 5,626 students drawn from 18 public schools. An instrument designed and developed from past WAEC questions by the researcher known as Biology Achievement Test (BAT) was validated by some senior lecturers in science, English and statistic from Ahmadu Bello University and senior biology teachers in Delta State. The instrument used was tested and certified to be reliable at 0.65 coefficient. Quasi-experimental design was adopted which involves two groups: experimental and control groups. The experimental group was subjected to treatment using instructional materials but the control group was taught without any instructional materials. Four null hypotheses were tested using t-test statistics. The following major findings were made: There is a significant difference between the mean academic achievement scores of students taught using instructional materials (EG) and those taught without the use of instructional materials (CG).There is no significant difference in the mean achievement scores of male and female students taught biology concepts using instructional materials. There is significant difference in the mean retention scores of students taught with instructional materials and those taught without instructional materials. There is significant difference in the retention ability of male and female students exposed to the use of instructional materials. On the basis of these findings some recommendations were made, one of which is teachers should make use of instructional materials to facilitate the teaching of biology at secondary school level.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Science explains the natural existence of man and his activities. Science could be seen as problem solving in order to improve the living standard of man. There are different definitions of science by different schools of thought; Owolabi (2004) defines science as an integrated part of human activities. It is seen as a dynamic human activity concerned with manipulating spherical world. It is seen as "knowledge covering general truths and laws, obtained and tested through scientific methods as concerned laws with the physical world". Science can be seen as the bedrock of national development. A nation that is not scientifically advanced is termed a backward nation. Science is used by humans to solve daily problems and control the environment.

The usefulness of science cannot be under-rated. There are many areas of life that science has contributed such as in medicine, geophysics, hydrology, agriculture, communication, technology, education, transportation, healthcare to mention a few. Agriculture has improved greatly through the introduction of high yield improved agricultural seeds. Science has led to breakthrough in medical care. Diagnostic machine for checking different ailments and diseases are now controlled and diseases cured through science. The usefulness of science to humanity cannot be over emphasized.

Biology is defined as the study of living things which include plants and animals. It is a fascinating study that ranges from microscopic-cellular molecules to the biosphere, encompassing the earth's surface and its living organisms (Sarigin, 2010). Biology is a core subject that is mandatory in all secondary schools in Nigeria as it is a pre-requisite to the study of many courses relevant to humanity which include the following; Medicine, Pharmacy,

Biochemistry,Agriculture, Anatomy, Physiology, Botany, Zoology, Microbiology, Cell Biology, Ecology, Entomology Immunology, Molecular biology, Evolutionary, Genetics and population dynamic among others. Biology can be conveniently taught in a laboratory which is a place designed and equipped with materials for teaching and learning. It is obvious that most secondary schools lack physical laboratories and where they exist, there are inadequate or lack of equipment. One of the problems militating against effort to enrich science is inadequate or absence of teaching aids or materials which include; indoor or outdoor laboratory, reagents, chemicals and unqualified teachers. Nwoji (1999) reported that some essential facilities were not available in the school visited (Baike 2000).

The importance of Biology is so much that it needs to be taught with instructional materials to arouse students' interest. Tabotndip (2004) lamented that abstract teaching goes on today where teachers do not use apparatus and students are not using textbooks. It is reported that most secondary schools do not have biology laboratory, the few existing ones have been converted into classrooms to create space for the overwhelming population of students arising from the Universal Basic Education (UBE) and Universal Primary Education (UPE). As a result of WAEC specification on SSCE examination, some schools resorts to multipurpose laboratory. There is need for a single laboratory for each of physics, chemistry as well as biology practicals. This ought not to be so for they have their disadvantages such as fire or chemical outbreak or accidents. In case of biology, the charts, specimen and models may not be displayed for recognition and observation. Learning occurs when all the facilities for study are harnessed for work during a teaching and learning experience (Azikwe1990,Tabotndip 2004). Visual imaginary e.g. pictures charts etc has become the most powerful means of communication in the society today. (Ajayi 2004).

Outdoor activities in form of outdoor laboratory learning could be encouraged in form of biology garden, field trips or around the school wall since the activities of the indoor laboratory

cannot unfold true happenings in nature or forms of living things e.g. reproduction of amphibians in water, observation of flowering plants, taxonomy of plants and animal. Morphology of living things can be studied in the laboratory to an extent but their activities, influence and interaction with one another in their habitat would be better studied outside the laboratory. This method of instruction promotes inquiring strategy. Inquiring is a process that encourages students to solve problems in a logical systematic manner using the process skills (James, and Permida (1997, 2000).

The Biology garden as an outdoor laboratory plays a very important role in the teaching and learning process that includes:

1. Free movement of teacher and students in terms of observation of specimens and objects.
2. It promotes good relationship between students and their teacher.
3. It encourages inquiry, discovery and meaningful learning.
4. It exposes the students to study plants and animals in their natural habitat.
5. Biological garden helps the teacher to collect specimen without travelling long distances.
6. It also reduces the cost of providing materials during WAEC examination.

There are still some biology concepts and phenomena that require indoor laboratory attention such as chemical reactions in Biology (Physiology) e.g. osmosis, turgidity, etc. in plants and some physiological activities in animals. It is necessary therefore to introduce the use of materials in teaching and illustration of biology concepts for a meaningful study to take place. These materials include; concrete objects, charts, stored specimens and other teaching materials. It is on this background that the study is focused, finding out the effect of instructional materials on academic achievements and retention of SS 2 Biology Students.

Instructional materials are teaching aids or materials used to illustrate the teaching process and make instruction more compressive to the learner. According to Franzer, Okebukola, and Jegede (1992) professionally qualified science teacher no matter how well trained would not be able to put his ideas into practice if the school setting lacks the equipment and materials necessary to translate potentials into reality. The use of teaching aids or instructional materials is an important tool in the teaching of Biology. The objective of any educational process determines the content, methods and materials needed for achieving such objectives. Different instructional materials are used for different concepts in Biology. Yero, (2000) mentioned four types of instructional aids or materials, which include the following: -

i. **Visual Aids: -** these are instructional materials that make visual impression – that is, it interprets the vision of the eyes. They include chalk board, posters, models, motion pictures, projected transparences.

ii. **Auditory Aids: -** these appeal to the sense of hearing and include record players, tape recorders and language laboratories.

iii. **Audio – visual Aids: -** these involve both hearing and visual senses e.g. based on sound and vision. Advancement in modern technology has led to the production of devices known as Information Communication Technology (ICT), which is also used in teaching.

iv. **Stimulation Devices: -** These include devices built to stimulate the actions and function of real thing or object. Instructional materials according to Oriade (2000) have the characteristics of holding attention of almost all the students because they reinforce verbal messages by providing a multi-media approach.

The importance of instructional materials according to Oriade (2000) emphasized that no matter how good a curriculum maybe, absence of the use of instructional materials can jeopardize its effective implementation. The selection and use of instructional materials depend

on the teachers, if the science or biology teacher does not have the skills to manipulate the materials, learning becomes difficult. Teachers should be committed and enthusiastic to use instructional materials in teaching biology concepts. The provision and application of instructional materials should be reinforced in the school system, for it is on this note that the effect of instructional materials on academic achievements of Biology students, could be determined by their interactive and participation in class which is based on the teacher's presentation of the biology concepts or subject matter. Both achievements and long term achievement could be measured by test analysis designed. An instructional material stimulates student's participation in class, increase knowledge and affects the achievement of biology students. The use of inappropriate teaching materials results such as wrongly labeled charts results in several academic problems which according to Josiah and Okaoboh (2001) ranges from mass failure or under achievement in public examination to the gradual deteriorating situation in educational institution at all levels. Instructional materials are seen as an improvement and great relief for teachers in impacting knowledge and making the message clearer, more interesting and easier for the learners to assimilate (Onasanga and Adegbija 2008).In their view, there is no need teaching if what is learnt cannot be recalled.

Retention is the ability to store what has been learnt and recall what has been stored in the memory. According to Bichi (2002) retention is the ability to retain and later remember information or knowledge gained after learning in to memory. The nature of the materials to be coded contributes to the level of retention. Instructional materials contribute to quality and level of retention in terms of meaningful, concreteness and image evolving characteristic.(Adeniyi 1997). The study therefore investigates the effect of instructional materials on the academic achievement of teaching and learning process in biology concept. Logoke,(1992) in Bichi (2002) investigated the retention ability of two groups of students; experimental group taught biological concepts using the analogical linage strategy while the control group was thought

(skeletal system) same concepts using the traditional teaching method. The results showed that the experimental group performed significantly better and retained more of the biology concepts taught than their counter parts in the control group. Akale and Usman (1993) and Eniayeji (1995) opined, that carefully selected and skillful use of teaching materials make facts and information better retained and learning more meaningful. It is on these findings that this study is focused. The study tends to consider gender factor in terms of biology achievement and retention.

Gender issue has been the concern of all classes and groups of people all over the world especially researchers and educators. The issue of gender is considered and treated based on certain facts such as social and cultural beliefs, pattern of life and priorities of individuals. In the colonial days, boys were allowed to attend school while girls remained in the house to do house chores. Today there is no disparity on gender. From the findings of Ifamuyiwa (2005), a total of 215 candidates that sat for school certificate further mathematics involving 181 males and 34 females; result analysis showed that though the females were much fewer; 16% female, 34% of male, they relatively performed better. Even though there was poor performance of some female student's which was attributed to certain factors such as negative and discouraging attitudes of female teachers, parents to the ideas of women engaging in "male careers" such as engineering. The learning of boys and girls is associated with the society's gender norms and perpetuated through informal education in the homes and society. (Erinosho1997).Studies have confirmed the inferiority of females in science enrolments and achievements.(Arends, (1991),andAgholor, 1993). According to Aleboisus, (2000) there is inequality in access to education, health and employment. This study tends to access the effect of instructional materials on academic achievements and retention among SS2 Biology students in Ika North East Local Government Area of Delta State considering gender factors.

1.1.1 Theoretical Framework

The theoretical framework of this study is based on constructivism theory, which is about providing material which is more effective for the opportunities of the student to test ideas and give them time to construct relationship among concepts and the use of higher level embedded assessment (Ronande dios 2012).

According to Good (2003) the modem teacher sees the child as akin to a plant that is helped to grow according to its abilities and aptitudes. The understanding of an individual derived from a learning situation depends on both the incoming ideas and knowledge and individual's organization of the knowledge and deliberate re-structuring of his pre-existing conceptual framework. Learning becomes more effective when students are actively involved in the teaching learning process. They make their own knowledge as a result of interaction with specific phenomenon as such from the basis on which new knowledge are anchored (Ronande Dios 2012). Studies of some science educators such as Okebukola (2005) advocated the use of activity oriented instructional strategies such as constructive instructional strategy to enhance the teaching and learning of sciences. The constructive instructional strategy is related to Ausubel's theory which is concerned with how an individual learn large amount of meaningful materials from verbal /textual presentation in school settings (in contrast to theory developed in the context of laboratory experiment Ronande Dios (2012)

The constructivist instructional strategies involve instructional materials. Constructivist learning encourages learners to acquire necessary knowledge and skills for finding meaningful solution to real world problems. Their learning involves learners-centered, goal-directed and situated activities. There are experiences in a traditional classroom where the constructivist learning process in practiced across various subject disciplines but to transform the constructivist learning to e-learning remains challenging.

There are two main reasons:

1. It requires adequate learning content design skills to ensure flexibility, re-usability and interoperability to meet learners requirement.
2. Learning content design must allow a sound educational purpose to enforce knowledge construction. An effective learning design is not driven by the advancement in technology; it has to be rooted in sound learning theories and appropriate instruction strategies (material).

A Primary process in learning according to Ausubel is the subsumption in which new material is related to relevant ideas in an existing cognitive structure on a substantive non-verbatim basis. Cognitive structures represent the residue of all learning experiences; forgetting occurs when certain details get integrated and lose their individual identity. (Ronande Dios (2012) Constructivist theory as related to Ausubel's learning theory of subsumption and advanced organizers is helpful to provide more clarification for better knowledge of the use of instructional material and strategies. Hollman (2007) according Ronande Dios (2012) is of the view that children who learn science by the discovery approach will discover for themselves the true structure of the discipline in complete harmony with modern philosophy of science education .

This study which is focused on instructional materials is based on constructist theory.

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 Delta State are no exception. The academic achievements of students in the sciences have been on the decline (Ajagun 2000) 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. The poor achievements in biology could be attributed to some factors such as: - lack of use of apparatus Tabotndip(2000), lack of fund to purchase material Ezeudu(1995). From experience as a teacher, there are other factors that contribute to poor achievement in biology which include: -

- Lack of facility for imparting knowledge.
- Inadequate equipment in laboratories where they exist.
- Lack of teacher's zeal to make use of instructional materials or improvise in the absence of standard materials.
- Lack of students' exposure to practical lessons and insufficient time for practical activities.
- Lack of interest in creativity in the part of teachers and poor teaching strategies.
- Large size of the classes, leading to inadequate or poor management of classes.
- Unqualified or inexperience teachers handling biology classes.

Analysis of students' poor achievements in recent WAEC examination and result poses a great concern to the nation. James and Pemida(2000) in a paper termed "biology education through the biological garden" is of the view that biology stands out distinctly to be taught and learnt among other science subjects by making use of available materials. According to James et al (2000) mere collection of specimens taken to the laboratory do not give room for active participation of students and thus, does not contribute to scientific attitude of students. The transfer of knowledge from school to life situations, to the development of decision making

skills and values, cannot be nurtured through the conventional chalk and board nor can it be effective through traditional laboratory experiments but the use of more interactive strategies that can facilitate participatory learning and independent enquiry (UNESCO 1987 –2006). Biology is developing more rapidly today than in past and so in Connell (2000), the skill and techniques of imparting useful biological knowledge, lecture and text book as a sole source of knowledge should give way to newer educational techniques that require the use of instructional materials.

Available literature shows that much of biology teaching is carried out through chalk and board with little or no emphasis on the use of instructional materials. This study therefore investigated effect of the use of instructional materials on academic achievements and retention of Biology concept among SS2 student in Ika North East area of Delta State.

1.3 Objectives of the Study

The study has the following objectives, to:

1. Investigate effects of the use of instructional materials on the academic achievements of SS2 Biology student's in Delta State.
2. Investigate effect of the use of instructional materials on the retention ability of SS2 Biology students in Delta State.
3. Examine the gender-related effect of instructional materials and academic achievements of biology students.
4. Examine the gender-related effect of instructional materials and retention ability among SS2 Biology students.

1.4 Research Questions

The following questions are set for answering:-

1. What is the effect of the use of instructional material on the academic achievement in biology among SS2 students in Ika North East Local Government Area of Delta State?
2. What is the effect of the use of instructional materials on the academic achievement of boys and girls among SS2 biology students?
3. Is there any difference in the mean retention scores of SS2 biology students taught biology concepts using instructional materials and that of their counterparts taught same concepts without the use of instructional materials?
4. What is the effect of the use of instructional materials on retention ability of male and female SS2 biology students in Ika North East Local Government Area of Delta State?

1.5 Null Hypothesis

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

$H0_1$: There is no significant difference in the mean achievement scores of students taught biology concepts using instructional materials and those taught without instructional materials.

$H0_2$: There is no significant difference in the mean achievement scores of male and female students taught biology concepts using instructional materials e.g chart and specimens.

$H0_3$: There is no significant difference in the mean retention scores of SS2 students taught Biology concepts using instructional materials and those taught same concepts without instructional materials

$H0_4$: There is no significant difference in the mean retention scores of male and female students taught biology concepts with the use of instructional materials.

1.6 Significance of the Study

This study is significant to Biology teachers in Delta 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 instructional 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 Delta State have adequate facilities for academic activities in schools.
2. That teachers are trained and encouraged to use instructional materials in teaching biology
3. That secondary school teachers are familiar with the use of instructional materials in teaching Biology.

1.9 Scope and Delimitation of the Study

This study would have covered more schools and areas of Ika North East Local Government Area of Delta State but due to constraints time and material resources, it was confined to SS2 Biology students in four (4)public schools in Ika North East Local Government Area of Delta State: they include, the following: -

1. Ekwuoma Mixed Secondary School Ekwuoma
2. Ika Grammar School Boji – BojiOwa
3. OwantaMixed Secondary School, Owanta
4. Mbiri secondary school, Mbiri

The topics of research are

(1) Biological Concepts of Skeleton

(2) Skeletal materials

(3) Types of Skeleton

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, literature relevant to the study is reviewed. Specifically, the chapter is organized and presented under the following sub-headings: -

2.1 Teaching Biology at Secondary School

2.2 Instructional Materials and Teaching Biology

2.3 The Use of Indoor Laboratory in the Teaching of Biology

2.4 Improvisations of Biology Teaching Materials

2.5 Science Teaching Methods

2.6 Academic Achievement in Biology

2.7 Gender and Academic Achievement in Science

2.8 Retention Ability in Biology

2.9 Overview of Similar Studies

2.9.1 Implications of Literature Reviewed on the Present Study.

2.2 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 (1998) 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.

2.3 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 (2000) mentioned four types of instructional aids, these are:

1. **Visual Aids: -** These include chalk board, posters, bulletin board, displayed models, motion pictures, slides, projected transparences, 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. **Audio-visual 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 (1998) 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 (1991) and Eshiet (1996). 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 (2008) mentioned seven basic roles of using instructional materials as identified by (Buoro2006). 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 21st 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 (1998) 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 1998).

On the use of computer by STM teachers, Daris (1997) 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 (1990) 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 (2002) science is resource-intensive. Onasanya (2004) 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 (2004) 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 (2002) 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.

2.4 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.

2.5 Improvisations of Biology Teaching Materials

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 (1990), 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 (1992) 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 (1997) 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 non-available 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 1998).

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 (2000) reported that teachers develop diverse attitude towards improvisation. Sobulo (1998) as reported by Egbebecha (1997), reported that some teachers develop positive attitude, also some find it a difficult task, time consuming and expensive. Njoku (2000) 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), lyang (1997) 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.

2.6 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.

2.7 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.

2.8 Gender and Academic Achievement in Science

Gender issue is a contemporary one that attracts attention of psychologists, sociologist, educationist, scientists and biologists and even the home and parents. The concept "gender" could be discussed in term of masculinity and femininity observed in an individual (en.m.wikipedia.org/wiki/gendergg). The physical character of an individual may not be expressed psychologically or emotionally. For instance, careers or subject that are feminine in nature such as catering, is practiced by boys while girls are studying engineering and carpentry meant for boys previously.

A lot of researches have been carried out on gender and paper presentations to create awareness on gender equality and disparity. Ifumuyiwa (2003) reported that 215 candidates sat

for further mathematics in school certificate Examination, 181 males and 34 females. The analysis indicates low participation of females 16%s to 84% male but yet the females performed better than their male counterparts at credit levels in the subjects. This low participation of female students in science related subjects were attribute factors such as: - attitude of teachers, students and parents to the idea of women engaging in male career such as Engineering, Technology, Architecture etc.

Some teachers and women are of the view that girls are intellectually incapable of competing in science and mathematics and difficult task with the boys (Joseph 2000). Some parents discourage their girls from science and technology careers saying that they are abnormal and may not be capable of managing marital home (Ifamuyiwa 2003). The girls themselves feel discouraged by the attitudes of teachers and parents and often suffer from self esteem. Research findings have shown that female students have less positive attitude to mathematics than the male and also demonstrated less superiority at secondary school level. This probably ought to be the result of stereo typing of task that takes place with more attention given to the training and education of males in science area (Ogwuazor 1992).

There is a report that there is a shortage of female representative in science, mathematics and technology (Madiabum 1994), Ladele (1997) and Joseph (2000). The under representative of female had its genesis from school science and mathematics and the participation of females is also low: (Balogun 1985), Mason and Kahle (1989), Egwazor (1992) and Erinosho (1994) as reported in Ifamuyiwa (2003).

Studies have documented disparities in the learning of boys and girls and the gaps associated to the society gender strategy are perpetuated through information education in the home and society (Erinosho 1997). The traditional idea that girls belong to the home and they are to be trained for domestic activities, marriage and motherhood whilethe boys are to look outside for more challenging situation is not completely eradicated from the society despite

advancement in literacy. This ideology is an impediment to progress and development in science and technology. (Balogun 1994) and Yoloye (1994). Erinosho(1994) attributed this low number of girls and women to gender stereotyping by the society.

In spite of the fact that certain measures have been taken to bridge the gap between boys and girls, gender in equality is still a limiting factor to the achievement of desired learning outcome and developments in science enrolment and achievements and results in unequal access to education, health and employment (Arends, 1991; Agholar, (1993).

For the teaching and learning of science in schools to progress, and especially bridge the gap in gender inequality, certain factors have to be considered; household factors, socio-cultural factors and policy related factors, school related factors, school curriculum (gender based) and environmental factors (Erinsho 1997,Onoche (1998), Chukwura and Nwuba (2000). Gender concept has actually attracted different world bodies and NGOs such as UNESCO, different countries and especially the office of the First Lady of Nigeria.

The study tends to investigate the effect of instructional materials on academic achievements of students especially on gender; to answer the research question what is the effect of gender on academic achievement of students.

2.9 Retention of Learned Concepts in Biology

The aim of teaching and learning some concepts in Biology, making use of different teaching strategy and using resource materials is to establish a behavioral object and make learning more meaningful; this is the ultimate goal. Meaningful learning is a product of retention.

Retention could be explained as the process or ability to retain and remember things and experiences learned by an individual at a later time. Retention occurs when experience are coded in the memory. According to Oyedekun (1998) in Bichi (2002) appropriate coding of

incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane. The level of retention is determined by the type of material used. In teaching and learning concept in Biology, different senses are appealed. Okeke, (1999) Onyegaegbu (1999), Nweji (2000) in Gbodi and Laieye (2006) revealed that video-taped instructions have the potential of enhancing the quality of science teaching, arouse students' interest, stimulate thinking and clarifies concepts. From the numerous qualities of video-taped instruction (V.T.I) retention level is enhanced and increased. Motivation conditions at the time of learning can either facilitate or interfere with its success. In other words it can enhance retention or facilitate forgetting (Bichi 2002). There are numerous factors that may affect retention among which are: Emotion, Painful experience are intentionally forgotten or repressed (Cross 1974, Ezenwa 1993 Adeniyi 1997) in Bichi 2002.

Thinking style of individuals; according to Cross (1974) Matins (1994) in Bichi (2002), fast learners are superior in both short terms memory. Age is also a factor that affects retention. Generally as one grows older the cells become weaker. Retention; according to Cross (1974) in Bichi (2002) increase from infancy throughout the teenage followed by slow recession in middle age to old age.

In recent years studies in Education have been focused on structural and instructional strategies or methods. In the findings of Akale and Usman (1993); Eniayeju (1995), carefully selected and skillful use of teaching aids make facts and information better retained and make learning meaningful and interesting. According to Eziefe (1991), computer simulation is one method of achieving mastery learning for the individual. Finding ofJegede, Okebukola and Ajewole (1992) shows that students who interactively use computer have a more favourable attitude towards the use of computer in learning Biology concepts than students who have no such opportunities (Umeoduagu, (2000).

2.9.1 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 (1995) 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 (2000), Akpochafo (2001), Arisi (2002) and Agboboroma (2005) 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 (2000)Fagbemi and Ibidapo (2001), as well as Folorunso, and Nwosu, (2006) 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 MansellandWehn (1998) 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, (2008) 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 (1994)Oyedokun (1998) proved inferior in enhancing students' achievement (Bichi 2002)Akele and Usman (1993) Eniayeju (1995) 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. This study investigates the use of instructional materials on achievements of biology students.

2.9.2 Implications of Literature Reviewed on the Present Study

A lot of literatures have been reviewed on the topic being investigated. These research findings of various researchers have been appraised, criticized in some cases and have some implications for the present study.

In the past decades, science teaching has been carried out mostly by traditional "chalk and talk" method which was not encouraging and did not enhance learning of science. Most schools established by missionaries had some standard materials in their laboratories but were more interested in administrative career; boys were at the fore front while girls were at home minding the house chores.

Since independence awareness has been created and the impact of science has been enormous for it has been attested that"A nation that is not scientific and technologically advanced is a backward nation. "word of Fafunwa".

A lot of efforts have been made by various educational groups and institutions to see that science is promoted and enhanced. Researchers have been investigating on effective and efficient ways of impacting science meaningfully. Biology which is a science subject has been inculcated into the school curriculum as a core subject for both male and female students. Poor achievements of students in the sciences were attributed to certain factors like lack of facilities and negative attitude of teachers to the use of instructional materials. Recently emphasis is laid on the use of instructional materials to enhance meaningful teaching and learning. Teachers are encouraged to develop positive attitude towards making use of instructional materials available and also improvise where necessary to enhance learning in Biology. NTI Kaduna through (SMASE) workshop encourages the training of some teachers from different states in Nigeria in

promoting the teaching of science through project, inquiring and adequate teaching strategies. As a matter of urgency and for development, the last couple of decades have undergone tremendous changes in the development of science and technology which has as its grass root science subjects such as biology and others. Science teachers have been searching for effective instructional strategies, materials that would enhance the teaching and learning of biology and science to the young ones. Information and Communication Technology (ICT) innovations have been a welcome device to the needs of the younger generation in terms of curriculum, materials and strategies.

Gender issue has been of great concern to the various classes in life ranging from school, state and different countries. Gender has created a lot of eye opening that it is being considered at both national and global levels. Gender disparity has been the matter on ground that UN director for women, MichelleBechelet visited Nigeria to discuss gender issues on women involvement in government (Mirror Newspaper of 15/1/2013) the intimidation of girls in school from the findings of most studies have been over taken by encouraging girls to study subjects they are good at especially sciences irrespective of their status. This will enable them contribute more to national development. This has led to the advocacy of women for change peace mission "initiative" of Nigerians (office of first lady of Nigeria).They see women as being in the forefront of the nation. According to Dame Patience Jonathan, "Empowering them means empowering the nation". It goes in line with, "to educate a girl is to educate a nation". The implication of all the issues discussed implies that biology as a subject should be taught with used of instructional materials, using fruitful teaching strategies and giving equal treatment to both male and females; in short gender disparity and inequality should be discouraged. Meaning full learning, egalitarian society and national development in all ramifications of life should be encouraged .The use of instructional materials make learning meaningful and enhances

retention. In this study the weaknesses of the study reviewed in the literature will be avoided and improved upon.

CHAPTER THREE

METHODOLOGY

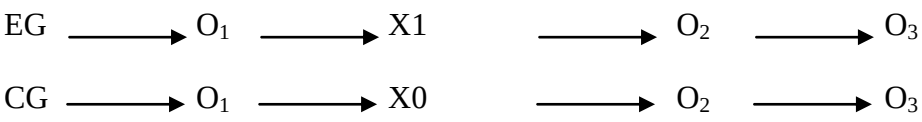
3.1 Introduction

This chapter outlines the methodology employed in conducting the study. The chapter is organized and presented under the following subheadings:-

3.2 Research Design

The study is Quasi experimental in nature involving pre-test, post-test and postpost test on two equivalent groups designated as experimental and control. In this design, a total of 141 SS2 Biology students were randomly selected, pretested and divided into two equivalent groups, viz experimental and control. The experimental groups were then taught Biology concepts using instructional materials while the control groups were taught same concepts without any instructional materials for a period of 6 weeks. The two groups were post tested and postpost tested for achievement and retention respectively. The design is illustrated in figure 3.1:

Figure 3.1 Research design illustration



Where: -

EG = Experimental group

CG = Control group

X1 = Treatment (instructional Materials)

0_1 = Pre-Test

X0 = No Treatment (without instructional Materials)

O_2 = Posttest

O_3 = Postpost test

3.3 Population of the Study

Population of a study refers to the totality of subjects, elements or an individual for whom a problem is concerned on whom measurement has been made and from whom generalizations are drawn. With regards to this study the target population consists of all SS2 Biology students in the Ika North East Local Government Area of Delta State. The total number of SS2 Biology students is 5,626 drawn from all part of the Local Government Area. The subjects have average age of 17 years and predominantly come from farming, trading and civil service families. Details of the population are given in Table 3.1.

Table 3.1. SS2 Population of the Study

S/N	Name of school	Location of school	Type	Biology Enrolment		
				Boys	Girls	Total
	Akumazi – Umuocha Secondary	AkumaziUmuocha	Mixed	150	200	350
	Ede Grammar School	Umunede	Mixed	184	198	202
	Erumu Secondary School	Ute – Erumu	Mixed	85	98	183
	Ekwuoma Secondary School	Ekwuoma	Mixed	100	130	230
	Idumuasha Secondary School	Idumuasha	Mixed	221	226	447
	Igbodo Comprehensive High Sch.	Igbodo	Mixed	124	139	253
	Ika Grammars School	Boji – Boji Owa	Boys	550	-	550
	Marymount College	Boji – Boy Owa	Girls	-	914	914
	Mbiri Secondary School	Mbiri	Mixed	73	81	154
	Owa-Oyibu Secondary School	Owo – Oyibu	Mixed	58	76	134
	Owa-Alizomor Secondary School	Owa-Alizomor	Mixed	40	47	87
	Owanta Secondary School	Owanta	Mixed	270	360	630
	Owa-Alero Secondary School	Owa – Alero	Mixed	116	124	294
	Owerre – Olubor Secondary School	Owerre – Olubor	Mixed	41	49	90
	Otolokpo Secondary School	Otolokpo	Mixed	73	75	148
	Umunede Mixed Secondary School	Umunede	Mixed	104	101	205
	Ute-Okpu Secondary School	Ute–Okpu	Mixed	200	207	407
	Ute-Ogbeje Secondary School	Ute–Ogbeje	Mixed	128	116	224
	Total			2,452	3,121	5,626

Source: *Ministry of Education: Ika North East Owa-Oyibo 2009*

3.4 Sample and Sampling Procedure

Sampling is the process whereby a small portion of the total population is selected to represent the entire population. The samples used in this study were randomly selected. According to William (2005), random sampling procedure assures that each element in a population has equal chance of being selected in the study. This random sampling procedure has the following characteristics or advantages and is efficient in research works. Making use of Tuckman's basis of central limits theory of 30 samples and above, 10%is adequate for a study of this type. A total of 86 SS2 students were pretested and selected as sample from a total enrolment of 5626 SS2 Students/population. A total of 86 students were pretested to ascertain their group equivalence. The groups were divided into two, two schools each were selected as experimental and control groups. The experimental groups were exposed to treatment, that is were taught biology concepts with the use of instructional materials while the control groups were taught the biology concepts without using instructional materials

TABLE 3.2 Sample for the Study

` **Name of school**	**Location of school**	**Type**	**Biology Enrolment**		
			Boys	Girls	Total
Ekwuoma Secondary School	Ekwuoma	Mixed	10	13	23
Owanta Secondary School	Owanta	Mixed	27	36	63
TOTAL			37	49	86

3.5.1 Instrumentation

The instrument used for this research work is an achievement test designed on Biology concept known a Biology Achievement Test (BAT). The Biology Achievement Test (BAT) was used as pretest, to establish the group equivalence of the experimental and control groups and also used as post test to ascertain achievement and as Postpost test to ascertain their retention level. Twenty (20) items of Biology Achievement Test were drawn from past West African Examination Council (WAEC) questions on skeletal system. The questions were selected to cover both theoretical and practical knowledge so as to determine effects of instructional materials.

3.5.2 Validity of Instrument

Validity of an instrument simply means the ability of the instrument to measure what it intends to measure accurately (Egbule 2002). The content validity of Biology Achievement Test (BAT) were subjected to scrutiny by experts in the subject area that include the following: -

(a) Two Senior Lecturers in Science Education at Ahmadu Bello University Zaria

(b) Two Biology Teachers from Secondary Schools in Delta State

(c) An English Language specialist who validated the items of BAT with respect to language clarity.

The senior lecturers in Science Education were given the following terms of reference:

i. Is the content of the instrument correct, current and of standard for SS2 students?

ii. Are the items clear and free from ambiguity?

iii. What general criticisms and suggestions could you give to improve the standard of the instrument?

The expert in language was asked to vet the context of the instrument in the area of:

i. The language used. Is it clear and within the standard of the student?

ii. Is the instrument free from grammatical errors?

iii. What general criticisms and suggestions would you give to improve the instrument?

The Biology teacher was asked to validate instrument in the area of curriculum and syllabus adequacy, viz;

i. Is the Test Instrument adequate and up to the standard of SS2 students?

ii. Are the questions suitable for the purpose they were meant?

iii. Do the items relate to the concepts?

iv. Were the items readable and unambiguous?

v. What general criticisms and suggestion would you give to enrich the content of the test Instrument?

The Test Instrument was examined by the different panel members who certified them free from ambiguity and confirmed them adequate. Further suggestions and criticisms were used to improve the instrument.

3.5.3 Pilot Test

A pilot study was conducted using the designed instrument in order to establish its reliability as well as the internal consistency index of the instrument. A total of twenty five Students were selected for the test using Akumazi-Umuocha Secondary School, Akumazi-Umuocha, which was not targeted for the main study. The test and re-test approach was used for the test. This means that the instrument was administered to the subject two times. Data collected were coded and subjected to statistical analysis using the statistical package for the social sciences.

3.5.4 Reliability of Instrument

The parallel option was selected in order to determine the reliability of the instruments using the data of the test and re-test scores and the two variables. The result showed that the

instrument was highly reliable with a reliability coefficient of **0.65** and internal consistency index of **0.65.** With these coefficients the instrument could be considered reliable and internally consistent for the study. The result of the parallel reliability is attached as appendix VIII

3.5.5 Procedure for Data Collection

The researcher administered the test instruments in the various schools with the assistance of two teachers. The instruments were collected, marked and recorded as pre-test. Biology teachers from the various schools were used as research assistants to invigilate and collect test items at the end of the test. The Experimental Group (E.G) was taught Biology concepts of skeletal system using instructional materials. (Like bones, models and charts) while the Control Group (C.G) were taught the same concepts without using any instructional materials. Both Experimental Group (EG) and Control Groups (CG) were post-tested to determine the achievement of each treatment. Two weeks later their retention ability was tested using Postpost test.

3.6 Procedure for Data Analysis

The procedure for data analysis is determined by the type of data and the nature of hypothesis to be tested. The student's achievement test used in this study involved interval data which brings out their differences and the hypotheses stated in Null form. On the basis of these criteria, t-test of significance between two means was used. It reduces the experimental errors and so increases the probability of rejecting the Null hypothesis when it is false (Ferguson(1974) as in Bichi (2002).The null hypotheses for this study are thus restated with the corresponding statistical tests:

Ho_1: There is no significant difference in the mean achievement scores of students taught biology concepts using instructional materials and those taught without instructional materials.

t-test statistics was used to analyze this hypothesis.

Ho_2: There is no significant difference in the mean achievement scores of male and female students taught Biology concepts using instructional materials.

t-test statistics was used to analyze this null hypothesis.

Ho_3: There is no significant difference in the mean retention scores of students taught with instructional materials and those taught without instructional materials.

t-test statistics was used to analyze the data in this null hypothesis.

Ho_4: There is no significant difference in the mean retention scores of male and female students taught biology concepts with instructional materials.

t-test statistics was used to analyze the data.

The statistical analysis used to test the hypothesis was t-test. The t-test statistics was used to test all the four hypotheses of this study and level of significance adopted for the analysis is $P \leq 0.05$. This level of significance formed the basis for retaining or rejecting the four null hypotheses.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

The focus of this study is to investigate effects of the use of instructional materials on the academic achievements and retention of Biology concepts among SS2 students in Delta State. In Chapter three, the methodology used in conducting the study was discussed.

The concern of this chapter is to analyze the data collected in relation to the research questions and null hypotheses stated in Chapter One. Three forms of data were collected using Biology Achievement Test (BAT) as follows:

i. Pretest data, to determine group equivalence of experimental and control groups.

ii. Post test data to determine achievement after six weeks of treatment.

iii. Postpost test data to determine retention of learned concepts.

These forms of data are analyzed in the following paragraphs and used to answer four research questions and their corresponding null hypotheses.

4.2 Presentation of Result

Answering Research Question 1.and its Corresponding Null Hypothesis

The first research question investigated the difference between the means score of students exposed to the use of instructional materials in the teaching of biology and those not so exposed. The research question is restated thus:

What is the effect of the use of instructional materials on the academic achievements in Biology concepts among SS2 Students in Ika North East Local Government Area of Delta State?

The corresponding null hypothesis is restated thus:

4.2 Null Hypothesis I: There is no significant difference between the mean achievement scores of students taught biology concepts using instructional materials and those taught without instructional materials in IKa North East Local Government Area.

To test $H0_1$ the post test data of experimental and control groups were subjected to t-test statistics to determine if there is any significant difference between the achievement of the experimental group and the control groups. Summary of the analysis is shown in Table 4.1.

Table 4.1: t-test Analysis of the Post Test Mean Scores of the Experimental and Control Groups

Group:	N	Mean	S.D	SEM	Df	t	P.	Remarks
Control	44	7.31	1.96	0.29				
				2.62	43	-3.88	0.01	Significant
Experimental	44	9.38	2.97	0.44				

At significance of $P \leq 0.05$

It is clear from Table 4.1 that the mean score of the experimental group taught using instructional materials which is 9.38 is greater than that of the control group which is 7.31 taught without instructional materials. This means the use of instructional materials enhances students' achievement. This finding answers research question No. 1.

From Table 4.1 the SEM of experimental group 0.44 is greater than SEM control 0.29 of of 1.96 at 0.05 level of significance. With a P value 0.01 which is less than 0.05 indicating that there is a significant difference between the mean academic achievement scores of students taught using instructional materials and those taught without instructional materials in favour of the former. This means the experimental group taught with instructional materials achieved significantly higher than the control group. The null hypothesis is therefore rejected.

Answering Research Question 2.and its corresponding null hypothesis

Research Question 2 What is the effect of the use of instructional materials on the academic achievements in Biology among male and female SS2 Students in Ika North East Local

Government Area of Delta State? Thus the second research question investigated if the male students taught using instructional materials performed better than their female counterparts. -

The corresponding null hypothesis is stated thus:

Null Hypothesis Two: There is no significant difference in the mean academic achievement scores of male and female students taught Biology concepts using instructional materials.

The Null hypothesis is analyzed using t-test statistics and summary of the analysis is shown in Table 4.2.

Table 4.2: t-test, analysis of PostTest Mean Scores of Male and Female Students in the Experimental Group Exposed to Instructional Material

Group	N	Mean	SD	SEM	Df	t	P	Remark
Male	24	9.08	2.94	0.60				Not Significant
					42	-0.73	0.56	
Female	20	9.75	3.04	0.68				

From Table 4.2, the mean scores of male 38.95 is slightly lower than that of female 9.75

This means that the females performed marginally better than the males students at 42 degree freedom. It then means that there is no significant difference in the mean academic achievement scores of male and female students taught biology concept using instructional materials. The hypothesis is therefore retained.

Answering Research Question 3.and its Corresponding Null Hypothesis

Research Question 3: What is the effect of the use of instructional materials on the retention ability of SS2 Biology students in Ika North East Local Government Area of Delta State.

The third research question thus investigated the use of instructional materials in the teaching and learning of Biology concepts on the retention ability of SS2 Biology students.

Null Hypothesis 3: There is no significant difference in the means retention scores of SS2 Biology students taught with instructional materials and those taught without instructional materials in Ika North East Local Government Area of Delta State.

The Postpost test data generated via BAT were analyzed and subjected to t–test statistics. Summary of the analysis are presented in Table 4.3.

Table 4.3: t–test Analysis of the Postpost Test Mean Scores of Experimental and Control Groups.

Group	N	Mean	SD	SEM	DF	t	P	Remark
Control	44	7.97	2.11	0.31				
								Significant
				2.39	43	-2.12	0.40	
Experimental	44	9.13	2.70	0.40				

Significant at $p \leq 0.05$ level

From Table 4.3, the mean retention score of the experimental group taught using instructional materials 9.13 is higher than that of the control group 7.97 taught without instructional materials. This finding answers research question 3. It is established that the experimental group retained the concept better than the control group. The results of the t-test as indicated in the table revealed that SEM of Experimental 0.40 which is greater than the SEM of Control 0.31 at df 43 and at 0.05 level of significant. This means that there is significant difference in the mean retention scores of students taught with instructional materials and those taught without instructional materials in favour of the former, thus the null hypothesis is rejected. This means that students in the experimental group taught using instructional materials retained the concepts

more significantly than their counterparts in the control group taught without instructional materials.

Answering Research Question 4.and its Corresponding Null Hypothesis

Research Question 4: What is the effect of the use of instructional materials on the retention ability of male and female SS2 Biology students in Ika North East Local Government of Delta State? The fourth research question investigated the difference in the retention ability of male and female SS2 Biology students taught with instructional materials in Ika Local Government Area of Delta State.

Testing null hypothesis 4

Null Hypothesis 4: There is no significant difference in the mean retention scores of male and female SS2 students taught Biology concept with instructional materials in Ika North East Local Government Area of Delta State.

To test this null hypothesis, the Postpost test scores of the experimental group were sorted out according to gender and subjected to t-test analysis. Summary of the analysis is presented in Table 4.4.

Table 4.4: t-test Analysis Postpost Test Mean Scores of Male and Female Students in the Experimental Group Taught Using Instructional Materials.

Sex	N	Mean	SD	SEM	DF	t	P	remarks
Male	24	8.6	3.10	0.63				
					42	-138	0.04	Significant
Female	20	9.75	2.04	0.45				

Significant at≤0.05 level

From Table 4.4, it can be seen that the mean score of male students in the experimental group exposed to instructional materials is 8.62 which is slightly lower than that of the female students

which is 9.75. This means the female students performed slightly better than the male. This finding answers research question No. 4

From Table 4.4 SEM of male 0.65 is higher than that of female of 0.45at 0.05 level of significance at degree of freedom 42. There is significant difference between the two means. The null hypothesis that there is no significant difference in the mean retention scores of male and female SS2 students taught Biology concept with instructional materials the null hypothesis is therefore rejected. This means there is significant difference in the retention levels of male and female students taught biology concepts using instructional materials. However, the slight difference between the two means is attributed to chance.

4.6 Summary of Findings

Major findings of the study are summarized as follows: -

1. Analysis of data to test hypothesis Ho_1 reveals that students exposed to instructional materials (i.e. experimental group) performed significantly higher than the students who were taught without instructional materials (control group). The null hypothesis $H0_1$ was therefore rejected.
2. Analysis of data in relation to Ho_2 shows that there is no significant difference in the achievements of boys and girls in the experimental group.
3. Analysis of data in relation to Ho_3 shows that students taught Biology concepts using instructional materials retained the learned concepts significantly better than their counterparts in the control group taught without instructional materials. Hypothesis rejected.
4. Analysis of data in relation to Ho_4 shows that there is significant difference in the retention ability of boys and girls taught biology concepts using instructional materials.

4.7 Discussion of Results

This study investigated effects of the use of instructional materials on the teaching and learning of biology concepts on the academic achievements and retention among year two Senior Secondary School (SS2) biology students in Delta State. Four hypotheses were tested and the results obtained are discussed in the following paragraphs: -

Null hypothesis one:

Analysis of post test scores of experimental and control groups using t-test revealed that students who were exposed to the use of the instructional materials in the teaching of biology concepts significantly performed better than those not exposed to the use of instructional materials. The null hypothesis was therefore rejected. This means that the use of instructional materials in the teaching of biology concepts increased students' academic achievement in the subject. These findings are in conformity with that of Johnson (1991) Eshiet (1991) Olaruwaju (1994) and Johnson (2000) where it was found that teachers use of instructional materials in teaching improved students achievements. There are many reports about the importance of instructional materials in the teaching of Biology in Secondary School. Ehuosu (2008) mentioned seven basic roles of using instructional materials which includes extension of human experience, provision of meaningful information, stimulation of interest, grouping of students' interest, overcoming physical limitation, stimulating problem solving and providing diagnostic and remedial tools for teachers in teaching.

Null Hypothesis Two:

This hypothesis centres on whether male and female students exposed to instructional materials differ significantly in their academic achievements in the subject. The result did not reveal significant difference in the academic achievements of the male and female students in the experiment. The Null hypothesis was therefore retained. The observation from the test confirms the fact that both male and female students receive the same impact when exposed to the use of instructional materials in the teaching and learning of Biology. This finding is contrary to that of Joseph (2000), where it was reported that girls are intellectually inferior to boys in Science and Mathematics.

The findings however agree with the report of Ifamuyiwa (2003) where it was observed that male participation in Science was higher but that the male and female performances were basically the same in terms of academic achievement.

Null Hypothesis Three

This hypothesis investigated the retention ability of SS2 students taught using instructional material and those taught without instructional material. The result of the t–test analysis revealed that the students who were exposed to the use of instructional materials in the teaching and learning of Biology concepts had significantly higher retention ability than those in the control group not exposed to instructional materials. The null hypothesis was therefore rejected. It was observed that the use of instructional materials in teaching and learning increases students' retention ability. This finding is similar to the findings by Okeke (1999) Nweji (2000) in Gbodi et al (2006) which revealed that video – taped instruction has the potential of enhancing the quality of science teaching, arouse students' interest, clarifies concepts and stimulates their thinking.

Null Hypothesis Four

This hypothesis investigated the effectiveness of the experiment on the students gender in terms of their retention ability. In the test of the hypothesis, the male and female students who were exposed to the use of instructional materials were subjected to post post test to establish possible retention ability. The result revealed significant differences in the retention ability of the male and female students involved. This null hypothesis was therefore rejected. It therefore implied that the use of instructional materials for teaching and learning of biology concepts enhances students' retention ability irrespective of their sex. This finding is in conformity with Ifamuyiwa's (2003) where it was reported that male out number female in Sciences but are never superior to them in academic achievements. This finding is contrary to Joseph's(2000) which reports that girls are intellectually inferior to boys in Science and Mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigates effects of instructional materials on academic achievements and retention of SS2 biology students. The last chapter analyzed the data used from the test scores and used it to test for the null hypotheses outlined to guide the investigation.

This chapter gives an over-view of the study and is presented under the following sub-headings:

5.1 Introduction

5.2 Summary

5.3 Major Findings

5.4 Conclusion

5.5 Recommendations

5.6 Contributions to Knowledge

5.7 Limitations of the Study

5.8 Suggestions for Further Studies

5.2 Summary

Poor performance of students in biology examination in West African Examination Council (WAEC) and National Examination Council (NECO) are of great concern to the Education Governing bodies (NTA News 2012). James et al (2000), suggested Biology Garden as a teaching strategy that would motivate students.

For learning to be more participatory and real, students should be involved in collection of specimens and handle things physically to gain real natural experience.

This study investigated effects of using instructional materials on academic achievement and retention of SS2 Biology students in Ika North East Local Government Area of Delta State. It also investigated gender influence on academic achievement of students. Four research questions and their corresponding null hypotheses were formulated and tested at 0.5 level of significance. Two groups of students, experimental and control groups were selected for the experiment using the SS2 students; the experimental group was exposed to the use of instructional materials in the teaching and learning of some selected biology concepts while the control groups were not exposed to the use of instructional materials.

The sample for this study comprised a total of 86 SS2 Biology students drawn from two Senior Secondary Schools in IKa North East of Delta State. They were selected by simple random sampling. Academic achievements and retention ability were the variables investigated. Pre-test was conducted to determine their academic equivalence, post test for academic achievements and postpost test to find out their retention ability. The data for the results were collected respectively. A total of 86 students made up of 44 students in experimental and 44 in the control groups were selected for the experiment.

A 20-item multiple choice instrument, the Biology Achievement Test (BAT) with reliability co-efficient of 0.65 and drawn from past WAEC questions was used to collect relevant data which were analyzed using t-test statistical (analyses) data. The results obtained are presented and discussed in chapter four.

At the end of this study, the following major findings were made.

5.3 Major Findings

1. The use of instructional materials in the teaching of Biology concepts significantly improves the academic achievements of students involved in the study.

2. The use of instructional materials in the teaching and learning of biology concepts is found to be gender-friendly.
3. The use of instructional materials enhances retention ability of students.
4. Students exposed to the use of instructional materials in the teaching of biology concept generally had better academic achievements and retention ability than students who were not exposed to use of instructional materials in the experiment.

5.4 Conclusions

From the findings of the study it is clear that the use of instructional materials in the teaching of biology at Senior Secondary Schools has significant impact on the student's academic achievements and their retention ability. It is therefore concluded that the use of instructional materials significantly improves students' academic achievements and retention among Biology students in Delta State.

The following conclusions were drawn from the findings of the study: -

1. The use of instructional materials in teaching Biology concept increases students performance.
2. The use of instructional materials in teaching strategies enhance learning and retention abilities.
3. Students taught using instructional materials perform better than their counterparts who were taught without the use of instructional materials.
4. The use of instructional materials has no significant difference in the ability of both male and female students.

5.5 Recommendations

Based on the findings emanating from this study, the following recommendations are suggested: -

1. Instructional materials should be provided by the Ministry of Education for effective teaching and learning of Biology concepts in Delta State Senior Secondary School.
2. Other Stakeholders like the PTA should also make effort to provide teaching materials to schools.
3. The pre-service teachers curriculum in the colleges of education should emphasize the use of instructional materials in Biology teaching.
4. Teachers should be fully and adequately trained to make use of instructional materials through regular workshops and seminars.

5.6 Contribution to Knowledge

This study empirically establishes that:

1. Students exposed to instructional materials performed significantly higher than the students who were taught without instructional materials.
2. There is no significant difference between male and female students
3. There is no significant difference in the retention ability of students taught with instructional material.
4. Instructional materials enhance students learning ability.

5.7 Limitations of the Study

This study has some limitations that include the following: -

1. There was limited time and facilities for the study.
2. The School time table and activities did not give enough room for extensive research work.

5.8 Suggestion for Further Studies

This study can be extended further in the following ways: -

1. Conducting a similar study in other Local Government Areas of Delta State to find out if the same findings can be established or determined.
2. The State Ministry of Education and Federal Ministry of Education may organize seminars for teachers and this study as pilot study; carryout similar study to propagate the effect of instructional materials in teaching Biology and other science subjects.

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APPENDIX I STUDENTS BIOLOGY ACHIEVEMENT TEST (SBAT)

IMPACT OF INSTRUCTIONAL MATERIALS ON ACHIEVEMENT AND RETENTION OF BIOLOGY CONCEPTS AMONG SECONDARY SCHOOL STUDENTS IN DELTA STATE, NIGERIA.

SECTION A
45 MINUTES

Name of School _____
Class
Class type Science ( ) Art ( )
Sex Male ( ) Female ( )

SECTION B
INSTRUCTIONS:

Introductions on Biology Achievement Test (BAT)

- Answer all the questions
- There are five options to each questions lettered A – E
- Circle round the letter option you have chosen
- Please do not circle more than one letter.

BIOLOGY ACHIEVEMENT TEST USED AS PRETEST AND POST

1. The frame work on which animals are built is known as:
   A. Block B. Skeleton C. Bone D. Muscle

2. Skeleton on invertebrates are grouped under the following except
   A. Chitin B. Cuticle C. Cartilage D. Muscle

   E. Bone

3. The Hollow cavity in the bone is known as:
   A. Bultes bone B. Blood in the bone C. Periosteum
   D. Bone Marrow E. Cartilage

4. Soft bodied animals posses one of the following
   A. Skeleton B. Muscles C. Chitin D. Bone
   E. Hydrostatic Skeleton

5. Small invertebrate gain support from one of the following
   A. Tugor of body fluid B. Cartilage C. Bone
   D. Tendon E. Liagament

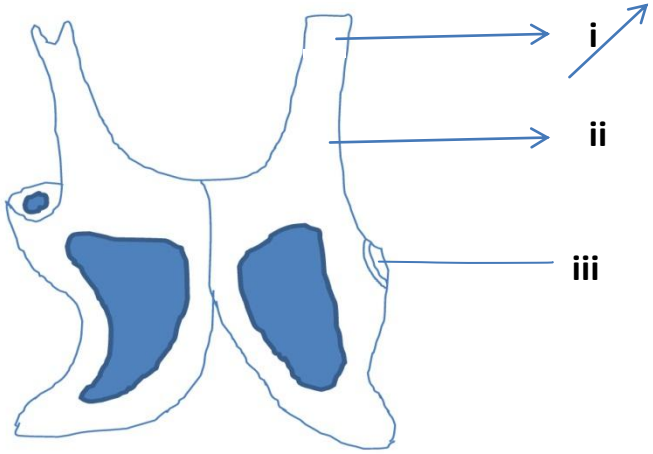
6. The point where two or more bones meet is known as a _____

A. TendenB. Cartilage C. Muscles
D. Ligament E. Joint

7. The axial Skeleton is made up of:
A. The ribs and the vertebrates B. The skull and vertebrates
C. The Sacrum and the limbs E. The fore limbs and hid limbs

8. Use the diagram below to answer 8 – 10

The piece of bone represented in the diagram is found in the



A. Pelvic region
B. Pectoral girdle
C. Vertebral column
D. Skull
E. Thoracic region

9. The parts labeled I is the

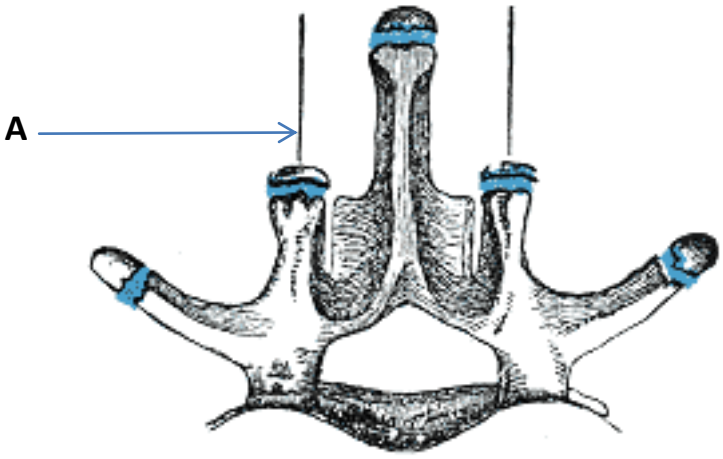
A. Lumbar
B. Sacrum
C. Ilium
D. Pubis
E. Coccyx

10. The bone that articulates with the part labeled III is the
A. Humerus
B. Femur (head)
C. Tibia
D. Sacrum
E. Fibula

11. Which of the following is not a function of the mammalian Skeleton? It…
A. Gives the body its shape
B. Provides the frame work on which internal organs are suspended
C. Protect; soft and delicate parts of the body
D. Provides attachment for muscles

E. Contracts and relaxes to bring about movement

12. Use the diagram below to answer question 12 to 13.



What type of vertebrate is represented in the diagram above?

A. Atlas
B. Axis
C. Cervical vertebra
D. Sacrum
E. Lumber vertebra

13. The structure labeled A represents the;

A. Transverse process
B. Neural cana
C. Neural canal
D. Centrum
E. Metamorphosis

14. Which of the following statement is not correct about the functions of each group of mammalian vertebra?

A. Cervical vertebra supports the neck
B. Thoracic vertebra articulates with the ribs
C. Lumber vertebra provides attachment for abdominal muscles
D. Sacral vertebra support the skull and allow nodding and rotating movements
E. Caudal vertebra support the tail and provide attachment for tail muscles.

15. The following are functions of the Skeleton Except: -
A. Providing support for the body
B. Protection of delicate internal organs
C. Maintenance of the shape of the body
D. Providing attachment for muscles
E. Controlling growth rate in animals

16. The thoracic vertebra is different from other vertebra by the possession of:
    A. Long Neural spine
    B. Odontoid process
    C. Vertebrateral canal
    D. Large centrum
    E. Transverse process

Study the list below and use it to answer question 17 – 19. The vertebral column of Mammals consists of the following bones;

    i. Lumber vertebra
    ii. Thoracic
    iii. Caudal vertebra
    iv. Cervical
    v. Sacral vertebrae

17. Which of the following is found immediately next to the skull?
    A. I
    B. II
    C. III
    D. IV
    E. V

18. Which of the following articulates with the ribs?
    A. I
    B. II
    C. III
    D. IV
    E. V

19. Which of the following; articulates with the pelvic girdle?
    A. I
    B. II
    C. III
    D. IV
    E. V

20. Which of these is not part of the appendicular Skeleton
    A. Clavicle
    B. Vertebrae
    C. Scapula
    D. Fermur
    E. Humerus

APPENDIX II

A PRETEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE EXPERIMENTAL GROUP SS TWO IKA GRAMMAR SCHOOL IKA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	10
2	16	Male	04
3	16	Male	03
4	17	Male	04
5	15	Male	07
6	16	Male	07
7	14	Male	10
8	15	Male	07
9	15	Male	02
10	15	Male	06
11	16	Male	08
12	16	Male	06
13	16	Male	06
14	15	Male	10
15	15	Male	10
16	16	Male	12
17	15	Male	08
18	15	Male	10
19	16	Male	08
20	15	Male	09
21	15	Male	08
22	15	Male	06
23	15	Male	06
24	15	Male	06

APPENDX III

POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF EXPERIMENTAL GROUP SS TWO IKA GRAMMAR SCHOOL IKA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	11
2	16	Male	12
3	16	Male	05
4	17	Male	15
5	15	Male	08
6	16	Male	11
7	14	Male	09
8	15	Male	09
9	15	Male	11
10	15	Male	11
11	16	Male	08
12	16	Male	13
13	16	Male	09
14	15	Male	07
15	13	Male	13
16	16	Male	10
17	15	Male	12
18	15	Male	11
19	16	Male	11
20	15	Male	08
21	15	Male	13
22	15	Male	06
23	15	Male	09
24	15	Male	12

APPENDIX IV

POST POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE EXPERIMENTAL GROUP SS TWO IKA GRAMMAR SCHOOL IKA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	12
2	16	Male	05
3	16	Male	11
4	17	Male	13
5	15	Male	07
6	16	Male	08
7	14	Male	08
8	15	Male	09
9	15	Male	12
10	15	Male	08
11	16	Male	10
12	16	Male	07
13	16	Male	08
14	15	Male	11
15	13	Male	12
16	16	Male	13
17	15	Male	10
18	15	Male	12
19	16	Male	10
20	15	Male	09
21	15	Male	10
22	15	Male	08
23	15	Male	09
24	15	Male	13

APPENDIX V

A PRETEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE CONTROL GROUP SS TWO MBIRI GRAMMAR SCHOOL MBIRI

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	07
2	16	Male	07
3	16	Male	05
4	15	Male	05
5	16	Male	07
6	16	Male	05
7	16	Male	05
8	16	Male	06
9	16	Male	03
10	16	Male	05
11	16	Male	04
12	16	Male	05
13	17	Male	06
14	16	Male	08
15	15	Male	06
16	16	Male	08
17	16	Male	09
18	16	Male	06
19	15	Male	08
20	16	Male	04
21	16	Male	11
22	17	Male	07
23	16	Male	05
24	17	Male	08
25	16	Male	05

APPENDIX VI

POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE CONTROL GROUP SS TWO MBIRI GRAMMAR SCHOOL MBIRI

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	08
2	16	Male	08
3	16	Male	10
4	16	Male	06
5	15	Male	05
6	16	Male	06
7	16	Male	07
8	16	Male	06
9	16	Male	04
10	16	Male	09
11	16	Male	07
12	16	Male	09
13	17	Male	09
14	16	Male	08
15	15	Male	05
16	16	Male	06
17	16	Male	10
18	16	Male	08
19	15	Male	08
20	16	Male	07
21	16	Male	12
22	17	Male	06
23	16	Male	05
24	17	Male	08
25	16	Male	07

APPENDIX VII

A POST POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE CONTROL GROUP SS TWO MBIRI GRAMMAR SCHOOL MBIRI

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	08
2	16	Male	08
3	16	Male	10
4	16	Male	06
5	15	Male	05
6	16	Male	06
7	16	Male	07
8	16	Male	06
9	16	Male	04
10	16	Male	09
11	16	Male	07
12	16	Male	09
13	17	Male	09
14	16	Male	08
15	15	Male	05
16	16	Male	06
17	16	Male	10
18	16	Male	07
19	15	Male	08
20	16	Male	07
21	16	Male	12
22	17	Male	06
23	16	Male	05
24	17	Male	08
25	16	Male	07

APPENDIX VIII

A PRETEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE CONTROL GROUP EKWUOMA SECONDARY SCHOOL EKWUOMA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	15	Male	06
2	16	female	09
3	16	Male	08
4	13	female	08
5	15	Female	07
6	16	female	04
7	16	female	06
8	17	Female	06
9	17	female	07
10	16	female	06
11	15	Female	05
12	17	Male	07
13	17	Male	08
14	18	female	09
15	16	Female	10
16	17	Male	06
17	18	Male	07
18	17	Male	07
19	16	Male	08
20	16	female	07
21	15	Male	06
22	15	female	06
23	16	Male	08
24	19	female	06
25	18	Male	05

APPENDIX IX

POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE CONTROL GROUP EKWUOMA SECONDARY SCHOOL EKWUOMA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	14	Female	06
2	16	Male	08
3	16	Male	05
4	15	female	09
5	17	Female	05
6	17	female	09
7	17	female	10
8	15	Female	05
9	17	female	06
10	16	Male	08
11	11	Female	06
12	18	Male	10
13	15	Male	02
14	18	Male	04
15	18	Male	08
16	18	Male	06
17	17	Male	07
18	16	female	08
19	16	Female	05
20	14	female	11
21	15	female	09
22	15	Female	08
23	16	female	09
24	19	Male	10
25	18	Male	05
26	17	Male	10
27	17	Male	06

APPENDIX X

POST POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF THE EXPERIMENTAL GROUP EKWUOMA SECONDARY SCHOOL EKWUOMA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	14	Female	06
2	16	Male	09
3	16	Male	06
4	15	female	10
5	17	Female	09
6	17	female	10
7	17	female	11
8	15	Female	06
9	17	female	09
10	16	Male	09
11	11	Female	07
12	18	Male	09
13	15	Male	04
14	18	male	04
15	18	male	09
16	18	Male	06
17	17	Male	06
18	16	female	09
19	16	Female	07
20	14	female	11
21	15	female	09
22	15	Female	09
23	16	female	09
24	19	male	11
25	18	Male	07
26	17	male	12
27	17	Male	07

APPENDIX XI

PRE TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF CONTROL EXPERIMENTAL GROUP OWANTA SECONDARY SCHOOL CONTROL. OWANTA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	06
2	15	Male	09
3	17	Male	07
4	15	Male	06
5	16	Male	04
6	16	Male	04
7	17	Male	06
8	17	Male	05
9	18	Male	08
10	15	Female	07
11	17	Female	08
12	15	Female	08
13	16	Female	04
14	15	Female	06
15	14	Female	08
16	16	Male	12
17	15	Female	13
18	16	Male	08
19	14	Female	07
20	18	Male	06

APPENDIX XII

PRETEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF EXPERIMENTAL GROUP OWANTA SECONDARY SCHOOL OWANTA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	16	Male	06
2	15	Male	08
3	17	Male	07
4	15	Male	10
5	16	Male	05
6	16	Male	04
7	17	Male	06
8	17	Male	07
9	18	Male	09
10	15	Female	06
11	17	Female	07
12	15	Female	08
13	16	Female	04
14	15	Female	05
15	14	Female	09
16	16	Male	10
17	15	Female	13
18	16	Male	08
19	14	Female	07
20	18	Male	07

APPENDIX XIII

POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF EXPERIMENTAL GROUP OWANTA SECONDARY SCHOOL OWANTA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	15	Female	07
2	14	Male	14
3	16	Male	03
4	14	Male	09
5	15	Female	06
6	15	Female	09
7	16	Female	03
8	16	Male	10
9	15	Male	10
10	16	Female	09
11	15	Female	04
12	16	Female	06
13	15	Male	11
14	17	Female	08
15	14	Female	06
16	14	Male	11
17	15	Male	05
18	17	Male	08
19	16	Male	11
20	19	Male	03

APPENDIX XIV

POST POST TEST RAW SCORES OF THE BIOLOGY ACHIEVEMENT TEST (BAT) OF EXPERIMENTAL GROUP OWANTA SECONDARY SCHOOL CONTROL. OWANTA

S/N	AGE (YEARS)	SEX	SCORE (20)
1	15	Female	10
2	14	Male	05
3	16	Male	03
4	14	Male	08
5	15	Female	09
6	15	Female	05
7	16	Female	05
8	16	Male	04
9	15	Male	08
10	16	Female	09
11	15	Female	10
12	16	Female	10
13	15	Male	12
14	17	Female	09
15	14	Female	07
16	14	Male	11
17	15	Male	06
18	17	Male	13
19	16	Male	12
20	19	Male	05

APENDIX XV

Science Education Section,

Department of Education,

Ahmadu Bello University,

Zaria.

14th June 2011

Dr. (Mrs) Lapini M

Institute of Education

Ahmadu Bello University

Zaria

VALIDATING A RESEARCH INSTRUMENT FOR ENOHUEAN VICTORIA OZOEMEZINEM

My M.Ed students named above has developed a research instrument designed to generate data for her M.Ed write up on The Effect Of Instructional Materials on Academic Achievements and Retention Among Senior Secondary School students in (Ika North East of) Delta State.

The instrument called Biology Achievement Test (BAT) drawn from the topic taught (Skeleton supporting tissue) consists of 20 items, past WAEC QUESTION from 1993-2009. As an expert in science education, I would like you to examine the items with reference to the following:

1. Is the content of the instrument correct, and appropriate to SS1 students?
2. Are the items clear, precise and standard?
3. What general criticism and suggestion could you give to improve the quality of the instrument?

I very much appreciate your assistance, please. Thank you.

Yours sincerely,

(Signed)

Dr .SS. BICHI

APPENDIX XVI

Science Education Section,
Department of Education,
Ahmadu Bello University,
Zaria.
14th June, 2011.

Mr. Oyem .H.
College of Education
Department of Integrated Science
Agbor.

VALIDATING A RESEARCH INSTRUMENT FOR ENOHUEAN VICTORIA OZOEMEZINEM

My M.Ed student named above has developed a research instrument designed to generate data for her M.Ed write up on the effect of instructional material on academic achievements and Retention among Senior Secondary School biology students in (Ika North East of) Delta State.
The instrument called Biology Achievement Test (BAT) drawn from the topic taught (Skeleton and supporting tissue) consists of 20 items, past WAEC QUESTIONS from 1993 – 2009. As an expert in science education, I would like you to examine the items with reference to the following:

1. Is the content of the instrument correct, and appropriate to SS1 students?
2. Are the items clear, precise and of standard?
3. What general criticisms and suggestion could you give to improve the quality of the instrument?

I very much appreciate your assistance, please. Thank you.

Yours sincerely,
(Signed)

DR. S.S.BICHI

APPENDIX XVII

Reliability

Case Processing Summary

		N	%
Cases	Valid	25	100.0
	Excluded[a]	0	.0
	Total	25	100.0

a. Listwise deletion based on allvariablesin the procedure.

Reliability statistics

Cronbach's Alpha	part 1	Value	1.000
		N of Items	1[a]
	Part 2	Value	1.000
		N of Items	1[b]
	Total N of Items		2
Correlation Between Forms			.477
Spearman-Brown	Equal Length		.646
Coefficients	Unequal Length		.646
Guttman Split-Half Coefficients			.591

a. The items are: TEST, TEST.
b. The items are: RE_TEST, RETEST

Intraclass Correlation Coefficient

	Intraclass Correlation[a]	95% Confidence Interval	
		Lower Boundary	Upper Boundary
Single Measures	.419[b]	.037	.695
Average Measures	.591[c]	.072	.820

Two-way mixed effects model where people effects are random and measure effects are fixed

Intraclass correlation coefficient

	F Test with True Value 0			
	Value	df1	df2	Sig
Single Measures	2.444	24.0	24	.016
Average Measures	2.444	24.0	24	.016

Two-way mixed effects model where people effects are random and measure effects are fixed

a. Type C intraclass correlation coefficients using a consistency definition- the between-measure variance is excluded from the denominator variance
b. The estimator is the same, whether the interaction effect is present or not.
c. The estimate is computed assuming the interaction effect is absent, because it is not estimable otherwise.

APPENDIX XVIII

TISSUE ANS SUPPORTING SYSTEM IN ANIMALS

WEEK 1

i. Biology significances
ii. Skeletal materials
iii. Types of skeleton

LESSON NOTE ON TISSUE AND SUPPORTING SYSTEM

CLASS: Senior Secondary School (SS2)

TOPIC: tissue and supporting system

WEEK: 1

PERIOD: 3periods of 45minute each

OBJECTIVES: at the end of the lesson, the students should be able to:

1. Define the term skeleton and also name the materials that make up bones
2. Name the skeletal material of the body
3. List the different types of skeletal system
4. List the biological importance of skeleton

INSTRUCTIONAL MATERIALS: different types of bones e.g. pelvic, pectoral

Fermur, humeruse.t.c.charts showing the skeletal system and models of skeleton

PERIOD 1

INTRODUCTION: the term skeleton is defined as the framework of the body. Some illustrations are drawn:

A, A tailor uses a wood or iron to hang the dress to keep it in position

B, The skin of an animal could be on the ground without any supporting structure e.g. skinned leather of goat

PRESENTATION

STEP 1: the term skeleton is defined and explained as the framework of the body and they comprises of different materials such as calcium, carbonate and phosphate

STEP 2: some skeleton are found within i.e. inside the body of the animal and are known as exoskeleton, while some are found outside the body of the animal and are known as exoskeleton. The skeleton gives support and protection to soft tissues and organs.

STEP 3: ask the students to mention some supporting system they have come in contacts with.

STEP 4: explain the different type of skeletons as chitin, cuticle, cartilage and bones. Body fluids give support in invertebrates as tugor body fluids give: muscles as in earthworm

STUDENTS ACCTIVITIES/EVALUATION: questions are received from students and questions are asked some students also

1. Define the term skeleton
2. Name the two different type of skeleton
3. List the different types of skeleton

CONCLUSION: round up the lesson by summarizing the concept od support and structures involved

ASSIGNMENT; read forms of skeleton and gather any skeleton seen

SECOND LESSON (PERIOD 2)

TOPIC; Forms of skeleton

DURATION: 45minutes

TEACHING AID: Exoskeleton of cockroach (chitin) earthworm (cuticle) and different bones of vertebrae

PREVIOUS KNOWLEDGE: Students can name different types of skeleton and define the term skeleton

INTRODUCTKION; Recall the previous lesson and ask students to explain what they understood about the skeleton as supporting structure. From students attempts mention some points like skeleton being the framework of the body of animals

PRESENTATION

STEP 1: draw the attention of students to the fact that there are two types of skeleton vizendo and exo skeleton and it depends on the habit and

physiology of the animal e.g. some invertebrates make use of body fluid-tugor for support. Arthropods have exoskeleton and vertebrate have endoskeleton

STEP 2: attention is drawn to the major types existing in different forms. Examples of the different forms are; I, cuticle, ii, chitin, iii, cartilage, iv, bones. Highlights of the two types and different forms are made to differentiate them and also keep them in memory by representation.

STEP 3; explanation of the different forms are giving and the forms depends on the following citeria;

I. Level of development
II. Ecological niche (where they live)
III. Habitat of the organism e.g. marine
IV. Fresh water for bony or cartilageous

STEP 5: the various forms of skeletons are mentioned as bone, cartilage, cuticle, chitin.

STUDENT ACTIVITY:

Group the students into four groups and make them observe and write the features of the different skeleton

CONCLUSION: the lesson is summarized and uncleared facts are explained

ASSIGNMENT: Collect bones of animal and bring to the next class

THIRD LESSON

TOPIC; TYPES OF SKELETON IN VERTEBRATES

DURATION: 45minutes

TEACHING AID: different types of vertebrae (bone specimen) charts of skeleton system

PREVIOUS KNOWLEDGE: students have been taught different types and forms of bones

INTRODUCTION: ask questions on the previous lessons:

I. What is skeleton
II. What are the different types of skeleton
III. What are the different forms of skeleton

PRESENTAION

STEP 1: Explain that skeleton is the framework on which the body is built. There are two types of skeleton, exoskeleton and endoskeleton. The exoskeleton is found outside the body of animals and its usually in invertebrates like protozoa (paramecium) euglena covered by pellicle) in arthropods is chitin e.g. arachida)

STEP 2: The endoskeleton is explained as the skeleton found inside the body of animals mostly in vertebrates such as pisces, reptiles, amphibians, aves and mammals. Vertebrate are animals that possess back bones.

STEP 3: There are some animals that neither have exo or endoskeleton nor need supports of their bodies. These are known as hydrostatic skeleton. These are possess by soft bodied animals like earthworm which also makes use of the body fluid and the environment to gain tugor and shape.

EVALUATION: Ask the students few questions on the lesson taught. The questions asked at the beginning of the lesson could also be used to evaluate.

i. Explain the term skeleton
ii. Differentiate between exo and endoskeleton
iii. Name the different forms of skeleton
iv. Explain hydrostatic skeleton and give example of an animal that possesses it.

CONCLUSION: briefly summarize the lesson again

Find out the meaning of the following terms

i. Vertebrates
ii. Invertebrates
iii. Observe the different bones collected and sketch three (3).

WEEK TWO (2)

TOPIC: BONES AND VERTEBRATES

PERIOD: 1

DURATION: 3 periods of 45minute each.

PREVIOUS KNOWLEDGE:

The students have been taught different types and forms of skeleton

OBJECTIVES:

At the end of the lesson the students should be able to:

i. Name the different types of skeletons in vertebrates
ii. Name different locations of various vertebral bones
iii. Name the two major regions of bones in vertebrates
iv. Describe the shape and characteristics of various bones in vertebrates
v. Draw and label the various bones of vertebrates

TEACHINF AID:

Different models of bones and bones specimen of various shapes.

INTRODUCTION:

Find out the response of the assignment giving the students on vertebrates

PRESENTATION

STEP 1: students are asked to explain what they understood by the term vertebrates. (From previous assignments)

STEP 2: Explain the meaning of the word or moderate the answer given by students. Vertebrates are animals with back b ones known as vertebral column

STEP 3: the vertebral column are the bones possessed by vertebrates. It consist of two parts, the axial and the appendicular regions

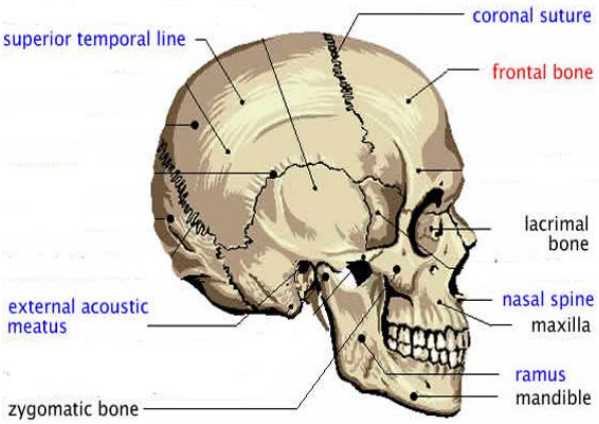
STEP 4: The axial skeleton consist of the skull (head) and the vertebral column (back bone). The appendicular skeleton consist of the limbs bones, humerus, fermur and pelvic bones

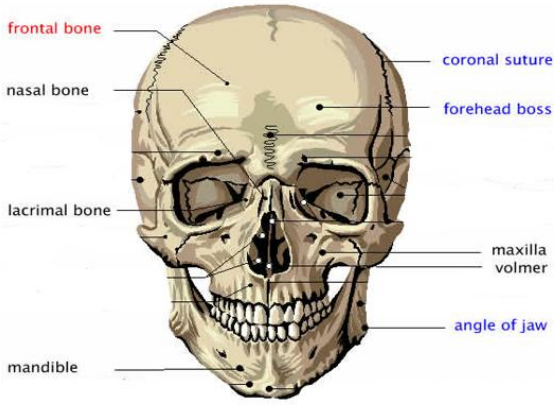
STEP 5: the skul is made up of different components such as:

i. The cranium (brain box) which protects the brain

ii. The facial bone, this carries the nose, eyes, and upper chick. It is also referred to as the snout

iii. The mandible: the comprises the upper and the lower jaw nad it houses the teeth.





STUDENTS ACTIVITY: observe the bones on the tables and write down their names

EVALUATION: ask few questions to find out the extent students followed the lesson e.g. the vertebral column is possessed by animals with ……..

CONCLUSION: summarize the lesson.

PERIOD TWO

SUB TOPIC: THE VERTEBRAL COLUMN

DURATION: 45minutes

TEACHING AID: Different specimen of bones of vertebrates e.g. cervical, thoracic, lumbar, sacral and caudal vertebral. Charts on skeletal system

INTRODUCTION:

There is a brief run down on what the vertebrates are and the vertebral columns stand for a column of bones arrange from the neck to the caudal region of the body.

PROCEDURE:

STEP 1: The teacher explains that the vertebral columns are bones arrange severally from the neck to the anus and it is possesses by animals with back bone.

STEP 2: Ask students to name some animals they have seen with such back bones. Accept the answers and moderate the possible answers.

STEP 3: Mention the different type of bones that makes up the vertebral column. Column such as I, cervical, ii, thoracic, iii, lumbar, IV, sacral, v, and caudal

Further explain that each of these bones that make up the vertebral are distinguished from others by their different characteristic.

STEP 4: Mention the different characteristic of the different bones such as:

The cervical: located at the neck region, next to the skull, the bone closest to the skull is the atlas, followed by the axis and followed by other five to make up seven; all seven bones have the following:

i. A large neural canal
ii. Short neural spine
iii. Two canals (vertebral canal)
iv. All except the atlas has centrum

STEP 5: mention the names of other vertebral and their characteristics e.g. thoracic 2, lumbar, 3, caudal, 4, sacrum and their peculiar characteristics.

STUDENTS ACTIVITY/EVALUATION

Ask the students few questions to find out if the lesson was clear

1. What is the vertebral column?
2. How many bones make up the vertebral column?
3. Name the first two cervical vertebral?
4. State the characteristics of the cervical bones?
5. Which of the bones lack centrum?
6. Name the other four bones of the vertebral column

CONCLUSION

From the teacher/students activity summary of the lesson is made

ASSIGNMENT

Students should observe the different bones collected and list the features observed from the lesson taught

PERIOD THREE

TOPIC: types of skeleton – using instructional materials to demonstrate

DURATION: 40minutes

TEACHING AID: bone specimen of different types. Viz atlas, axis, thoracic, lumbar, sacral, and caudal: including models and charts.

INTRODUCTION:

So much has been said about the bone structure, types, forms and functions, bring out your bone specimen.

PROCEDURE

STEP1: this involves teacher/students activities. Both the teacher and the students display the bones specimen collected.

STEP 2: pick one bone each and list the features observed. Form the listed features what could be the name of the specimen you have?

STEP 3: draw any of the bone you have and label it in biology practical notebook.

CONCLUSION:

The lesson is rounded up using instructional materials to illustrate. The evaluation comes as the post – test. +05 3