EFFECT OF CONSTRUCTED MODEL OF HUMAN EYE ON SECONDARY SCHOOL BIOLOGY STUDENTS LEARNING OUTCOME IN BOSSO LOCAL GOVERNMENT AREA NIGER STATE

BY

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ABSTRACT

This study investigated effect of constructed model of human eye on secondary school biology students learning outcome in Bosso Local Government Minna. The study sample consisted of 160 SS2 biology students randomly selected from a population of 5,656 students drawn from 20 public schools. An instrument designed and developed by the researcher known as Biology Achievement Test (BAT) was validated by some senior lecturers in School of Science College of Education Minna, A Lecturer from Science Education Federal University of Technology Minna. The instrument used was tested and certified to be reliable at 0.05 coefficient. Quasi-experimental design was adopted which involves four groups: two experimental groups and two control groups. The experimental group was subjected to treatment using constructed model of human eye but the control group was taught without the constructed model. Four null hypotheses were tested using t-test statistics. The following major findings were made: There is a significant difference between the mean achievement scores of students taught using constructed model of human eye (EG) and those taught without the use of the model (CG).There is no significant difference in the mean achievement scores of students taught biology concepts using constructed model of human eye based on gender. There is no significant difference in the mean retention scores of students taught with constructed model of human eye and those taught without the constructed model. There is no significant difference in the mean retention scores of students taught Biology using constructed Model and those taught without the Model. On the basis of these findings some recommendations were made, one of which is teachers should make use of constructed model to facilitate the teaching of biology at secondary school.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

In the 21st century, the need for human resource with scientific knowledge is in the forefront of public discuss, because innovation is driven by science technology, engineering and mathematics. These underscore the importance of the meaningful learning of science at all levels of education. Schwab in Nixon (2015) divided science into three distinctive disciplines which include physics, Chemistry and biology. However science teaching and learning has suffered setback. These can be seen in a poor performance of student especially in secondary schools**.**

Science is the bedrock in which cutting-edge day technological step ahead is hinged. Specific authors in accordance to their private understanding have described science. Hohenberg (2010) Defines science as a body of knowledge that belongs to humanity as a whole. Its emergence and success over the past 400 years is a miracle. Science aim at, and thus attains at least approximately, objective and universal knowledge and it is thereby limited to those questions that can have universal answers. Onasanya and Omosewo, (2011) Define science as the foundation upon which the bulk of present day technological breakthrough is built.

Science and technology are inevitable forces in the current drive towards a guarantee of good life, peace, security and survival of mankind. This had led governments, private organizations and individuals to invest on the teaching of science and scientific researches particularly in Nigeria to promote, hold and sustain the interests, needs and aspirations of our children, youths and teachers in science (Oyekan, 1984; Federal Republic of Nigeria, 2004; Gbore & Daramola, 2013).

The major goal of science education is to come up with a genuine interest in science as an important part of scientific literacy, and thus a critical goal for science education. Recent studies however, have found that school science has not been effective in meeting this goal, an important reason for which is lack of the knowledge about what makes science interesting to the students. Using instructional episodes as the unit of analysis, this study investigated the effects of learning environment elements (content topic, activity and learning goal) on student interest in science. (Wiley Periodicals 2012). This understanding helps man to know more about the universe. Without the application of science, it would have been difficult for man to explore the other Planets of the universe. Science comprises the basic disciplines such as Physics, Chemistry, Mathematics and Biology. Furthermore, scientific literacy is important to every individual because the knowledge of science is applicable to human daily activities in home, school, industry etc. The knowledge needed in solving domestic issues such as, operation of home appliances, fixings of electric globe, operation of television etc. Permanent literacy and numeracy skills for all individuals will be achieved as stated in the National Policy of Education (FRN, 2013).

Biology is the study of living things and a subject that provides part of the literacy needed for national growth and development. Despite the quest by all nations to grow scientifically and technologically, Biology status as contained in the National Policy on Education (FRN, 2013) is now elective for science students only in Nigerian senior secondary schools. The latest development that may constitute negative influence on the national growth and development led to this paper that addressed reconsidering the status of Biology in Nigerian senior secondary schools curriculum: implications for scientific literate society. The study concluded that the knowledge of Biology is needed by all students. Also, it was recommended that government and relevant stakeholders should promote teaching and learning of Biology by all students in Nigerian senior secondary schools among others.

Biology, the study of life, teaches us why we are the way we are, why we need what we need to survive, how all living things are categorized, where we all come from(Horan, 2012). Biology is a branch of science that is concern with life and living organism.

Biology is the study of plants and animals which partly provide scientific literacy required for national growth and development. Biology is a natural science that deals with the living world: How the world is structured, how it functions and what these functions are, how it develops, how living things came into existence, and how they react to one another and with their environment (Umar, 2011) Scientific literacy is getting popularized daily due to global growth and development in the field of science and technology. Biology gives explanations to body anatomy and physiology, health issues, understanding microorganism around us, the effects of the microbes, how to control them. Biology is one of the requirements for studying science and the science related courses in the tertiary institutions.

Learning cannot take place without a planned of programme of activities; and the document that contain the totality of activities that take place in schools is termed curriculum

This implies that the mastery of Biology concepts might not be fully achieved without the use of instructional resources that the students are abreast with. The teaching of Biology without instructional materials may certainly result in poor academic achievement. The report of West African Examination Council (WAEC) on the Senior Secondary School Certificate Examination (SSCE) (2011) on student enrolment and performance in Nigeria by subject, grade, and sex revealed low enrolment of girls for science subjects as well as low academic achievement in biology and other science subjects and the persistent poor achievement of students in biology at senior school certificate examination (WAEC; Chief Examiner's report 2007-2010), leaves one in doubt about the effectiveness of instructional Materials and teaching methods popularly used by the biology teachers for the teaching and learning of biology.

On this note, resources are seen as materials, which help in doing something. For Example, flour, sugar, water, and so on serve as resources for the preparation of bread or Cake. In the classroom situation, resources are materials or devices that are used to facilitate teaching and learning. National Teachers Institute (2010) reported that resources in the Classroom can be classified into two broad categories, those that appeal to the sense of sight which are classified as visual resources and those which appeal to the sense of hearing, classified as audio materials. There are also those that combine both features and are classified as audio-visual (A-V) materials. Isola (2010) referred to instructional resources as objects or devices, which help the teacher to make a lesson much clearer to the learner.

The teaching of Biology cannot be done effectively without interaction between the Teacher, students and the environmental resources. The Biology curriculum is planned to enable the teacher use activity oriented, child-centred approach (guided inquiry) to teach. Nzewi & Nwosu,(2010). However, evidence from research has shown that instructional materials, resources and equipments for science, especially biology are either in short supply or are completely lacking in schools to the extent that most teachers end up with verbal exposition of scientific principles, facts and concepts. Studies have also revealed that the achievement of Nigerian students in Ordinary Level Biology was generally and consistently poor over the years (Nwagbo, 2010). This has been a major source of concern to the school administrators, parents and the government at large.

The study of any of the branches of science is incomplete without the mention of relevant subject like biology neither can any meaningful research be complete which is aimed at improving the lives of man without reference to Biology. If biology have this far reaching implication, then launching the country Nigeria into the class of technologically advanced countries has a lot tied to the adequate and meaningful learning of biology in all levels of education. The federal government through the ministry of education has set up various

board of directorates and organization to look into this issue. The board includes National board for Technical Education (NBTE), National Education Technology Centre (NETC). These boards are properly funded through the government to carry out their functions of making Nigeria what she should be, but as sad as it were, the performance of students in science particularly in biology was not encouraging. This is because it is taught theoretically without Practical in our Secondary Schools. Biology require the use of perfect equipment which is readily un-available in our schools. Marjorie and Brown (2014) warned that teachers should not use inadequate facilities and equipment as an excuse for poor teaching and learning process. Hence there is need for some of these materials to be improvised to enhance teaching and learning and also to improve their level of retention. Balogun (2010) was of the view that models will provide opportunities for the learner to have a direct experience with learning materials. Models can be constructed from locally sourced materials like plasticine, clay, casting with iron and other metal materials. Models serves dual purpose in teaching particularly teaching of the human Eye which is made of different organelles that cannot be seen with the naked eyes, such organelles includes the Sclera, Conjunctiva, Cornea and others. Model is a three dimensional object or representation of a real thing that can be used to explain in details both the internal and external structure of an object. It is known that it is usually valuable to observe the real object in the natural environment. This is not usually possible in practice. Real object are not always readily available when and where they are needed. This is because they may be both too big and complex or even harmful to be brought to the classroom. Some may too small that good observations are possible. It is based on these difficulties that biology instructional models enhances visuals imagery, stimulates and scintillates the learners thereby boosting their perception, creativity, better understanding and high performance. For effective biology teaching and learning to take place, it demands the use of instructional materials such as

posters, Models and others, challenges are faced especially when these materials are expensive or not available, thus students' performance is affected. Most of these material are imported from a foreign country and the process of importation takes longer time resulting in these materials not being readily available at the time when needed.

The solution to these problems lies in improvisation. Improvisation is the substitution of already made or original object with the locally produced ones. It is an alternative to the real or desired material. The process of improvisation is teacher centered and the improvised materials should serve the same purpose as the original one. Balogun, (2011) stated that models would provide opportunities for the child to have a direct experience with learning materials because the sense organs are appealed to and are actively involved in the learning. Improvisation can go a long way in improvising the process and teaching of Biology. Different materials are utilized to the purpose such as clay, stone beads and plasticine. If local production can be encouraged, a lot of contribution would be made towards the provision of needed materials in the Schools. Balogun (2010) was of the view that models will provide opportunities for the child to have concrete experience with learning materials. These materials produce certain responses from the child, which will pave way for further learning. In the same vein Buseri (2010) contends that to meet up with the rapid scientific progress in technology requires the presence of a well-trained, efficient, knowledgeable and skillful teachers who are versatile in the discharge of their duties and responsibilities. The government authorities cannot grant all the request concerning educational needs, therefore the teacher is left with no option rather than to do what he/she could do within the limited time and space to produce the improvised instructional material that which motivates the learner and makes the process of teaching easier. The present work on construction a model of human eye is a step towards making teaching and learning of biology more meaningful and interesting to the students thereby making science particularly biology more attractive.

Human eye is the organ of seeing as well as the organ of balance in mammals. A mammal has two eyes, one on each of the side. It is an organ that reacts with light and allows light perception, color vision and depth perception. The greater part of the eye is embedded in the skull. The structure are complex and abstract and impose difficulty in understanding the concept. To tackle the problem, instructional materials or models to teach this concept are not available in most of the schools. Thus improvisation is the only solution. Improvisation tackles the problem of creativity among teachers.

1.2 Statement of the Research Problem

There is an urgent need for the students to understand tough biological topic and one way to make the students understand such concept is to look into some factors contributing to their failure. Some of the factors include: The equipment lack accuracy: Here, most of these equipment does not really contain most of the details that the teacher needs to pass across information to the students. Over population of the students: The population of our secondary school students is high, which does not give room for effectiveness. Inadequate equipment in Laboratories: Most of the laboratories in the schools are not well equipped for the magnitude of the work prescribed in the secondary school curriculum. Cost efficiency: Some of these equipment cost quite a lot of money to purchase. Most of the school in this present economic condition cannot afford to buy such equipment neither the federal government or state government can afford such amount for all the schools. Therefore to draw attention of students to science, most especially biology, improvisation of instructional materials is very paramount importance. These would stimulate and attract the attention of the students, making them to see, touch and feel what has been taught thus might improve their learning performance.

1.3 Aim and Objectives of the Study

The aim of this study is to determine the effect of constructed model of human eye on student's achievement and retention in biology.

This study specifically will strived to determine:

i. The mean difference in achievement of the students taught using constructed human eye model and those taught without the model.
ii. The mean difference in achievements of the students taught using a constructed model of human eye based on gender.
iii. The mean difference in retention of students taught using constructed model of human eye and those taught without the model
iv. The mean difference in retention of the students taught using constructed model of human eye and those taught without the model based on gender.

1.4 Research Questions

The following research questions will guide this study:

1. What is the difference in mean achievement scores of student taught Biology using a constructed model of human eye and those taught without the model?
2. What is the difference of gender on students mean achievement scores when taught using a constructed model of human eye?
3. What is the mean retention scores of student taught using constructed model of human eyes and those taught without model?
4. What is the difference of gender on students mean retention scores in Biology when taught using constructed model of human eye?

1.5 Research Hypotheses

The following null hypotheses were formulated to guide this study and were tested at 0.05 alpha level of significance.

Ho_1: There is no significant difference in the mean achievement scores of student taught Biology using constructed model of human eye and those taught without the model.

Ho_2: There is no significant difference in the mean achievement scores of student taught Biology using constructed model of human eye based on gender.

Ho_3: There is no significant difference in the mean retention scores of student taught Biology using constructed model of human eye and those taught without model.

Ho_4: There is no significant difference in the mean retention scores of student taught Biology using constructed model of human eye based on gender.

1.6 Scope of the Study

The study is on the effect of constructed model of human eye on students' achievement and retention in biology. This study was conducted using SS2 Biology students in secondary schools located in Bosso Local Government Area of Niger State, Nigeria. The content scope is the human eye and the instrument scope are the Achievement and Retention of test question. The study lasted for 6 weeks.

1.7 Significance of the studies

This study would be useful to classroom teachers, curriculum planners, students, researchers and parents.

Classroom teachers: Teachers will be better informed on how to help and guide their students on better way of producing improvised materials with local resources where standardized materials are unavailable or inadequate. The teacher can also engage students to do some of the illustrations during biology instructions.

Curriculum Planners: The study could be beneficial to curriculum planners who would design functional curriculum by taking into considerations students teacher's improvised instructional materials.

Students: This study will help to develop problem solving skill in students and will also help the student to be more resourceful during lessons.

The findings of this study, if discussed in workshops and seminars will guide the choice of improvised instructional materials used in teaching and learning process in biology and other subject areas. The findings of this study will equally help to alleviate the problem of the scarcity of instructional materials for biology teaching and learning.

Researchers: The results of the study could provide information to researchers interested in working on student-teachers generated improvised materials in other subject areas. This may help them to get more information on the efficacy of improvisation especially researchers in the area of science and technology.

Parents: Parents will be better informed on how to encourage and help their wards to produce improvised materials. This may be inform of sourcing local materials and providing fund for those that cannot be found in their environment.

1.8 Operational Definition of Terms

1. Model: Models are direct replica, image or copy of real, original or natural objects or figure
2. Academic achievement: refer to the progress students make in school as measured by their scores.
3. Instructional material: Instructional materials are print and non-print items that are employed to impact information to students in the educational process
4. Academic retention: It is a process by which a student recalls what he/she was taught.

CHAPTER TWO

LITERATURE REVIEW

The review of related literature is presented under the following sub-headings: Conceptual framework, Theoretical framework, Empirical Studies and Summary of the literatures Reviewed.

2.1 Conceptual Framework

2.1.1 Structure of the Eye and its Function.

The mammalian eye consist of the following parts, these include the Tear layer, Cornea, Anterior chamber, Iris, Lens, Vitreous Humor (chamber), Retina, choroid, sclera, optic nerve and extra ocular muscles. The tear layer (The lacrimal system) is the first layer of the eye that light strikes. It is clear, moist and salty. Its purpose is to keep the eye smooth and moist. Cornea is the second structure that light strikes. It is the clear, transparent front part of the eye that covers the iris, pupil and anterior chamber and provides most of an eye's optical power. It needs to be smooth, round, clear and tough. It is like a protective window. The function of the cornea is to let light rays enter the eye and converge the light rays. Anterior chamber is filled with aqueous humor. Aqueous humor is the clear, watery fluid that fills the space between the back surface of the cornea and the front surface of the vitreous, bathing the lens. (The anterior and posterior chambers. Both are located in the front part of the eye, in front of the lens). The eye receives oxygen through the aqueous. Its function is to nourish the cornea, iris and lens by carrying nutrients, it removes waste products excreted from the lens and maintain intraocular pressure and thus maintains the shape of the eye. This gives the eye its shape. It must be clear to function properly. The iris is the pigmented tissue lying behind the cornea that gives color to the eye and controls the amount of light entering the eye by varying the size of the papillary opening. It functions like a camera. The color of the iris controls light constantly, adapts to lighting changes and is responsible for near point reading (to see close, pupils must constrict). Pupil is a variable sized black circular opening

in the center of the iris that regulates the amount of light that enters the eye. The pupil needs to be round in order to constrict. Constricted pupil occurs when the pupil size is reduced to constriction of the iris or relaxation of the iris dilator muscle. The iris constricts with bright illumination with certain drugs and can be a consequence of ocular inflammation.

A dilated pupil is an enlarged pupil, resulting from contraction of the dilator muscle or relaxation of the iris sphincter. It occurs normally in dim illumination, or may be produced by certain drugs (mydriatics) or result from blunt trauma. Lens is the natural lens of the eye (chrystaline lens). Transparent, biconvex intraocular tissue that helps bring rays of light to focus on the retina. (it bends light, but not as much as the cornea). Suspended by fine ligaments (zonules) attached between ciliary processes. It has to be clear, has to be pliable so it can control refraction (This becomes less pliable as you age leading to presbiopia). Ciliary Body is the circumferential tissue (a ring of tissue between the end of the choroids and the beginning of the iris) inside the eye composed of the ciliary muscle (involved in lens accommodation and control of intraocular pressure and thus the shape of the lens) and 70 ciliary processes that produce aqueous fluid. Vitreous Humor (chamber) is the transparent, colorless gelatinous mass that fills rear two-thirds of the eyeball, between the lens and the retina. It has to be clear so that light can pass through it and it has to be there or eye would collapse. Retina is the light sensitive nerve tissue in the eye that converts images from the eye's optical system into electrical impulses that are sent along the optic nerve to the brain, to interpret as vision. Forms a thin membranous lining of the rear two-thirds of the globe; consists of layers that include two types of cells: rods and cones. There is no retina over the optic nerve which causes a blind spot (this is the sightless area within the visual field of a normal eye. It is caused by absence of light sensitive photoreceptors where the optic nerve enters the eye). Cones are the light sensitive retinal receptor cell that provides the sharp visual acuity (detail vision) and color discrimination; most numerous in macular area.

Function under bright lighting. Rods is the light-sensitive, specialized retinal receptor cell that works at low light levels (night vision). The rods function with movement and provide light/dark contrast. It makes up peripheral vision. Macula it is the "yellow spot" in the small (3) central area of the retina surrounding the fovea. It is the area of acute central vision (used for reading and discriminating fine detail and color). Within this area is the largest concentration of cones. Fovea is the central pit in the macula that produces the sharpest vision. It contains a high concentration of cones within the macula and no retinal blood vessels. Choroid is the vascular (major blood vessel), central layer of the eye lying between the retina and sclera. Its function is to provide nourishment to the outer layers of the retina through blood vessels. It is part of the uveal tract. Sclera is the opaque, fibrous, tough, protective outer layer of the eye (white of the eye") that is directly continuous with the cornea in front and with the sheath covering the optic nerve behind. The sclera provides protection and form. Optic nerve is the largest sensory nerve of the eye. It carries impulses for sight from the retina to the brain. Composed of retinal nerve fibers that exit the orbit, pass through the optic foramen into the cranial cavity, where they meet fibers from the other optic nerve at the optic chiasm. Extraocular Muscles, there are six extraocular muscles in each eye: Rectus muscles, there are four rectus muscles that are responsible for straight movements: superior (upward), inferior (lower), lateral (toward the outside, or away from the nose), and medial (toward the inside, or toward the nose). Oblique Muscle: There are two oblique muscles that are responsible for the angled movements. The superior oblique muscles control angled movements upward toward the right and left. Inferior oblique muscles control angled movements downward toward the right and left.

2.1.2 Mechanism Involved in Seeing

For seeing to take place, the light rays emitted by various objects are captured by eyes and then send inwards. The light rays entering the eyes are either parallel or diverging when they

strike the eye. In both the cases, the light rays need to be bend or refracted to focus on the retina. The work of refracting the light rays is done by curved cornea. The work of refracting the light rays is done by the curved cornea, refracting eye lens and the humors present in the eye. The light rays are visible wavelength are focused on the retina through the cornea and the lens. This generates the potentials (impulses) in the rods and the cones present in the retina. The photosensitive compounds (photopigments) in rods in the human eyes are composed of opsin and retinal. Similarly, the cone pigments in human eyes are composed of the retinal and three different types of proteins (opsin) to which retinas are attached. However, when light falls on rods and cones, it causes dissociation of retinal from opsin. This results in changes in the structure of the opsin. This change in the structure of the opsin, causes membrane permeability changes. As a result of potential differences are generated in the photoreceptor cells that is rods and cones. As the photoreceptor cells synapse with the bipolar cells, a signal generates the action potential in bipolar cells also. Now bipolar cells synapse with ganglion cells, so action potentials are generated in the ganglion cells through the bipolar cells. So finally the action potential (impulses) generated in the ganglion cells are transmitted through their axons, that is optic nerve to the visual cortex area of the brain. After reaching the visual cortex area, the neural impulses are analyzed, the image formed on the retina is recognized. This recognition is based on earlier memory and the experience stored in the brain.

2.1.3 Concept of Improvisation

Improvisation is the act of using materials and equipment obtained from the local environment or designed by either or with the help of local personnel to enhance instruction Gabriel, (2010). Eniajeju, (2011) also sees it as the act of using alternative materials and resources to facilitate instruction wherever there is a shortage of some specific firsthand teaching materials. This actually translates that when certain materials and tools are not

readily available, they can be changed with prototype of such materials within the immediately locality. Improvisation is a need to of each and every teacher especially in the aspect of biology where very abstract concepts need to be taught and instructional materials to help in the process of teaching is unavailable. Improvisation of material or equipment during educating method helps to fill the hole that would have existed in the absence of the foreign kind of materials. Locally made instructional materials should be able to serve equal feature as the real one would due to the fact that no difference should exist between the two. An essential and solely distinction is that one is overseas and the other is made with the useful resource available inside the immediate environment. Improvisation is all about making use of the available resources within the environment to fill the instructional vacuums, they may not look like the original one however they should fill the academic vacuum and help in learning process. Science educating ought to be accompanied with the use of instructional materials however when these are no longer effectively available, improvisation is the next choice. Science teachers need to be creative and be capable to improvise. The students too can be involved it encourages ingenuity on their part; it additionally gives them the perception that science be learnt with the use of primary apparatus. The teacher is the first-rate designer of improvised materials as he is aware of what he desires the students to learn and understand.

There is then favor to analyze improvisation which may additionally embody know-how of wielding and cutting, woodwork and metalwork. Most teachers are lacking in these capabilities and can easily learn from specialist or expert in technical workshops and handcraft centers. This is because as noted (Schemele and Rock Castles, in Nsofor, (2010) the foundation of all learning in science in firsthand experience with real things. Thus, encouraging the use of instructional materials, practical classes to learn such firsthand experience. The use of visual aids is of importance. Akerele, (2012) asserted that they are

materials or an object which helps the teacher to make the lesson explicit to the student. They motivate the students, aids in retaining more easily learnt materials etc. Cirfat, (2013) emphasized that scientific concepts requires effective communication techniques. These techniques are basically instructional materials. When such equipment not available, there are plentiful local assets that the teacher can draw inspiration, from to produce the wanted materials. Rote learning and verbalism has been discredited by Cirfat and Hut, (2010), they insisted that no meaningful learning takes place and as such no real concept has been formed. They encourage concrete experience as fundamental strategies for promoting and understanding science.

Improvisation reveals that there are probabilities of alternatives to teaching and learning aids. It is stated to be an act of designing replica of well-known equipment assigned to play some designated role to meet specific teaching and learning situations. Improvisation in biology is an aspect of creativity and resourcefulness, it is the use of nearby resources in our immediate environment to build, assemble, would or make instructional teaching and learning materials that can help in the clean dissemination and transfer of knowledge from teachers to students. Landy (1982) in Adebiyi, (2013) defines improvisation as an unscripted, unrehearsed, spontaneous set of actions in response to minimal directions from a teacher, usually including statement of whom one is, where one is and what one is doing there. The centre of attention is thus on identifying with characters, enacting roles and coming into their inner drive of creativeness and fantasy. According to McCashin (1990) in Adebiyi, (2013) the focus of improvisation is on helping learners to discover their own resources from which most imaginative ideas and strongest feelings flow, participant gain freedom as self-discipline and the ability to work with others develops.

2.1.4 Rationale for Improvisation of Instructional Materials

Improvised instructional material is a meaningful attempt towards finding suitable substitute or alternative to conventional science materials. Due to state of our nation's economy, teachers, students, school authorities and communities should engage in improvising instructional materials in order to develop in students and teachers adequate skill for improvisation. For effective verbal communication in science education there is an acute want to make use of the proper instructional materials to enhance this process. These instructional materials are integral ingredient that will aid smooth studying of science. Schools should be properly equipped with these resources but it is a sad case, that these assets are not accessible in our science schools. Most public schools are so poorly outfitted that the science laboratories are very bare. The problem of inflation in the country, the problem of purchasing unsuitable equipment, the problem of lack of man power to make use of the equipment are difficult tasks facing the teacher for this singular reason there is need for improvisation. Improvisation allows the teacher to carry on with his instructional process without interruption. The teacher is also challenged and tasked towards using his creative mind to produce such materials. The teacher will not have to wait endlessly for the government to supply his needs and it saves the embarrassment and the stress of running helter-skater during external examination period. Improvised materials are not usually as expensive as the imported materials and do not reduce learning experience on student's part. Improvisation allow the teacher to carry out his practical works easily most especially in schools found in rural area settlement where ordinary practical work have been exempted due to insufficient of instructional materials. As such having direct effects on the students both in the present and in the future. Science education is expected to help in building a strong and self-reliant country (Nigeria) but unfortunately, Science education has proven ineffective in promoting the socio-economic transformation that is desired. This happens as

a result of inefficient equipment and materials for meaningful learning of science. Majorie and Brown, (2011) stressed that the solution to this problem lies on improvisation and encourages the teachers never to use inadequate facilities and equipment as an excuse for poor teaching rather they should embark on improvisation of instructional materials as an alternative to the real materials.

2.1.5 Effect of Improvised Instructional Materials in Teaching

Instructional materials helps in effective communication, additionally it also aid the students to assimilate and understand what they are taught. They appraise the teacher's effort and aid the teaching process rather than dominating it.

Schuller and Wiltich, (2011) asserted that learning, seeing, touching and listening are gateway to human learning. They believed that materials meant for learning should be presented in a manner as to provide students with the opportunity to become actively motivated intellectually, perceptually and physically, they also transmit information idea, notes to the student in such a manner that will modify their attitudes, habits and practices. Ahmed (2010) claimed that instructional materials ensure that the learners see, hear, feel, recognize, and appreciate as they learn utilizing almost all the five senses at the same time. In view of the above, the effect of improvised instructional materials in teaching such as model will provide the learner with direct learning experience with such learning materials. It is believed that improvised instructional materials are good alternative in such situation where equipment and materials are lacking. It promotes a harmonious relationship between the teacher and the students. It also fill the gap that would have existed in the absence of the needed instructional materials Nsofor, (2010) asserted that for teaching to be meaningful it must be experienced, that is why verbalism is not effective for science teaching. This simply means that to teach science in its proper method, it entails the use of instructional materials like charts, model realia (real thing) etc. science as a whole involves the use of sense organs

seeing, touching, and tasting, feeling and smelling. It is pre-eminent that all of these sense organs have to be put to full use. The scientific process and inquiry involves observation, asking of question, carrying out experiment. Drawing analysis and making a hypothesis. All of these processes are needed to be followed consciously and unconsciously in the classroom by the teacher during instruction process. A basic objective of instructional technology can be said to be, how to design appropriate teaching materials that can be used to get the learner to understand the abstract level of printed and abstract means of instruction. For instance where a teacher make use of model realia to illustrate his teaching, the learner is tuned the instructional process and learn faster than the use of ordinary verbal description and explanation on the chalk board. Cirfat (2013) there is an acute need to encourage student's active participation through the use of instructional materials.

2.1.6 Improvisation of science Equipment and Materials in Secondary Schools.

A major fact to bear in mind is that no educational authorities can sufficiently equipped the science laboratory in educational setting. No matter how rich the educational authorities might be, they cannot sufficiently cater for the economic hardship in Nigeria and also there is an increase in the number of schools students' enrolment is also on the increase. As such, in situation where school science laboratories are poorly equipped, the teaching and learning process is greatly hindered. There is the need for resourceful teachers who can enrich the laboratories with substituted locally produced equipment and materials in order to meet up the present day need and standard of senior secondary school. Prospective teachers of science and technology especially biology will have to be knowledgeable, skillful, adapted and must be disposed to continue learning new skills and methods. Biology as a study of life deals with a lot of concepts that are voluminous hence ensuring that every detail is put into remembrance with the use of models or improvised work. The learning process becomes more interesting and richer in information.

2.17 Gender and Academic Achievement.

There is indeed no doubt that in any society in the world females and males are assigned different roles as dictated by tradition of the people. As noted in Iwendi and Oyedun, (2012) that to a greater extent, the differences in the behaviors of male and females are mainly socially determined rather than biologically or genetically influenced. It is documented that there is disparity between male and female students achievement in biology. In some cases boys achieve more than girls academically, while in some, girls had an edge over the boys while in some cases both the boys and the girls had an equal tendency.

The controversy as to which of the sexes would perform better academically, it is better to look beyond gender characteristics into the interaction between individual learner's specific characteristics and particular features of instructional treatment in order to determine the reasons for academic achievement. Other theories of interest here, suggest that the academic achievement largely depends on the gender of the teacher. One of the theory noted that the teacher's gender tend to shapes communications between teacher and students, while another says the teacher acts as a gender specific role model, regardless of what they teach. According to the second theory, students are more engaged, behave more appropriately and perform very high when taught by a teacher who shares their gender. Conclusion was arrived that, Boys are better off when taught by men while girls have better educational achievements when taught by women.

2.2 Theoretical Framework

Jerome Bruner's Learning Theory

Bruner introduced the concept of learning by discovery. Bruner is of the view that learning is effectively engaged in if the learner is giving the opportunity to discover facts by him/herself. Bruner argues that mere presentation of information will not enhance effective solution of a problem. The theory stresses cognitive effectiveness. Because of this, some

referred to Bruner's theory of learning as Bruner's theory of cognitive development. Bruner believed that learning by discovery begins when science teacher purposefully (i.e. intentionally) create (present) a problem and present it to the students by introducing some inconsistencies (i.e. contradictions) among source of information which are giving in the process of instruction. According to Bruner such inconsistencies lead to intellectual discomfort that will stimulate (i.e. motivate) the students to initiate individual discoveries through cognitive restructuring (i.e. internal reorganization). The intellectual discomfort created by the inconsistencies makes the learner to attempt to bring order out of this confusion by engaging in mental processes i.e. discovery activities which involve observation, hypothesizing, measuring, stating problem, data collection, classifying, inferring, etc. Through mental processes, the student can generate facts from his/her desperate experiences. Experiences gained during the mental processes enable the students to sense the disparity.

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

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

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

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

- Physical activity (motor activities) called Enactive representation.

- Imagery called Ionic representation.
- Symbolic activities

The three activities coexist with each other and for this reason; the attainment of one does not mean the total abandonment of the others. At enactive stage, the child manipulates the learning materials directly by neuro muscular activities. At ionic stage, the child deals with mental images of objects, but does not manipulate them directly. At symbolic stage the child uses language. The interpretation of the above is that when a child, say at secondary school level shows deficiencies in his/her learning capacity especially in symbolic representation, it could be that he/she was deficient in early stages (i.e. enactive and ionic stages) which he/she skipped. It is therefore necessary to fill in the missing gap by providing concrete support that will make up for the deficiency.

Application of Jerome Bruner's Theory of Learning to Science Teaching/Learning:

The science teacher should intentionally create or present problems to students either in form of apparent contradiction or inconsistency among sources of information which are giving in the process of instruction. Encouraging discovery learning in science class by science teachers will result into aiding problem solving. One of the major objectives of science teaching is creativity. Therefore, discovery learning encourages creativity. Students should be taught concepts in such a way that they have applicability beyond the situation in which they were learned. Retention of science concepts are aided by knowledge acquired through discovery learning. Teachers must encourage students to make intuitive guess more systematically. Bruner supported a radical reorganization of the curriculum across all levels of education. Bruner advocated the fundamental structure of curriculum to begin with simple contents and later graduated to complex contents. That means that learning should proceed from simple to complex, from concrete to abstract, and from specific to general. Teaching should be inductive. Bruner supported the spiral nature of curriculum as we have in our

present science curriculum at all levels of education. Bruner's Constructivist Theory asserts that learning is an active process in which learners construct new ideas based upon their current knowledge. Instruction can be made more efficient by providing a careful sequencing of materials to allow learners to build upon what they already know and go beyond the information they have been given to discover the key principles by themselves. In relation to the present study: Effect of Students' Produced Improvised Instructional Materials on Senior Secondary Students Achievement in Biology, the application of Bruner's constructivist theory to learning will help the students to have a focused attention on the principles they learn and also increase and sustain students' attitude to learning environment. Secondly, Bruner's theory of learning by discovery and his theory of cognitive development suggested that instructions at all level should be geared towards the learning maturational development or cognitive operation. Bruner's theory is directly related to the present study: effect of students' produced improvised instructional materials. This is because effective use of students' produced improvised materials involves the learner actively working on his own to find solutions to problems. So, Bruner's theory is in support of the present study.

Piaget's Theory of learning

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

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

Accommodation: This is the modification of existing schemas to fit reality. The organism is capable of learning when it can modify its schemas. As the organism continues to accommodate, it continues to learn. Piaget believes that cognition develops from age to age and from level to level. According to Piaget, the driving force for cognitive development is equilibration. By equilibration, Piaget means balancing assimilation and accommodation to adapt to the demands of the environment.

Piaget believes that for people to learn, they must assimilate and accommodate. Piaget opined that at each stage of development, people use a distinctive underlying logic or structure of reasoning to guide their thinking. Piaget identified four stages of cognitive development – sensorimotor, pre-operational, concrete operational and formal operational to explain cognitive development from infancy to adolescence. However, we should be concerned with the 'formal operational stage'. This stage occurs within the adolescence stage. At this stage, the young individual can start to think more abstractly. This stage of cognitive learning is characterized by ability to manipulate abstract as well as concrete objects, ideas, and events. At formal operational stage, the young individual acquires more ability to deal with abstractions and may engage in hypothetical reasoning based on logic. At the adolescence stage, individuals can easily carry out practical experiments and demonstrations. Formal operational stage offers the ability for the individual to use abstract symbols for representational purposes. For instance, the individual, if taught, could understand that H2O is water and may abstractly understand why it represents water. Piaget's theory of intellectual development holds that cognitive development takes place

from active interaction of the child with his environment. This means that the basis of learning is the child's own ability as he interacts with his physical and social environment. Piaget is of the opinion that a child must act on the objects in his environment for him to learn. This means that he should be actively involved not be passive. The active involvement of the child may be in form of direct manipulation, visual observation or through mental or internal transportation or change. Piaget believed that mental activity, which is involved in cognitive organization, is a process of adaptation, which is divided into two opposing but inseparable processes of assimilation and accommodation. Accommodation means to modify self to fit the new materials, while assimilation means to modify the materials to fit the self.

The Piagetian theory places the child as the principal agent in the teaching/ learning situation. This being the case, the teacher's job is to provide the individual with situations that encourage experimentation and manipulation of objects and symbols. The theory has direct implication on the researcher's study: effect of students' produced improvised instructional materials on academic achievement of students in Biology. In the first place, the Piagetian theory of intellectual development holds that cognitive development takes place from active interaction of the child with his environment. This is why the researcher advocates the use of students' produced improvised instructional materials, because it is a student- centered, activity oriented- teaching strategy in which the teacher acts as a facilitator of learning, guiding the students through a series of activities and problems, which will enhance achievement by learners.

Secondly, Piaget's theory emphasized active participation of the child which students' produced improvised instructional materials encourages. This is because when students are allowed to produce their own instructional resources, the students may likely understand the subject matter better as they pass from the known to the unknown and in an increasing order

of difficulty. A child must master a step before proceeding to the next one and in doing so, the learner is actively involved in the learning process. Moreover, there are a lot of activities which the learner is expected to carry out by himself, making the learner very active in the learning process.

2.3 Empirical Studies

Several studies have been conducted on the use of improvised instructional materials and resources for science teaching. There has been little or no study done on students' produced improvised instructional materials for science teaching. Onasanya and Omosewo (2010) carried out a study on the effect of using standard instructional materials and improvised instructional materials on Secondary School Students' Academic Achievement in Biology in Ilorin, Nigeria. The sample consisted of selected Secondary Schools in Ilorin Metropolis of Kwara State. The research employed a quasi-experimental design of the pretest posttest non-randomized control group design. Two hypotheses were designed and tested at 0.05 level of significance. From the analysis, the following findings were made (1) there was significantly difference between the students taught with standard instructional materials and those thought with improvised instructional materials, i.e., mean scores on the posttest ($t = 4.09$, df 14, $p = 0.05$), (2) there was no significant difference between the post test scores of the experimental group and control group. This shows that the improvised instructional materials in the comparison of the male mean scores of experimental and control groups were the same entry level with regard to academic ability ($t = 1.23$, $df = 7$, $p = 0.05$). The implications of improvised instructional materials were discussed. Recommendations for the improvement of standard instructional and improvised instructional Aids in teaching of biology and suggestions for further studies were made. Adeyemi and Olaleye (2010) investigated the effect of students' involvement in the production of instructional materials on their academic achievement in Biology. A pre-test – posttest control Group Quasi-

Experiment design was used. Intact class of one hundred and twenty (120) students of SS2 class was used. A sample of sixty (60) students' constituting the experimental Group were taught using produced models while the control group of sixty (60) students used already prepared pieces of bones. Data was collected using Biology Achievement Test for Instructional Materials (BATIM) and were analyzed using ANCOVA. A significant difference existed between students taught Biology using produced models and those taught Biology using already prepared bones. The Scheffe tests carried out to determine the direction of significance show that the difference in means of students' achievement between those taught Biology using produced models and those taught using already prepared bones were significant. The need for teachers to ensure practical experience in the teaching of Biology was the major recommendation of the study. Based on the finding that students' involvements in the production of instructional materials impacted on their academic achievement in Biology, therefore the present study assumed the usability of the improvised instructional materials. This study is related to this present student in terms of the independent variables but differs in the subject area used for study and location. Achor, (2011), investigated the relative efficacy of the use of improvised and manufactured analogue voltmeters in secondary school physics. A pre-test –posttest control Group Quasi-Experimental design was used. This is because random selection of students was not done; rather, intact class was used. Senior Secondary (SS) two class was selected for use being the most stable class quite unlike the SS1 that is freshly being introduced to the subject or SS3 that is preparing for external examination. The (standardized) improvised and manufactured equipment were used to teach experimental group 1 and 2 students on how to take measurements of voltage respectively while the control group was taught using alternative to practical (i.e. conventional method). Data was collected using Physics Achievement Test on Voltage Measurements (PATVM) were analyzed using ANCOVA. A significant

difference existed between students taught voltage measurements using manufactured voltmeter, improvised voltmeter, and conventional method. The Scheffe tests carried out to determine the direction of significance show that the difference in means of students' achievement between those taught using manufactured and conventional method as well as those taught using improvised analogue voltmeters and conventional method were significant. However, the difference in means between the two experimental groups was not significant. The need for teachers to ensure practical experience as well as use of improvised models in the absence of the manufactured ones to physic was the major recommendations of the study. The aspect of standardization of the improvised instructional resources was completed and reported elsewhere. Based on the finding that improvised resources compare favorably with the manufactured ones, the present study assumed the usability of the improvised instructional materials. Ugbe and Dike, (2012) carried out a study on the comparative effect of using improvised freefall apparatus and bomb calorimeter in teaching the concept of enthalpy in Nigeria Senior Secondary Schools Chemistry. The purpose of the study was to determine the effectiveness of using improvised freefall apparatus and bomb calorimeter in teaching the concept of enthalpy. The study was in response to the call for the deployment of materials within the learners' immediate environment as a means of finding a solution to persistent shortage of learning resources for the teaching of Chemistry in Nigeria Secondary Schools. A total of 93 Senior Secondary two (SS2) chemistry students were involved in the study. This number was made up of 48 females and 45 males from four secondary schools in Calabar Educational Zone of Cross River State of Nigeria. A pretest – posttest control group design was used for the study. Analysis of Covariance (ANCOVA) was used to analyze the data. From the finding, it was observed that improvised freefall apparatus as a resource for teaching the concept of enthalpy was more effective in enhancing students' academic performance in chemistry as compared to bomb calorimeter. The result

also showed an insignificant difference existing between the performance of male and female students when taught the concept of enthalpy using freefall apparatus. Ibrahim (2012) investigated the effects of improvised and conventional instructional materials on students' academic achievements and attitude to Basic Science. Experimental design using pretest and posttest was adapted. Random sampling was used to select the 3 schools out of 10 co-educational primary schools in Wase Supervisory Zone of Wase LGA Plateau State. The sample of 120 primary 5 pupils was selected through the use of table of random numbers. The selected schools were randomly assigned to experimental group I, experimental group II and control group. The experimental group I was exposed to improvised materials and experimental group II was taught with conventional instructional materials. The control group was taught with lecture method. The instruments used for data collection were Basic Science Achievement Test (BSAT) and Basic Science Attitude Questionnaire (BSAQ) with reliability co-efficient of 0.73 and 0,83 respectively. Three hypotheses were tested at P_0.05 level of significance using Analysis of variance (ANOVA), t-test and Wilxocon Signed Rank Test. The findings showed that pupils taught with improvised and conventional materials have no significant difference in their mean scores but showed significant difference with the control group. In addition, no significant difference in the pupils' attitude before and after exposure to improvise and those exposed to conventional instructional materials. Based on this finding, it was recommended that Basic Science teachers should be trained through workshops on how to effectively design and used improvised materials in teaching Basic Science.

The researcher learnt from the study that despite the importance of the use of improvisation to enhance the academic achievement of students, it appears that many still do not use improvised equipment even in the absence of the manufactured materials and equipment. While some argue that improvisation, which makes use of local and sometimes substandard

materials, would lead to substandard science teaching, others however argue that in a situation where the manufactured materials are not available, a validated improvised model could be used. In the light of this argument, the following pertinent questions readily come to mind: Are improvised materials not able to serve the same purpose as the manufactured materials? Moreover, would improvised materials not enhance achievement better than the conventional method of teaching? The present investigation is an attempt to address these questions with particular reference to the effect of students' produced improvised instructional materials on academic achievement of secondary school students. Eriba (2011) improvisation is the act of construction of instructional materials from a locally available materials that can adequately replace or function in place of the original material which otherwise may be expensive or short in supply or unavailable, improvisation therefore is not just an un pre-conceived on the spot activity, improvisation is a state of mind and it is a skill that lies at the heart of good science teaching. Eniayeju (1983) as cited in (Eriba, 2011) sees it as the art of using alternative materials and resource to facilitate instruction whenever there is a lack or shortage of some specific first hand teaching aids. Akinmoyewa (1992) as cited in (Eriba, 2011) sees it as the art of using alternative materials and resources due to lack or insufficiency of some specific first hand teaching aids. Ada (1985) as cited in (Eriba 2011) sees it as a provision of materials locally made by teachers, students or even an education agency as a substitute and supplement to standard and learning of biology.

2.4 Summary of the Literature Reviewed

The problem of inadequate or lack of equipment and instructional materials on human Eye in our secondary schools may be solved through improvisation. But from all literature reviewed, there is no work on there is no work on the improvisation of Internal structure of human Eye that is why we embarked upon. The effect of instructional materials produced by the teacher through improvisation shows that instructional materials enhance effective

communication of science particularly biology. The improvisation of science equipment will go a long way in solving the trouble of lack of interest, low enrolment of science students and poor achievement during examination at senior secondary schools in Nigeria.

The strong factor of the model in this work would go a prolonged way in solving the problem of verbalism during instruction. On the other hand, the improvised model of human Eye from local resource materials would make the concepts seeing clearer enough to sustain the interest of the students in biology. Also it will enable students to visualize, differentiate and have a better understanding of the concept.

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter described the research procedures adopted to collect, analyze and interpret data under these sub-heading – Research Design, Population of the study, Sample and Sampling Techniques, Research Instrument, Method of Data collection and Method of Data Analysis.

3.1 Research Design

The design adopted for this research was a pretest-posttest control group design. The groups of school were first pretested and thereafter the experimental group was taught using a constructed model of the human eye while the control group was taught without using the model.

After the treatment a posttest (same as the pretest) was administered to the groups. The design layout is shown below:

Table 3.1 Research Design Format

Group	Pre-Test	Treatment	Post-Test	Retention
Experimental	O_1	X_1	O_2	O_3
Control	O_1	X_1	O_2	O_3

Key

O_1 = Pre-Test

X_1 = Treatment (instructional Materials)

X_0 = No Treatment (without instructional Materials)

O_2 = Post-test

O_3 = Retention test

3.2 Population of the study

The population of this study consists of all Senior Secondary Schools in Bosso Local Government Area of Niger State in which we have 20 Secondary Schools both in Rural and

Urban areas. However the total number of all SS2 Biology students in all Secondary School in Bosso Local Government Area was 5656 from 20 Secondary Schools. The sample size was 160 SS2 students from the 4 selected Senior Secondary Schools in Minna Metropolis.

3.2 Sample and Sampling Techniques

The sample for the study was made up of 160 SS2 students from 4 Senior Secondary Schools randomly selected in Minna, Niger State. Two of the schools were used as Control group and the other two were used as Experimental group. Tudun Fulani Model Secondary School, Day secondary School Maitumbi formed the Experimental Group while Day Secondary School maikunkele A and Bosso Secondary School formed the control group. Each school used in this study have a population of more than 40students in a class but the researcher randomly selected 40 students (20 boys and 20 girls) to be taught using the constructed model and 40 students (20 boys and 20 girls) to be taught without the model. This is because the study of structure and functions of the eye was part of SS2 content to be learn. A random sampling technique was used in this study to select the samples. According to Tuckman (2012) random sampling is a procedure that assures that each element in a population has an equal chance of being selected.

Table 3.2 Distribution of Experimental and Control group by school

Group	School	Male	Female	Total
Experimental Group	Tudun Fulani Model School	20	20	40
	Day secondary School Maitumbi	20	20	40
Control Group	Day Secondary School Maikunkele A	20	20	40
	Bosso Secondary School	20	20	40
	Total	**80**	**80**	**160**

3.3 Research Instrumentation

Two instruments were developed and used for the purpose of collecting data for this study, they are;

a. Treatment instrument (constructed model of the human eye).

b. Test instrument (Biology Achievement Test BAT)

3.3.1 Development of Biology Achievement Test (BAT)

Biology Achievement Test (BAT) was developed and 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 Post-test to ascertain their retention level. The Biology Achievement Test comprised twenty (20) multiple choice items drawn from past West African Examination Council (WAEC) questions on eye and each question had four options with one correct answer. And each correct answer was scored two marks and the overall scores were forty (40) marks.

3.3.2 Development of human eye model

Picture showing the human eye was downloaded from the internet. Material used includes; 2 by 3 plywood, ceiling board, white rug, paint, top bond gum, frame. The designer in conjunction with the researcher used the picture to develop the human eye model following these procedures

3.3.3 Procedure

The picture was downloaded and printed, the print-out was placed on a plywood using evostic gum. The parts were labelled. The parts were carved out using a fret saw. The bulk was constructed using wood and plywood fastened it together with nails, it was later wrapped with goat net to minimize the usage of POP hence, reducing the weight and cost. Plaster of Paris (POP) was mixed with white glue (top bond) and water into the paste. The structure was covered with the paste until a desirable shape is achieved. It was left to dry and then

painted with the suitable red-oxide auto paint. Each of the parts of the transverse section of the human eye was carved out and painted into different colours using auto paint. These were allowed to dry then fixed into each individual place using evostic gum and glue. The labelling was done using computer and printed hard card. The parts were cut out in rectangular shapes. Each of the parts were held in a position using painted brooms and super glue. The form is held unto the base of ceiling board (Painted white) with screws. The structure was enclosed in a transparent plastic with a base of ceiling board to be lifted using a handle.

MATERIALS USED

Plastic	Metal
wood	Goat net
Plywood	Brooms.
Ceiling board	Nails
Screw	Plaster of Paris (POP)
Water	Adhesives
Cards	Auto Paints

TOOLS

Panel saw	Screw driver
Hammer	Paint Brush
Computer	Hand set
Fret saw	Scissors

3.3.4 Validation of Research Instruments

The two instruments were validated as follows:-

i. **Validation of constructed model of the human eye**

The constructed Model of the human eye was validated by experts from Science Education Department in the School of Science and Technology Education, Federal University of Technology, Minna, Niger state. These experts examined the constructed model of the human eye in terms of fitness, suitability, acceptable technical quality and practicability. Useful and constructive suggestions were made and used for final production of the model.

ii. **Validation of Biology Achievement Test (BAT) instrument**

The test instrument was face and content validated by experts from Science Education Department Federal University of Technology, Minna and Niger State College of Education Minna, Niger State. They scrutinized the instrument in terms of; clarity of instruction to the subject, proper wording of the items, appropriateness and adequacy of the items for the study, structure and adequate timing. Comments and recommendations of these experts helped to modify the items in the instrument.

3.3.4 Reliability of Research Instrument

For the purpose of this study, a test retest method of pilot test was conducted and the data collected were analyzed using the Pearson Product Moment Correlation of Coefficient statistics. Pilot test was conducted in Tudun Fulani Model Secondary School, Minna for two weeks and two classes of SS2 students were randomly selected for the study. A reliability coefficient of 0.05 was obtained.

3.4 Method of Data Collection

The schools selected were visited by the researcher with letter of introduction from the Head of Department of Science Education. Permission was sought from the principal of each of the selected schools which was given. The researcher was introduced to the biology teachers and the students. The aim and mode of research was explained to both the teachers and the students for their cooperation and research assistants were also trained. Thereafter, the

students were sampled; pretest was administered to the students in the two (2) schools in order to assess their entry behavior before the commencement of the treatment while, Posttest was administered after the treatment in the selected schools.

The 1st week was used for orientation for both the teachers and the students, then 2nd week a pretest was administered to the students and the result was recorded. The 3rd and 4th week was given to both Experimental and Control group, the experimental group (Tudun Fulani Model School) was taught using the model of constructed model of human eye while the control group (Day Secondary School Maikunkele A) was taught the same concept without the model. The 5th week revision was done so as to aid assimilation and lastly on the 6th week a posttest was administered to both groups.

3.5 Method of Data Analysis

The data collected was analyzed using Mean and Standard Deviation to answer the research questions, while t-test was used to test each of the hypotheses at 0.05 level of` significance. Any hypothesis that is greater than 5% or p = > 0.05 was rejected and any hypothesis that is less than 5% i.e p = < 0.05% was retained.

CHAPTER FOUR

DATA ANALYSIS AND RESULTS DISCUSSION

4.1 Pre – Test Result

The table below shows the analysis of pre-test score obtained by students from both Experimental and Control group.

Table 4.1 Analysis of Pre-Test Score of Experimental and Control group

	N	Mean	S.D	Df	t-value	p-value	Remark
Experimental	80	14.65	5.464				
				158	1.272	0.205	Not Sig.
Control	80	15.65	4.430				

Table 4.1 shows the score of both experimental and control group. Experimental group has a mean of 14.65 with standard deviation of 5.464 and control group has a mean of 15.65 with standard deviation of 4.430. The degree of freedom is 158 with t-value of 1.272 and p-value of 0.205. P > 0.05 which implies that there is no significant difference between the experimental group and control group.

4.2 Analysis of Research Hypotheses

4.2.1 Analysis Research Hypothesis One

There is no significant difference in the mean achievement scores of students taught Biology using constructed model of human eye and those taught with conventional method.

Table 4.2: t-Test Results of the Difference in Posttest Mean Scores of the Experimental and Control Groups

Group	N	Mean	S. D	Df	t-value	P-Value	Remark
Experimental	80	18.15	3.58	158	3.461	0.001	Sig.
Control	80	15.70	5.22				

Table 4.2 revealed independent t-test results of the mean score difference of the experimental and control groups achievement in the post-test. The Experimental group got mean score of 18.15, standard deviation 3.58, while the control group obtained mean of 15.70, standard deviation 5.22. The t-value is 3.461 with p-value of 0.001. P<0.05which implies that there is significant difference between the mean achievement of students taught Biology using constructed model of human eye and those taught with conventional method. Hence the null hypothesis was rejected.

4.2.2 Analysis of Research Hypothesis Two

There is no significant difference in the mean achievement scores of male and female students taught Biology using constructed model of human eye

Table 4.3: t-Test Results of the Gender Difference in the Posttest of the Experimental Group

Group	N	Mean	S.D	Df	t-value	P-Value	Remark
Males	40	23.93	3.91	78	0.949	0.346	Not Sig.
Females	40	24.73	3.62				

Table 4.3 revealed the independent t-test results of the difference in the achievement of male and female students taught Biology with Collaborative teaching strategy. The male students got mean score of 23.93, standard deviation of 3.91, while the female students had mean score of 24.73, standard deviation of 3.62. The t-value 0.949 with p-value is 0.346. P > 0.05 which implies that there is no significant difference between the academic achievement of male and female students taught Biology using constructed model of human eye and those taught with the conventional method. Hence the null hypothesis was retained.

4.2.3 Analysis of Research Hypothesis Three

There is no significant difference in the mean retention scores of students taught Biology using constructed model of human eye and those taught with conventional method

Table 4.4: Gender Difference in the Retention Mean Scores of the Experimental Group

Group	N	Mean	S.D	Df	t-value	P-Value	Remark
Males	80	18.15	3.58				
				158	3.461	0.001	Sig.
Females	80	15.70	5.22				

Table 4.4 revealed the independent t-test results of the difference in the achievement of male and female students taught Biology with Collaborative teaching strategy. The male students got mean score of 18.15, standard deviation of 3.58, while the female students had mean score of 15.70, standard deviation of 5.22. The t-value is 3.461 with p-value of 0.001. P < 0.05 which implies that there was significant difference between the academic achievement of male and female students taught Biology using constructed model of human eye and those taught with conventional method. Hence the null hypothesis was rejected.

4.2.4 Analysis of Research Hypothesis Four

There is no significant difference in the mean retention scores of student taught Biology using constructed model of human eye based on gender.

Table 4.5: Gender Difference in the Retention Mean Scores of the Experimental Group

Group	N	Mean	S.D	Df	t-value	P-Value	Remark
Males	40	18.40	4.08	78	0.622	0.536	Not sig.
Females	40	17.90	3.04				

Table 4.5 revealed the independent t-test results of the difference in the achievement of male and female students taught Biology with Collaborative teaching strategy. The male students got mean score of 18.40, standard deviation of 4.08, while the female students obtained mean score of 17.90, standard deviation of 3.04. The t-value is 0.622 and p-value is 0.536. P>0.05 which implies that there was no significant difference between the academic achievement of male and female students taught Biology using constructed model of human eye based on gender. Hence the null hypothesis was retained.

4.3 Discussion of Results

1. There was no significant difference between the academic achievement mean scores of the experimental and control groups in the pre-test.
2. There was significant difference between the academic achievement of students taught Biology using constructed model of human eye and those taught with conventional method.
3. There was no significant difference between the academic achievement of male and female students taught Biology using constructed model of human eye.

4. There was significant difference between the academic retention mean scores of students taught Biology using constructed model of human eye and those taught with conventional method.
5. There was no significant difference between the academic retention mean scores of male and female students taught Biology using constructed model of human eye.

4.4 Summary of Findings

From the data presented and analysed in this chapter, it is clear that students who are taught Biology using constructed model will perform better than students taught without constructed model because the model aid students retention ability. From this study it is advised that constructed models should be used in the teaching and learning process of Biology.

CHAPTER FIVE

SUMMARY CONCLUSION AND RECOMMENDATION

5.0 Introduction

This study investigates effect of constructed model of human eye on Secondary School biology students' outcome in Bosso Metropolis. 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:

5.0 Introduction

5.1 Summary

5.2 Major Findings

5.3 Conclusion

5.4 Recommendations

5.5 Contributions to Knowledge

5.6 Limitations of the Study

5.7 Suggestions for Further Studies

5.1 Summary

The study looked at the design and construction of the structure of the human eye for biology instruction and also the academic achievement and retention among biology students. The study has 4 aims, 4 research questions and 4 hypothesis. Two of the hypothesis were accepted while the other were rejected at 0.05 alpha level of significance. A pretest, posttest and retention test for experimental and control was designed and was used. Biology Achievement Test was used as an instrument for data collection.

5.2 Major findings

The major findings from this study shows that the use of instructional materials such as constructed model has so many merit, most especially in enhancing teaching and learning of Biology concepts.

However the major findings from the study include:

1. The use of constructed model in teaching of Biology concepts significantly improves the academic achievements of students involved in the study.
2. The use of constructed model in the teaching and learning of biology concepts is found to be gender-friendly.
3. The use of constructed model as instructional Material enhances retention ability of students.
4. The use of constructed model enhances retention ability of students.
5. Students taught biology concept with the constructed model generally had better academic achievements and retention ability than students who were not taught with the use of constructed model.

5.3 Conclusion

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 retention ability. It is therefore concluded that the use of constructed model significantly improves students' academic achievements and retention among Biology students in Bosso Local Government Minna, Niger state.

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

1. The use of constructed model in teaching Biology concept increases students' performance.

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

5.4 Recommendation

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

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

5.5 Contributions to Knowledge

The contributions of the study to knowledge are as follows:-

1. Learning activities and achievement of students can be enhanced through the use of models and instructional materials.
2. Use of constructed models will reduce the abstract nature of some concepts in biology thereby making learning more stimulating to students.
3. Students exposed to instructional materials and models performed significantly higher than the students who were taught without instructional materials.

5.6 Limitations of the Study

This study has some limitations that include the following: -

1.The study is limited to biology studies.

2. The study is limited to Secondary Schools

5.7 Suggestions for further studies

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

1. Conducting a similar study in other Local Government Areas of Niger 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 constructed model in teaching Biology and other science subjects.

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APPENDICES

APPENDIX A

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

DATE: ……

SCHOOL NAME: ……

CLASS: SS2 ( )

GENDER: MALE ( ) FEMALE ( )

SECTION A: BIOLOGY ACHIEVEMENT TEST (BAT) PRETEST

INSTRUCTION: Answer the following question by ticking ( ) on the right answer.

1- The …….. is the outer layer of the eye and is about 1 millimeter, it is composed of white fibrous tissue.
   A) Choroid
   B) Rod and Cones
   C) Mucous Membrane
   D) Sclera

2- The retina contains …… and …….. cells
   A) Blood vessels and Uveal tract
   B) Optical system and Cornea
   C) Rod and Cone
   D) Iris and Lens

3- The …….. is the internal layer of the eye
   A) Optical nerve
   B) Retina
   C) Reflex
   D) Cornea

4- Aqueous Humor contains the following except
   A) Protein
   B) Vitamin
   C) Water
   D) Blood

5- Choroid is the vascular central layer of the eye lying between …… and …….
   A) Retina and Sclera

B) Rods and Cones
C) Eyeball and Rectus muscles
D) None of the above

6- The eye has …….. layers
A) 5 layers
B) 2 layers
C) 4 layers
D) 3 layers

7- The ……. Is an organ that reacts to light in many circumstances
A) Nose
B) Skin
C) Mouth
D) Eye

8- The sclera is the outer layer of the eye that gives ……. to the eyeball
A) Strength
B) Support
C) Protection
D) All of the above

9- The basic function of choroid is to provide nourishment to the outer layers of the retina through ……..
A) Plasma
B) Lens
C) Blood vessels
D) Thin Layer

10- The …….. nourishes the lens and cornea since they have no blood supply.
A) Suspensory ligament
B) Aqueous humor
C) Optic nerve
D) Vitreous humor

11-Iris is the pigmented tissue lying behind the ……..

A) Sclera
B) Lens
C) Cornea
D) Choroid

12- These following are parts of the eye except

A) Retina
B) Sclera
C) Iris

D) Vestibule

13- The ……. is responsible for maintaining and supporting the position of the eyeball in its normal upward and forward position within the orbit.

A) Rectus muscles
B) Oblique Muscles
C) Suspensory ligament
D) Papillary opening

14- The ……... Is the light sensitive nerve in the eye

A) Lens
B) Iris
C) Sclera
D) Retina

15- The sclera is composed of …….

A) Oblique Muscles
B) Fibrous Tissues
C) Rod and Cone cells
D) None of the above

16- The sclera is the outer layer of the eye and it is about …… thick.

A) 3 millimeter
B) 1 millimeter
C) 2 millimeter
D) 4 millimeter

17- …… is the pigmented tissue lying behind the cornea that gives colour to the eye and controls the amount of light entering the eye?

A) Ciliary Muscles
B) Retina
C) Iris
D) Choroid

18- The .....is the transparent, colorless gelatinous mass that fills rear two-thirds of the eyeball.

A) Suspensory ligament
B) Vitreous Humor
C) Sclera
D) Iris

19- Vitreous humor is found between the …….. And …….

A) Lens and Retina
B) Lens and Cornea

C) Sclera and Retina
D) None of the Above

20- …….. is also called the white of the eye

A) Rectus Muscles
B) Mucous Membrane
C) Optical Nerve
D) Ciliary Muscles.

APPENDIX B

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

DATE: ……

SCHOOL NAME: ……

CLASS: SS2 ( )

GENDER: MALE ( ) FEMALE ( )

SECTION A: BIOLOGY ACHIEVEMENT TEST (BAT) POSTEST

INSTRUCTION: Answer the following question by ticking ( ) on the right answer.

1-The …….. is the outer layer of the eye and is about 1 millimeter, it is composed of white fibrous tissue.

A) Choroid

B) Rod and Cones

C) Mucous Membrane

D) Sclera

2-The retina contains …… and …….. cells

A) Blood vessels and Uveal tract
B) Optical system and Cornea
C) Rod and Cone
D) Iris and Lens

3-The …….. is the internal layer of the eye

A) Optical nerve
B) Retina
C) Reflex
D) Cornea

4-Aqueous Humor contains the following except

A) Protein
B) Vitamin
C) Water
D) Blood

5-Choroid is the vascular central layer of the eye lying between …… and …….

A) Retina and Sclera
B) Rods and Cones
C) Eyeball and Rectus muscles
D) None of the above

6-The eye has …….. layers

A) 5 layers
B) 2 layers
C) 4 layers
D) 3 layers

7-The ……. Is an organ that reacts to light in many circumstances

A) Nose
B) Skin
C) Mouth
D) Eye

8-The sclera is the outer layer of the eye that gives ……. to the eyeball

A) Strength
B) Support
C) Protection
D) All of the above

9-The basic function of choroid is to provide nourishment to the outer layers of the retina through ……..

A) Plasma
B) Lens
C) Blood vessels
D) Thin Layer

10-The …….. nourishes the lens and cornea since they have no blood supply.

A) Suspensory ligament
B) Aqueous humor
C) Optic nerve
D) Vitreous humor

11-Iris is the pigmented tissue lying behind the ……..

A) Sclera
B) Lens
C) Cornea
D) Choroid

12-These following are parts of the eye except

A) Retina
B) Sclera
C) Iris
D) Vestibule

13- The ……. is responsible for maintaining and supporting the position of the

eyeball in its normal upward and forward position within the orbit

A) Rectus muscles
B) Oblique Muscles
C) Suspensory ligament
D) Papillary opening

14-The ……... Is the light sensitive nerve in the eye

A) Lens
B) Iris
C) Sclera
D) Retina

15-The sclera is composed of …….

A) Oblique Muscles
B) Fibrous Tissues
C) Rod and Cone cells
D) None of the above

16- The sclera is the outer layer of the eye and it is about …… thick.

A) 3 millimeter
B) 1 millimeter
C) 2 millimeter

D) 4 millimeter

17- …… is the pigmented tissue lying behind the cornea that gives colour to the eye and controls the amount of light entering the eye?

A) Ciliary Muscles
B) Retina
C) Iris
D) Choroid

18- The .....is the transparent, colorless gelatinous mass that fills rear two-thirds of the eyeball.

A) Suspensory ligament
B) Vitreous Humor
C) Sclera
D) Iris

19- Vitreous humor is found between the …….. And …….

A) Lens and Retina
B) Lens and Cornea
C) Sclera and Retina
D) None of the Above

20- …….. is also called the white of the eye

A) Rectus Muscles
B) Mucous Membrane
C) Optical Nerve
D) Ciliary Muscles.

APPENDIX C

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT OF SCIENCE EDUCATION

DATE: ……

SCHOOL: ……

CLASS: SS2 ( )

GENDER: MALE ( ) FEMALE ( )

SECTION C: BIOLOGY ACHIEVEMENT TEST (BAT) RETENTION TEST

1- Vitreous humor is found between the …….. And …….

A) Lens and Retina
B) Lens and Cornea
C) Sclera and Retina
D) None of the Above

2- These following are parts of the eye except

A) Retina
B) Sclera
C) Iris
D) Vestibule

3- The ……. is responsible for maintaining and supporting the position of the eyeball in its normal upward and forward position within the orbit.

A) Rectus muscles
B) Oblique Muscles
C) Suspensory ligament
D) Papillary opening

4- …….. is also called the white of the eye

A) Rectus Muscles
B) Mucous Membrane
C) Optical Nerve
D) Ciliary Muscles.

5- The …….. is the outer layer of the eye and is about 1 millimeter, it is composed

of white fibrous tissue

A) Choroid
B) Rod and Cones
C) Mucous Membrane
D) Sclera

6-The retina contains …… and …….. cells

A) Blood vessels and Uveal tract
B) Optical system and Cornea
C) Rod and Cone
D) Iris and Lens

7-The …….. is the internal layer of the eye

A) Optical nerve
B) Retina
C) Reflex
D) Cornea

8-Aqueous Humor contains the following except

A) Protein
B) Vitamin
C) Water
D) Blood

9-Choroid is the vascular central layer of the eye lying between …… and …….

A) Retina and Sclera
B) Rods and Cones
C) Eyeball and Rectus muscles
D) None of the above

10- The eye has …….. layers

A) 5 layers
B) 2 layers
C) 4 layers
D) 3 layers

11-The ……. Is an organ that reacts to light in many circumstances?

A) Nose
B) Skin
C) Mouth
D) Eye

12-The sclera is the outer layer of the eye that gives ……. to the eyeball

A) Strength
B) Support
C) Protection
D) All of the above

13-The basic function of choroid is to provide nourishment to the outer layers of the retina through ……..

A) Plasma
B) Lens
C) Blood vessels
D) Thin Layer

14-The …….. Nourishes the lens and cornea since they have no blood supply.

A) Suspensory ligament
B) Aqueous humor
C) Optic nerve
D) Vitreous humor

15- Iris is the pigmented tissue lying behind the ……..

A) Sclera
B) Lens
C) Cornea
D) Choroid

16- The sclera is composed of …….

A) Oblique Muscles
B) Fibrous Tissues
C) Rod and Cone cells
D) None of the above

17-The sclera is the outer layer of the eye and it is about …… thick.

A) 3 millimeter
B) 1 millimeter
C) 2 millimeter
D) 4 millimeter

18- …… is the pigmented tissue lying behind the cornea that gives colour to the eye and controls the amount of light entering the eye?

A) Ciliary Muscles
B) Retina
C) Iris
D) Choroid

19-The .....is the transparent, colorless gelatinous mass that fills rear two-thirds of the eyeball

A) Suspensory ligament
B) Vitreous Humor
C) Sclera
D) Iris

20-The …….. is the outer layer of the eye and is about 1 millimeter, it is Composed of white fibrous tissue.

A) Choroid
B) Rod and Cones
C) Mucous Membrane
D) Sclera

APPENDIX D

ANSWERS TO BIOLOGY ACHIEVEMENT TEST (PRETEST & POSTEST)

1- D

2- C

3- B

4- D

5- A

6- D

7- D

8- D

9- C

10- B

11- C

12- D

13- C

14- D

15- B

16- B

17- C

18- B

19- A

20- B

APPENDIX E

ANSWERS TO BIOLOGY RETENTION TEST

1- A

2- D

3- C

4- B

5- D

6- C

7- B

8- D

9- A

10- D

11- D

12- D

13- C

14- B

15- C

16- B

17- B

18- C

19- B

20- C

APPENDIX F
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
LESSON PLAN FOR EXPERIMENTAL GROUP

SCHOOL	Tudun Fulani Model Secondary School
DATE	9/08/2021
CLASS	SS 2
SUBJECT	Biology
TOPIC	Sense Organ (Human Eye)
SUB-TOPIC	Parts of the Eye
TIME	9:00am – 10:00am
DURATION	60minutes
METHOD	Demonstration
INSTRUCTIONAL MATERIAL	Constructed Model of Human Eye
PREVIOUS KNOWLEDGE	The students on their own knows the use Of the eye which is for sight
BEHAVIOURAL OBJECTIVES	At the end of the lesson, the student Should be able to:

1- Describe the structure of Human Eye
2- State the three layers of the eye
3- Discuss the three layers of the eye
4- List at least five part of Human eye
5- Explain the function of at least three part of the eye.

INTRODUCTION	The teacher introduces the lesson by writing the topic on the chalkboard the topic. Sense Organ (Human eye)
PRESENTATION	The teacher presents the lesson in the following steps.
STEP 1	The teacher describe the human eye. The human eye is an organ that reacts to light in many circumstances. As a conscious sense organ, the human eye allows vision, rod and cone cells in the retina allow conscious light perception and vision, including differentiation of colors.
STEP 2	The three layers of the eye are Sclera, Retina and Choroid
STEP 3	Function of the three layers of the eye.

1-	Sclera is the outer layer of the eye and is about 1 millimeter thick, it is composed of fibrous tissues and gives strength, support, protection and form to the eyeball from the front.
2-	Retina is the internal layer of the eye and it contains rod and cone cells. The retina is the light sensitive nerve in the eye.
3-	Choroid is the vascular central layer of the eye lying between the retina and sclera. It basic function is to provide nourishment to the outer layers of the retina through blood vessels.
STEP 4	List five parts of the eye
1-	Aqueous humor
2-	Lens
3-	Vitreous humor
4-	Iris
5-	Suspensory Ligament
STEP 5	Explain the functions of 5 parts of the eye listed above.
1-	Suspensory ligament is a series of fibres that connect the ciliary body of the eye with the lens holding it in place, the ligament is responsible for maintaining and supporting the position of the eyeball in its normal upward and forward position within the orbit.
2-	Iris is the pigmented tissue lying behind the cornea that gives color to the eye and controls the amount of light entering the eye by varying the size of the papillary opening. It functions like camera.
3-	Aqueous humor is a thin transparent fluid, it is made up of 99.9% of water, and the other 0.1% consist of sugars, vitamins, proteins and other nutrients. This fluid nourishes the cornea and the lens, and gives the eye its shape.
SUMMARY	The teacher summarizes the lesson by highlighting the main points.
EVALUATION	The teacher evaluates the student to know if the concepts have being understood by asking the following questions.
1-	Describe the structure of human eye
2-	State the three layers of the eye
3-	List at least five parts of the eye
CONCLUSION	The teacher concludes the lesson by giving the student Assignment to take home.
1-	Draw a well label diagram of human eye
2-	Explain at least two label part

APPENDIX G
FEDERAL UNIVERSITY OF TECHNOLOGY MINNA
LESSON PLAN FOR CONTROL GROUP

SCHOOL	Day Secondary School Maikunkele A
DATE	9/08/2021
CLASS	SS 2
SUBJECT	Biology
TOPIC	Sense Organ (Human Eye)
SUB-TOPIC	Parts of the eye
TIME	9:00am – 10:00am
DURATION	60minutes
METHOD	Demonstration
INSTRUCTIONAL MATERIAL	Chalkboard
BEHAVIOURAL OBJECTIVES	At the end of the lesson, the student
	Should be able to:

1- Describe the structure of Human Eye
2- State the three layers of the eye
3- Discuss the three layers of the eye
4- List at least five part of Human eye
5- Explain the function of at least three part of the eye.

INTRODUCTION	The teacher introduce the lesson by writing the topic on the chalkboard. Sense organ (Human eye)
PRESENTATION	The teacher presents the lesson in the following steps.
STEP 1	The teacher describe the human eye. The human eye is an organ that reacts to light in many circumstances. As a conscious sense organ, the human eye allows vision, rod and cone cells in the retina allow conscious light perception and vision including differentiation of colors.
STEP 2	The three layers of the eye are Sclera, Retina and Choroid
STEP 3	Function of the three layers of the eye

1-	Sclera is the outer layer of the eye and is about 1 millimeter thick, it is composed of fibrous tissues and gives strength, support, protection and form to the eyeball from the front.
2-	Retina is the internal layer of the eye and it contains rod and cone cells. The retina is the light sensitive nerve in the eye.
3-	Choroid is the vascular central layer of the eye lying between the retina and sclera. It basic function is to provide nourishment to the outer layers of the retina through blood vessels.
STEP 4	List five parts of the eye
1-	Aqueous humor
2-	Lens
3-	Vitreous humor
4-	Iris
5-	Suspensory Ligament
STEP 5	Explain the function of any 3 parts the eye listed above.
1-	Suspensory ligament is a series of fibres that connect the ciliary body of the eye with the lens holding it in place, the ligament is responsible for maintaining and supporting the position of the eyeball in its normal upward and forward position within the orbit.
2-	Iris is the pigmented tissue lying behind the cornea that gives color to the eye and controls the amount of light entering the eye by varying the size of the papillary opening. It functions like camera.
3-	Aqueous humor is a thin transparent fluid, it is made up of 99.9% of water, and the other 0.1% consist of sugars, vitamins, proteins and other nutrients. This fluid nourishes the cornea and the lens, and gives the eye its shape.
SUMMARY	The teacher summarizes the lesson by highlighting the main points.
EVALUATION	The teacher evaluates the student to know if the concepts have being understood by asking the following questions.
1-	Describe the structure of human eye
2-	State the three layers of the eye
3-	List at least five parts of the eye
CONCLUSION	The teacher conclude the lesson by giving the student Assignment to take home.
1-	Draw a well label diagram of human eye
2-	Explain at least two label parts.

Descriptives

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
POST-EXP	80	22.15	.760	6.801
POST-CONTROL	80	23.40	.514	4.594
Valid N (listwise)	80			

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
POST-EXP	Male	40	19.70	6.907	1.092
	Female	40	24.60	5.804	.918

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
POST-EXP	Equal variances assumed	3.920	.051	-3.435	78
	Equal variances not assumed			-3.435	75.752

Independent Samples Test

	t-test for Equality of Means

		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
POST-EXP	Equal variances assumed	.001	-4.900	1.426	-7.740
	Equal variances not assumed	.001	-4.900	1.426	-7.741

Independent Samples Test

		t-test for Equality of Means: 95% Confidence Interval of the Difference Upper
POST-EXP	Equal variances assumed	-2.060
	Equal variances not assumed	-2.059

Descriptives

Descriptive Statistics

	N	Mean		Std. Deviation
	Statistic	Statistic	Std. Error	Statistic
REN-EXP	80	15.70	.584	5.220
REN-CONTROL	80	18.15	.401	3.583

Valid N (listwise)	80			

Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
REN-EXP	Male	40	14.80	6.090	.963
	Female	40	16.60	4.056	.641

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
REN-EXP	Equal variances assumed	2.696	.105	-1.556	78
	Equal variances not assumed			-1.556	67.911

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference Lower
REN-EXP	Equal variances assumed	.124	-1.800	1.157	-4.103
	Equal variances not assumed	.124	-1.800	1.157	-4.109

Independent Samples Test

		t-test for Equality of Means: 95% Confidence Interval of the Difference: Upper
REN-EXP	Equal variances assumed	.503
	Equal variances not assumed	.509

Descriptive Statistics

	N	Mean	Std. Deviation
PRE-EXP	80	14.65	5.464
PRE-CONTROL	80	15.65	4.430
Valid N (listwise)	80		

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean: Lower Bound
PRE-EXP	Male	40	13.80	5.431	.859	12.06
	Female	40	15.50	5.430	.859	13.76
	Total	80	14.65	5.464	.611	13.43
PRE-CONTROL	Male	40	16.80	4.681	.740	15.30
	Female	40	14.50	3.889	.615	13.26
	Total	80	15.65	4.430	.495	14.66

Descriptives

		95% Confidence Interval for Mean		
		Upper Bound	Minimum	Maximum
PRE-EXP	Male	15.54	6	24
	Female	17.24	8	28
	Total	15.87	6	28
PRE-CONTROL	Male	18.30	10	24
	Female	15.74	8	24
	Total	16.64	8	24

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PRE-EXP	Between Groups	57.800	1	57.800	1.960	.165
	Within Groups	2300.400	78	29.492		
	Total	2358.200	79			
PRE-CONTROL	Between Groups	105.800	1	105.800	5.713	.019
	Within Groups	1444.400	78	18.518		
	Total	1550.200	79			

NIGER STATE MINISTRY OF EDUCATION, MINNA

LIST OF SENIOR SECONDARY SCHOOLS IN BOSSO LGA BY BY ENROLMENT AND GENDER

S/N	SCHOOL NAME	TOWN	LGA	TYPE OF SCHOOL(PUBLIC OR PRIVATE)	LOCATION (URBAN OR RURAL)	ENROLMENT BY CLASS								
						SS1			SS2			SS3		
						MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE	TOTAL
1	FEDERAL GOVERNMENT COLLEGE MINNA	Tungan-Goro	BOSSO	Public	Urban	244	185	429	172	140	297	154	114	268
2	ABDULLAHI DADA SECONDARY SCHOOL MAIKUNKELE	Maikunkele	BOSSO	Public	Urban	42	75	117	63	59	122	47	73	120
3	DAY SECONDARY SCHOOL MAIKUNKELE 'A'	Maikunkele	BOSSO	Public	Urban	71	47	118	68	55	123	60	30	65
4	DAY SECONDARY SCHOOL CHANCHAGA MINNA'B'	Chanchaga	BOSSO	Public	Urban	215	231	446	144	161	305	163	161	324
5	GOVERNMENT ARMY DAY SECONDARY SCHOOL	Chanchaga	BOSSO	Public	Urban	350	341	691	360	362	722	346	759	1105
6	BOSSO SECONDARY SCHOOL MINNA	Shango	BOSSO	Public	Urban	274	188	462	211	199	410	162	141	303
7	HILLTOP MODEL SECONDARY SCHOOL	Maitunbi, Minna	BOSSO	Public	Urban	274	492	766	188	292	480	234	324	558
8	NIGER STATE SCHOOL FOR SPECIAL EDUCATION MINNA	Bosso	BOSSO	Public	Urban	24	3	27	25	13	38	22	10	32
9	DAY SECONDARY SCHOOL MAITUMBI MINNA	Maitunbi, Minna	BOSSO	Public	Urban	164	200	364	184	200	384	120	90	210
10	SHEIKH MUHAMMAD SANBO COLLEGE OF ARTS AND ISLAMIC STUDIES TUDUN FULANI MINNA	Tudun-Fulani, Mi	BOSSO	Public	Urban	239	35	274	345	49	394	202	35	237
11	DAY SECONDARY SCHOOL GBADA GIDAN MONGORO	Mongoro	BOSSO	Public	Rural	174	163	337	115	94	209	97	60	157
12	GOVERNMENT DAY SECONDARY SCHOOL BEJI	Beji	BOSSO	Public	Rural	136	132	268	79	87	166	131	86	217
13	DAY SECONDARY SCHOOL GARATU	Garatu	BOSSO	Public	Rural	102	59	161	74	47	121	75	42	117
14	GOVERNMENT SENIOR SECONDARY SCHOOL KAMPALA	Kampala	BOSSO	Public	Urban	59	65	124	58	80	138	58	51	109
15	DAY SECONDARY SCHOOL SHATTA	Shatta	BOSSO	Public	Rural	34	38	72	50	27	77	50	27	77
16	DAY SECONDARY SCHOOL PYATA	Pyata	BOSSO	Public	Rural	37	48	85	59	66	125	93	89	182
17	GOVERNMENT TECHNICAL COLLEGE, MINNA	Tungan-Goro	BOSSO	Public	Urban	443	21	464	458	66	524	340	58	398
	SCIENCE SCHOOLS													
18	GOVERNMENT SCIENCE COLLEGE CHANCHAGA	Chanchaga	BOSSO	Public	Urban	142	186	328	220	251	471	221	234	455
19	MARYAM BABANGIDA GIRLS SCIENCE COLLEGE, BOSSO	Bosso-Minna	BOSSO	Public	Urban	0	500	500	0	372	372	0	427	427
20	MODEL SCIENCE COLLEGE TUDUN FULANI	Tudun-Fulani, M	BOSSO	Public	Urban	87	104	191	82	96	178	60	50	110

SOURCE: 2019/2020 ANNUAL SCHOOL CENSUS REPORT

ABDULLAHI ABUBAKAR MUSA
HEAD OF UNIT
FOR: SECRETARY (PRS)

Min. of Educ. Science & Tech.
Minna Niger State
Sign.... Date 29-J-2024

67471
30230

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

DEPARTMENT SCIENCE EDUCATION

Vice Chancellor: PROF. ABDULLAHI BALA, Ph.D Fssn
Head of Department: DR. RABIU M. BELLO PhD, MSTAN

Federal University of Technology
P.M.B. 65,
Minna, Niger State.
Nigeria.

Date:

Name: Salihu Ibrahim Lemu

Matriculation No: 2017/3/69245BE

TO WHOM IT MAY CONCERN

The student Candidate whose particulars appear on this form is carrying out his/her final year project work.

Please, kindly assist him/her in whatever way possible towards completing this research work.

Thank you in anticipation of your full cooperation.

Dr. Rabiu M. Bello
HOD, Science Education.

Head of Department
Science Education
Fed. University of Technology
Minna
DATE

Contact: 234-803-592-7009
234-802-635-6884
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PRINCIPAL
DAY SECONDARY SCHOOL
NKELE
12/8/2021

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA.

SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION

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Head of Department
Science Education
Fed. University of Technology
Minna
DATE

PRINCIPAL
Model Science College
Tudun Fulani Bosso, Minna
Date 11-05-2021

RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma,

The candidate Salihu Ibrahim Lemu with Admission Number 2017/3/69245BE is a student of the department. You are requested to make amends or inputs that will improve the quality of the instrument. Your professional expertise is expected to assist the researcher towards the award of the degree.

Thank you

Dr. Rabiu M. Bello

Head of Department
Science Education
Federal University of Technology
Minna

HOD (Signature, Date & Official Stamp) DATE

Title of the Research Instrument: EFFECT OF CONSTRUCTED MODEL OF HUMAN EYE ON SECONDARY SCHOOL BIOLOGY STUDENTS LEARNING OUTCOME

SECTION A

1. Appropriateness of the Research Instrument title: The (Model) is appropriate for the study and its title. (research instrument)
2. Suggest amendment if not appropriate: Non
3. Completeness of Bio-data Information: Complete with minor modification
4. Suggest inputs if incomplete
5. Suitability of items generated: Very suitable for the targetted audiance
6. Structure of the questionnaire/ test items generated: Appropriate
7. Structure of the instrument in line with the objectives of the study: Suitable and inline with the objective
8. Items coverage and distribution across constructs and domains measured: The items cover all relevant parts aimed at measuring
9. Appropriateness of the instrument in relation to the type of data to be collected: Appropriate
10. What is the general overview and outlook of the instrument? Satisfactory / Good.
11. Rate the Instrument between 1-10 (8)

SECTION B

Name of the validator: Dr. Bala Abubakar

Designation/Rank: Chief Lect.

Name of institution: C.O.E., Mx.

Department/ School: Mathematics

Telephone No/GSM No: 08092038244b4

E-Mail Address: abubakarbala 0820 gmail.com.

11/08/2021.

Signature, Date and stamp (if available)

RESEARCH INSTRUMENT VALIDATION FORM

Sir/Ma

he candidate Salihu Ibrahim Lemu, with Admission Number 2017/3/69245BE
e student of the department. You are requested to make amends or inputs that will improve
he quality of the instrument. Your professional expertise is expected to assist the researcher
owards the award of the degree.

Thank you

Dr. Rabiu M. Bello

Head of Department
Science Education
Fed. University of Technology
Minna

HOD (Signature, Date & Official Stamp)

itle of the Research Instrument: EFFECT OF CONSTRUCTED MODEL OF HUMAN EYE ON SECONDARY SCHOOL BIOLOGY STUDENTS LEARNING OUTCOME

SECTION A

1. Appropriateness of the Research Instrument title: The Instrument is an appropriate one.
2. Suggest amendment if not appropriate: NIL
3. Completeness of Bio-data Information: Complete
4. Suggest inputs if incomplete NIL
5. Suitability of items generated They are correct for the data it intend to generate.
6. Structure of the questionnaire/ test items generated They are well structured
7. Structure of the instrument in line with the objectives of the study. well structured
8. Items coverage and distribution across constructs and domains measured It has Covered a substantial Part
9. Appropriateness of the instrument in relation to the type of data to be collected Appropriate
10. What is the general overview and outlook of the instrument? The Instrument is a good one
11. Rate the instrument between 1-10 9

S

SECTION B

Name of the validator: Mal A.U. Laka

Designation/Rank: Graduate Assistant

Name of institution: FUT Minna

Department/ School: SCIENCE EDUCATION

Telephone No/GSM No: 08035094972

E-Mail Address: aulakab@gmail.com

10/08/2021

Signature, Date and stamp (if available)