EFECTS OF VISUAL INSTUCTIONAL MATERIALS ON STUDENTS' PERFORMANCE IN AGRICULTURAL SCIENCE OF SENIOR SECONDARY SCHOOLS IN TARABA STATE, NIGERIA

BY

Sani maikano ABDULLAHI

DEPARTMENT OF EDUCATIONAL FOUNDATION AND CURRICULUM,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

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BY

Sani Maikano ABDULLAHI,
BSc. (Ed.) AGRIC. EDUCATION (ABU, ZARIA)
P14EDFC 8065

A DISSERTATION SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN CURRICULUM AND INSTRUCTION

DEPARTMENT OF EDUCATIONAL FOUNDATION AND CURRICULUM,
FACULTY OF EDUCATION,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

Supervisors;

Dr. A. A. Dada

Dr. M. A. Aminu

MARCH, 2019

DECLARATION

I hereby declare that this Dissertation titled "Effects of Visual instructional materials on students' performance in Agricultural science of senior secondary schools in Taraba State, Nigeria" was written by me in the Department of Educational Foundation and Curriculum under the supervision of Dr. A. A. Dada, Dr. M. A. Aminu and Prof. (Mrs.) H. O. Yusuf, the head of Curriculum Instruction Section. The information derived from the literature has been duly acknowledged in the text and a list of reference provided. There is no part of this work that has been presented for another degree or diploma at any institution.

_____ _____

Sani Maikano ABDULLAHI Signature & Date

CERTIFICATION

This Dissertation entitled EFFECTS OF VISUAL INSTRUCTIONAL MATERIALS ON STUDENTS' PERFORMANCE IN AGRICULTURAL SCIENCE OF SENIOR SECONDARY SCHOOLS IN TARABA STATE, NIGERIA by Sani Maikano ABDULLAHI meets the regulation governing the award of the degree of Masters of Education in Curriculum and Instruction of Ahmadu Bello University Zaria and is approved for its contribution to knowledge and literary presentation.

_____ _____

Dr. A. A. Dada — Date
Chairman, Supervisory Committee

_____ _____

Dr. M. A. Aminu — Date
Member, Supervisory Committee

_____ _____

Dr. M. I. Harbau — Date
Head of Department

_____ _____

Professor A. Z. Abubakar — Date
Dean School of Postgraduate Studies

DEDICATION

This work is dedicated to my beloved and caring wife, Rahinatu Habila Mamman for her financial support, patience and prayers that made this work a reality.

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All thanks be to Allah, the Almighty, who sustained my life up to this moment, who give us power, wisdom and patience throughout the period of my studies. I also pray to our beloved Prophet Muhammad (peace be upon Him), His family, His companions and to all those who follow their ways of life up to the last hour, ameen. The researcher will like to specially thank Dr. A. A. Dada for his patience and courage in putting me through in the course of this work. He is my teacher, mentor and supervisor. The researcher expresss profound gratitude to Dr. M. A. Aminu my other supervisor for his patience, understanding, useful and constructive criticisms at every stage of the work which had refined the work. I express my deep appreciation to the Head of Department, Dr. M. I. Harbau for his fatherly advice to me and the entire students. I am also grateful to the Head of Curriculum and Instruction Section, Prof. (Mrs.) H. O. Yusuf for her useful advice to the entire students. Also, I express my deep appreciation to the entire members of the supervisory committee such as, Prof. A. Guga, Dr. (Mrs.) W. A. Ehinmidu, Dr. (Mrs.) Y. A. Halima, Dr. S. U. El-Yakub, Lawal Abubakar, Dr. I. Ismaila and Dr. P. A. Motemilola who worked tirelessly with keen interest during seminars. May the GOD Almighty reward them abundantly ameen.

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ABSTRACT

This study was conducted to investigate the effects of visual instructional materials on students' performance in Agricultural Science of senior secondary schools in Taraba State, Nigeria. Three thousand, one hundred and five students were the target population. The study had a sample size of three hundred and forty-two students in intact classes from the four senior secondary schools in the Northern Senatorial District of Taraba State. The researcher used quasi experimental design. size. The study had four Objectives which include; assess the effect of diagrams on students' performance in agricultural science of senior secondary schools, ascertain the effect of maps on students' performance in agricultural science of senior secondary schools, identify the effect of specimens on students' performance in Agricultural Science of Senior Secondary Schools and compare the effect of diagrams, maps and specimens on students' performance in Agricultural Science of Senior Secondary Schools; four research questions; which include, what are the effect of diagrams on students' performance in agricultural science of senior secondary schools, what are the effect of maps on student' performance in Agricultural Science of Senior Secondary Schools, what are the effect of specimens on students' performance in agricultural science of senior secondary schools what are the effect of diagrams, maps and specimens on students' performance in Agricultural Science of Senior Secondary Schools and four null hypotheses were formulated in line with the research objective. The pretest and posttest items were fifty (50) used as instruments for data collection before and after the treatment, respectively. The descriptive statistics was used to analyze the research questions, while inferential statistics was used to test the four null hypotheses at 0.05 level of significance. Results of the null hypotheses show that, the four null hypotheses were all rejected. Criteria for the selection of Visual Instructional Materials includes; need of the learners, objectives of the lesson, Teacher capability, size of the class, Knowledge, authority and Appropriateness of the visual instructional materials, Scope of the learners and visual materials. Among the findings of the study were that; there was a significant difference on the mean performance of experimental group taught anatomy and physiology of farm animal's concepts using diagrams in agricultural science and those taught without diagrams among senior secondary school students; there was a significant difference on the mean performance of the experimental group taught animal nutrition concepts using specimens in agricultural science and those taught without specimens among senior secondary school students. As a result of the findings from this study, it was concluded that the use of visual instructional materials in teaching and learning of Agricultural science in senior secondary schools in Taraba State was very effective as it enhanced students' performance in test administered on them. The following recommendations were made, the teachers should ensure that, they are always using diagrams in teaching anatomy and physiology of farm animals and other related concepts in Agricultural Science as this simplify and clarify what is complex and difficult to explain in words. As a skilled based subject, the teacher should always expose students to different types of specimens that will motivate them to think critically as well as to stimulate and sustain their interest throughout the period of lessons.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

Agricultural Education like any other educational sector is very essential for agricultural development. Education serves as the avenue for change and hastens the adoption of innovation by providing the curriculum materials and manpower to service the agricultural sector. In Nigeria, agricultural education has been identified as one of those factors to be used to improve agricultural productivity. For this reason, institutions and departments specializing in the teaching of Agricultural Science have been established. Such schools and departments include Polytechnics, Colleges of Agriculture and Education, conventional universities and specialized universities of Agriculture. The Nigeria government has also made the teaching of Agricultural Science as vocational subject compulsory in both primary and post primary school levels (FRN, 2009).

The areas to specialize normally include Crop science and production, Plant pathology, Soil Science, Animal production and protection, agricultural economics and extension. Graduates in the specialized areas have continued to play a leading role in the management of the agricultural sector in the country. FRN, (2009) has stated the Agricultural Science curricular objectives of senior secondary schools as; to prepare students for occupation in Agriculture, stimulate and sustain students' interest in agriculture, enable students acquire basic knowledge and practical skills in Agriculture, as well as to prepare students for further studies in various fields of agriculture.

Visual instructional materials are those teaching materials used by the teachers while teaching and which make teaching clearer and easier for the students to understand. Such visual instructional materials include, graphic aids: display boards: 3-d-aids: printed materials and activity aids. The visual instructional materials are one of the Agricultural Science curriculum materials that the teacher of Agricultural Science uses in achieving its

objectives. These visual instructional materials are indispensable tools in teaching – learning process of Agricultural Science. The Agricultural Science teacher uses these things to help students in their learning (Yusuf, 2012). Visual instructional materials are inexpensive to use and relatively less sophisticated as compared to audio-visuals. Visual instructional materials strengthen understanding, motivate and sustain students' interest, especially abstract processes which one can envision in their mind. For instance, if a student can see models or activity aid or an animation of the abstract process, they will learn more easily than just abstract.

Student academic performance can be seen as how students perform in school or the level of attainment in an examination or in acquiring some skills. Hence, the success of a learner is generally determined by the academic performance in the subject taken. According to Cambridge University Reporter (2003), academic performance is frequently defined in term of examination performance. The students' performance is his ability to do something (Fachano and Malongo, 2015). This ability is evaluated by the marks and grades that the students obtain in a test or examination which is done at the end of a topic, school term or year or education cycle. The scores and grades that a student obtains measures the degree of his performance.

Student academic performance is a critical determining factor for student to exploit areas of discipline in the field of agriculture. Academic performance is also applicable to prepare students for occupation and for further studies in agriculture. Therefore, in measuring students' academic performance in Agricultural Science as a school subject, various activities are undertaken within and outside the classrooms. Such tasks as assignment, test, examination, farm practical and fieldwork. External and independent examining bodies such as West African Examination Council (WAEC) and National Examination Council (NECO) have also emerged to validate the assessment of

student academic performance in Agricultural Science. These examination bodies measure students' academic performance.

Agricultural science as a subject in senior secondary schools is studied as a science and a business of crop producing and livestock for economic purposes. Agricultural Science is also a broad multidisciplinary field of biology that encompasses the parts of exact, natural, economic and social sciences that are used in the practice and understanding of agriculture. Agriculture is the set of activities that transform the environment for the production of animals and plants for human use (South African Qualification Authority 2003). Agricultural Science as a science refer to the utilization of all modern technologies developed through a scientific principle such as crop improvement/breeding, crop protection, animal improvement/breeding, Agricultural economics and extension, to maximize the yield and profit. Agricultural Science as a business aims at maximum net return through the management of land, labour, water and capital, employing the knowledge of various sciences for production of food, feed, fibers and fuel. Agricultural Science as a subject consists of the following branches; crop production, horticulture, agricultural engineering, forestry, animal husbandry, fishery sciences and Home Science (Talathi, Naik and Jalgaonkar, 2014). Although, most people see Agricultural science as just production of crops and animals that are useful to man, a number of techniques are involved in agricultural practices.

It is a well-known fact that agriculture has contributed a lot to the national economy such as; a source of national income, providing employment opportunities, providing manpower to industry, source of foreign exchange, Interdependence between agriculture and industry, contribute to the capital formation and increase the purchasing power of people. Iwena (2008), said that agricultural sector, like any other sectors, in the Nigerian economy, has helped in building a dynamic, strong and self-reliant nation. With

these giant contributions of the agricultural sector to the national economy, the subject needs to be properly taught and handled in all the senior secondary schools in Taraba state and Nigeria as a whole.

Secondary Schools are educational institutions below tertiary level established to inculcate in the learners the societal values and needs, and make them skillful. These needs, values and teachable skills are designed into bodies of knowledge and taught to learners, such as agricultural science. Agricultural science is largely the application of scientific principles for successful production of crops, livestock and other uses for man benefits. Agricultural science as a subject in secondary schools, seeks to teach the students the principles of using scarce resources to produce crops and animals to feed the world's population and service other related uses.

The teaching and learning of Agricultural Science as a vocational study as a skilled based sciences have often called for the use of visual instructional materials during content delivery to aid learners' learning pace and retention (Onu and Ikeli,2013). Visual instructional materials provide an easier way in understanding some concepts and skills which can be learned and in which discussion and co-operative working may be practiced. The students turn from passive listeners of information receivers to active, free self-learners. The teacher acts just as a facilitator, rather than a primary source of information or dispenser of knowledge.

The delivery of vocational agriculture at senior secondary level should not be handled as a science per se, but rather as a vocational subject for acquisition of practical agricultural skills for meaningful living. Vocational agricultural skills and training of students for job should give more emphases in such areas as production, marketing and conservation. It is therefore important for the agricultural science teachers to use visual instructional materials to make teaching effective, interesting and meaningful. Effective

agricultural Science teaching requires understanding what students know and need to learn and then challenging as well as supporting them to learn it well. It is in this light, that this research is designed to find out the effect of visual instructional materials that can help students in their academic performance at senior secondary schools.

1.2 Statement of the Problem

This study was designed to test the effect of visual instructional materials on students' performance in Agricultural Science at Senior Secondary Schools in Taraba State. The researcher observed that most Agricultural Science teachers in the Senior Secondary schools were using conventional method of teaching only, neglecting the use of visual instructional materials and practical aspects of Agricultural Science in senior secondary schools in Taraba State. This negligence by the teachers had seriously affected the successful academic performance of students in Agricultural Science in the senior school level in the state. This was indicated by the Agricultural Science results of promotion examination, mock and Senior Secondary Schools Certificate examination of agricultural science (Taraba State Post Primary Schools Management Board Jalingo, 2016).

The researcher also observed that there was an increasing failure in Agricultural Science as a subject in most external examinations by the students. This problem of poor performance of students in agricultural Science has been recorded for some years from 2010-2014 by the examination bodies of senior school's certificate examination conducted by the West African Examination Council (WAEC) and National Examination Council (NECO) (Taraba State Ministry of Education Jalingo, 2015).

The researcher also that most students see Agricultural Science as difficult, as students were scared because of the practical nature of the subject, for example school farm practical, hence they develop negative attitude towards it (Iwena, 2008). In addition,

most teachers of Agricultural Science teach the subject as a liberal art subject. These have also contributed toward the negative impression by the students of Agricultural Science in the senior schools. Also, the inappropriate use of visual instructional materials to teach Agricultural Science, lack of agricultural Science laboratory equipment, lack of school farm\garden, lack of technical expertise, incompetent teachers, and non-improvisation of visual instructional materials by Agricultural Science teachers, all need serious attention (Iwena, 2008). This study explored the effect of visual instructional materials on students' performance in teaching Agricultural Science in senior secondary schools setting in Taraba State.

1.3 Objectives of the study

This study set out to achieve the following objectives: -

1. Assess the effect of diagrams on students' performance in Agricultural Science of senior secondary schools in Taraba State.
2. Ascertain the effect of maps on students' performance in Agricultural Science of senior secondary schools in Taraba State.
3. Identify the effect of specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State.
4. Compare the effect of diagrams, maps and specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State.

1.4 Research Questions

The following research questions are to be answered in the course of the study: -

1. What are the effects of diagrams on students' performance in Agricultural Science of senior secondary schools in Taraba State?
2. What are the effects of maps on students' performance in Agricultural Science of senior secondary schools in Taraba State?

3. What are the effects of specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State?
4. What are the effect of diagrams, maps and specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State?

1.5 Hypotheses

The following null hypotheses (H_0) are stated to guide the study:

H01. There is no significant effect of diagrams on students' performance in Agricultural Science of senior secondary schools in Taraba State

Ho2. There is no significant effect of maps on students' performance in Agricultural Science of senior secondary schools in Taraba State.

Ho3. There is no significant effect of specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State.

Ho4. There is no significant effect of diagrams, maps and specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State.

1.6 Basic Assumptions

For the purpose of this study, the following assumption were made;

1. Most Agricultural Science teachers in the senior secondary schools do not effectively use or are not using diagrams and other visual instructional materials during content delivery.
2. That very few senior secondary schools have maps and other visual instructional materials.
3. That most agricultural science teachers in the senior secondary schools often teach without specimens and other visual instructional materials during content delivery.

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1.7 Significance of the Study

This study will be of great importance to the following stakeholders; Agricultural science students in senior secondary schools; parents: Agricultural Science teachers: quality assurance in both Local, States and Federal ministries of Education: publishing companies: Agricultural Science Subjects' specialist: curriculum planners: Administrators and the researchers in education. This study is of great importance to the students, because the students are at a center of educational programs, which can help them (learners) to be more attentive, motivating and interesting when handling and manipulating the visual materials during teaching and learning process. The study would be significant to them, as each student learn at his or her own pace, thereby increasing their retention and comprehension rate, when they are in direct contact with the concept and how it actually works in real life situation. The study can help the students to perform well in Agricultural Science as all their senses would be involved in learning the subject.

Subsequently, the findings from this study would help Agricultural Science teachers by saving their energy and time in explaining abstract concepts in words as they employ visual materials in their teaching processes. This study would also be of significance to Agricultural Science teachers by improving and updating their knowledge through workshop, seminar and conferences on how to use and improvise visual materials in teaching Agricultural Science. The study would be of great help to the Agricultural Science teachers in the selection of the most appropriate visual instructional materials for specific learning tasks. The Agricultural science teacher would have more confidence in utilizing the visual instructional materials during content delivery as a result of the knowledge he / she acquired from the study and their application to the classroom.

The quality assurance responsible for the supervision of the school facilities would benefit from the finding of this study. They would be able to understand the extent

of the availability or non-availability of visual instructional materials as well as the level of their utilization in all the senior secondary schools. This would help the management of the various schools to know those visual materials that are either over utilized or under-utilized in order to carry out supervisory function in the study areas.

Parents will also benefit from the study as the cost of purchasing different types of visual materials for their wards will be reduced and cost of employing personal teacher to teach their wards at home for extra lesson will also be reduced, as most of the textbooks produced by the publishing companies would contain a lot of these visual aids that will be self-explanatory. The finding from the study will equip and inform publishing companies on the topics that need to be expanded and require a lot of visual aids. They will be informing on the demand of copies of textbooks and visual materials by each senior schools so that they can produce more copies of the books.

Moreover, the finding of the study would be of great significance to curriculum planners and curriculum developers by reviewing the Agricultural Science curriculum based on the emerging needs of the learners and the needs of the society in general. This study would have equipped the educational administrators at the Universal Basic Education Commission, the Ministry of Education, Science and Technology and Faculty of Education on the needs to provide adequate visual materials for teaching Agricultural Science and other sciences in the senior secondary schools setting particularly in the selected senior secondary schools.

The study would be useful to policy makers to formulate policies that would facilitate the development of education in the three tiers of education in Taraba State in particular and Nigeria as a whole. The States, Federal Ministries of Education and Non-Government Organizations in education, to formulate laws and policies which may be useful in the implementation of Agricultural Science curriculum especially the policy of a

using visual instructional materials in teaching the subject. The Federal, State and Local education authorities can justify provision of adequate funds for the purchase of visual instructional materials in all the senior secondary schools. Lastly, the study would immensely benefit the researchers in the field of Agricultural Science by forming a basis for further studies on the effectiveness of visual materials on the performance of students in agricultural science as a subject.

1.8 Scope of the Study

This research study is limited to the six local government areas of Northern Senatorial Zone of Taraba State. The study is delimited on three hundred and forty-two Agricultural Science Students from four senior secondary schools in Northern Senatorial zone in Taraba State. The Senior Secondary Schools are as follows; Government Day Secondary School Mutum-daya, Government Day Science Secondary School Jalingo, Government Day Secondary School Sunkani and Government Day Secondary Karim Lamido. The research study is delimited on the use of diagrams, maps and specimens on students' performance in Agricultural Science of the senior secondary schools.

CHAPTER TWO
REVIEW OF RELATED LITERATURE

2.1 Introduction

The aim of this chapter was to review related literature on the topic "Effect of visual instructional materials on the performance of students in Agricultural Science in senior secondary schools in Taraba State, Nigeria". Thus, the review is presented under the following sub-headings. Theoretical framework, conceptual framework, resources for implementation of agricultural science curriculum of senior secondary school level, factors affecting student performance in Agricultural Science, instructional materials and its categories, students' performance indicators, types of visual instructional materials, importance of visual instructional materials in Agricultural Science, criteria for selection of visual instructional materials, characteristics of visual instructional materials, factors affecting the use of visual instructional materials, empirical studies and summary.

2.2 Theoretical framework

The research study looks at the constructivist theory of AbyHeroell & Jordan (2008), because it is a learner centred approach that give emphases to the importance of individual actively constructing their knowledge and understanding with the guidance of the teacher. In their view, teachers should not simply pour in information into children minds. Rather, children should be encouraged to explore their world, discover knowledge, reflect and think critically with careful monitoring and meaningful guidance from the teachers. According to constructivists, the students for a long time, have been required to sit still, be passive learners and memorize irrelevant and as well as relevant information (Selberman, 2008). But today, there is emphasis on collaboration by the constructivists which is children working with one another in their efforts to know and understand (Bodrova and Leong, 2010; Heyson, Opple and Jones, 2008).

The constructivist theory of cognitive development deals with cognitive self-regulation which allows students to be actively involved in learning. This theory is considered for this study, because Agricultural Science is a natural and practical subject, which is taught both in the classroom and outside the classroom. The students are on practicals either within the school environment as in demonstration farms and laboratory or outside the school environment, for the purpose of teaching and learning. It gives them opportunity to meaningful construct knowledge and understands the visual instructional materials while guiding their learning (Orstain, Lasley and Mandes, 2011). As students see, feel or touch, they better the will assimilate, understand and link the new information to that which they previously know. These will increasingly improve their educational performance and their specialization in the field of agriculture. Students, in effect, actively construct knowledge and understanding with guidance from the teachers during classroom activity, farm/garden, laboratory practical, and by so doing, students' knowledge widens and deepen as they continuous to build new information and experiences on the existing knowledge base.

2.3 Conceptual Framework

Concept of Instructional Materials

They are resources or teaching materials which a teacher utilizes in the course of presenting a lesson in order to make the content of the lesson understandable to the learners. They could be audio, video, or picture or actual objects being taught. Instructional materials aid learning as well as retention and recalling (Nwike and Onyejegbu, 2013; Ikehi, Paradang & Zimogben, 2011). Examples of instructional materials include: audio-visual learning display, living objects and most commonly, textbooks, diagrams, charts, maps and globe and related items that help explain learning content. Instructional materials are also referring to as teaching aids or substance of the

curriculum. That is, those things and people that assist students and teachers in the teaching –learning process. They can be seen, heard, manipulated or talk about as instruments which facilitate learning activity.

Categories of Instructional Materials

Instructional material can be categorized into - Textual and Non textual (Osam, 2015), Textual materials are all the printed materials used in schools, which may include textbooks, manuals, pamphlets, magazines, journals, newspapers, bulletins to mention but a few. They are the most widely available and most used in schools.

Non textual materials – These are materials which combine with textbooks to provide richness in learning experiences. They can be categorized into five groups; the audios, the visuals, audio –visuals, phenomenal, and manipulatives

Concepts of Visual Instructional Materials

Visual instructional materials are materials that appeal to the sense of sight and possibly touch. They constitute the largest group of the non - textual materials. Examples are: chalkboard, maps, globes, diagrams, specimens, charts, bulletin boards, graphs, posters and flannel boards. They provide students with first hand experiences necessary for concept formation (Osam, 2015). The visual instructional materials are also known as non-projected aids. They are teaching aids that are used in teaching agricultural science which do not employ the use of electricity to project and enlarge. They are inexpensive to use and relatively less sophisticated as compared to audio-visual or projected aids (Akram, Sufiana and Malik, 2012). They sub-divided visual materials into five (5) heads; graphic aids such as, maps and globe, charts, diagrams; display boards such as, black/chalkboard and bulletin boards; 3-d-aids such as, specimens, and models; and activity aids or community resources such as, Field trips/study tour, demonstration and excursion. Examples of visual materials are: chalk/blackboard, agricultural science

textbooks, charts, diagrams, maps and globes, models, specimens, a practical farm, school gardens, laboratory, survey equipment, simple farm tools, farm machinery and implement, cages of small animals (poultry and rabbits) poultry feeds, concentrates, feeding and drinking trough, termiterium, plants, animals, insects, different types of soil sample, organic and in organic manure, fish samples, feathers to mentioned but a few. These are materials that appeal to the sense of sight and possibly touch. They constitute the largest group of the non –textual materials.

Umaru (2011) classifies visual instructional materials for teaching Agricultural Science in secondary schools as follows;

i. Printed and reference materials: Textbooks, newspapers, magazines, teacher's guide, journals, handbooks, bulletin, pictures, workbooks, pamphlet, leaflets to mentioned but a few. These printed materials are important in transferring useful information that contains agricultural knowledge on new technologist that will be beneficial to the students and teachers as well. It also contains useful information that will help Agricultural Science students in changing their attitude towards agriculture and agricultural practice as well as improving students' performance in their field of specialization (Hussain, 2009). He said printed materials are important tools in educating both agricultural science teachers and students on the latest agricultural technologies of various crops, vegetables and flora culture, and animal production within and around world.

ii. Graphic materials or aids: Graphics, charts, diagrams, maps and globes to mention but a few. These visual materials are mostly used in teaching Agricultural Science concepts or ideas that are otherwise difficult to explain only in words. For example, Agricultural Science teacher can use diagrams or charts to teach the process of digestion or transport system in animals or plants, or describe

amount of rain fall recorded in every month of a year. Therefore, using graphic aids in teaching Agricultural Science in senior secondary schools will help to have better understanding of concepts or ideas and to retain information that will lead to better performance of students in the subjects.

iii. Display board or materials: Black/chalkboard, bulletin board, magnetic board and funnel board. These are the commonest visual materials mainly used by the Agricultural Science teachers in displaying any vital information either as a subject matter as on chalkboard, or as a notice as on bulletin board, or as a sign, so that they represent a learning laboratory, that is botanical garden, soil plots, aquatic areas. These boards are very useful in providing information to students of Agricultural Science that will also facilitate their learning (Prasad, 2009).

iv. Activity aids also known as community resources: field trips/study tour, excursion and demonstration to mention but a few are visits to interested places to both teachers and students. Examples are zoos, agro-allied industries/establishments, agricultural extension service centers, parks, agricultural research institutions and market place. These visual aids are mainly used by the teacher to provide real life experience to students outside the classroom (Ofsted, 2008). He further said that when Agricultural Science teacher exposes students to learning outside the classroom, it contributes significantly to students understanding and improving students' performance as well as their social and emotional development.

Concept of Student Academic Performance

The academic performance is active rather than passive acquisition. Olamie (2012) defined academic performance as how students deal with their studies and how they cope with or accomplish different tasks given to them by the teacher. Academic performance is the ability to study and remember facts and being able to communicate the knowledge orally or in writing on paper (http://www.google.Jan,2012). A sound education can give students greater opportunities and prepare them to make significant contribution in the field of agriculture (Ning-Kuang & Kathlen (2009). Academic performance is a critical determining factor for students to exploit area of specialization in the field of agriculture.

Academic performance according to the Cambridge University Research (2003) is frequently defined in terms of examination performance. It can be seen as how one performs in school or the level of attainment in an examination, hence the access of an individual in the entire subject taken. In a similar trend Howy (2011) defined students' performance as the ability of students to do something. Academic performance on the other hand refers to the quality and quantity of knowledge, skills, techniques and positive attitudes, behavior and philosophy that learners achieve or acquire (Forguson, 2008). This ability is rated by the works and grade that the students attain in a test or examination which is done at the end of a topic, school term, and year or education cycle. These score and grade that each student obtains measure the degree of his or her achievement.

Concept of Agricultural Science

So many people view Agricultural Science as a simple and very easy subject. They see it as just production of crops and animals that are useful to man. But Agricultural science is a broad multidisciplinary field of biology that encompasses the part of exact, natural, economic and social sciences that are used in the practice and

understanding of agriculture. Agriculture is the set of activities that transform the environment for the production of animals and plants for human use (South African Qualification Authority 2003).

Agricultural science is the study of the relationship between soils, plants and animals in the production and processing of food, fiber; fuel and any other agricultural commodities that have an economic, aesthetic and cultural value. They further said, it is an integrated science that contributes the knowledge and skills from physical life, social and earth sciences, engineering, mathematics and economics (Oberle and Keeney, 2012). They stated that agricultural science is a complex and multidisciplinary field that represents the vital link between human (socio-economic) systems and the natural environment. In nutshell agricultural science is a science and arts of plants and animal production to uplift the standard of living of people and society.

Talathi, Naik, and Jalgaonkar (2014), defined Agricultural science as the utilization of all modern technologist developed on scientific principles such as, crop improvement, crop breeding, crop production, crop protection, economics and so on, to maximize the yield and profit. For example, new crops and varieties developed by hybridization, transgermic, crop varieties resistant to pest and diseases, hybrids in each crop, high fertilizer responsive varieties, water management, herbicides to control weeds, use of bio-control agents to combat pest and disease and so on.

Agricultural science as the business; as long as agriculture is a way of life of rural population, production is ultimately bound to consumption. But agriculture as a business aim at maximum net return through the management of land, labour, water and capital, employing the knowledge of various sciences for production of food, feed, fiber and fuel. In fact, in recent years, agricultural science is commercialized to run as a business through mechanization.

Agricultural education in secondary schools

The teaching of agricultural science at the secondary level in Nigeria today is done at two (2) levels:

i. At the junior secondary school (JSS)
ii. At senior secondary school (SSS) level.

At the senior secondary school level (SSS) spanning through the last three (3) years of secondary education. The "guided discovery" method of teaching is being suggested such that learning by doing is emphasized and the students are trained to be able to produced food and other agricultural product for themselves and their community. A series of activities suggested in these programmed is designed to ensure development of psychomotor skills in agricultural students. Hence, the National Agricultural Science Curriculum for senior secondary schools also took cognizance of the existing examination bodies such as West Africa Examination Council (WAEC), National Examination Council (NECO), National Board for Technical Education (NBTE) as well as ordinary and advanced level syllabus.

Specifically, the objectives of the senior secondary school agricultural education should be able to:-

i. Stimulate and sustain students interest in agriculture
ii. Enable students acquire basic knowledge and practical skills in agriculture
iii. Prepare students for occupation in agriculture
iv. Prepare students for further studies in agriculture;

In order to achieve these objectives, the curriculum content has been structured around three (3) major concepts of production, protection and economics. The curriculum further recommended that;

i. Each student be guaranteed adequate equipment, farm space, structures and regular supply of fertilizers and animal feeds.

ii. In addition to having a farm, each school should keep at least two (2) farm animals.

iii. Student achievement should be continuously assessed through various of test and during field and laboratory practical.

iv. Individual assessment should be carried out for activities in crop production while group assessment should be restricted to performance in animal production activities (Federal Republic of Nigeria, 2009).

Resources for Implementing Agricultural Science Curriculum

In an attempt to define curriculum implementation of Agricultural Sciences different scholars have different views on the concept of curriculum implementation. Onleadu (2010), sees curriculum implementation as the processes of putting all that have been planned as a curriculum document into practice in the classroom through the combined effort of the teachers, learners and parents.

Onyeachu, (2008), Zahid, Aslam and Hassan, (2011), Curriculum implementation is referring to as a restructuring of education programmed that include adjusting personal habit, course emphasis, learning space, existing schedule and ways of behaving. All these modifications depend particularly on the excellence of initial planning with which step of curriculum developments have been carried out, Zahid, Aslam and Hassan (2011). For a successful curriculum implementation, curriculum leaders must consider in-services training offered to the teachers, availability of competent teachers, and effort for training of pre-service teachers for implementation of new curriculum. They must take decisions about correct orientation of the teacher – learner interaction,

new learning materials given to the students and resource – material supplied to the teachers.

Curricular implementation also include decision making about new curriculum assessment procedures and detail procedures to deal with the problem encountered in curriculum implementation. They should also take decisions for the formulation of checklist to monitor the newly implemented curriculum and procedure for successful monitoring and feedback. Other important aspect should be considered in this regard are student background and understanding, teacher's attitude and proficiency, the school environment, resources available and external restrictions.

In the implementation of Agricultural Science curriculum, the following many resources or factors are used. These factors determine to a greater extent how successful or otherwise any given curriculum can be adequately implemented. These are; teachers, the learners, the society, method of teaching, curriculum materials, knowledge discipline, textbooks authors, and subject specialist, classroom organization, time allocation as well as economy or finance (Yusuf, 2012).

Teacher; A teacher can be considered as a heartbeat of the curriculum. For a teacher to be effective and efficient as the performance of his duties, he/she must have good knowledge of the subject matter, added to a teacher qualification is his experience. A teacher who cares less about the success of his students is not likely to perform well. Therefore, success or failure of a teacher is on the commitment and dedication of a teacher.

The learner/student; The learner is at the center of any educational programmed. This being the case, any curriculum planning must be given adequate consideration to the learner. The whole idea of curriculum planning and development will be meaningless if

the learners who are directly involved in the curriculum implementation process are not taken into account.

The needs of each individual learner vary. Therefore, certain questions must be raised about the characteristics of the learners. Example of such question include what can a learner learn at a given age, his level of motivation, learner's intellectual capacity, his learning experience, his socio-economic background, what is likely to motivate him to learn as well as his interest. Answer to these questions will determine the extent to which any given curriculum shall be successfully implemented. A curriculum that is adequately planned, useful and relevant must clearly reflect the fundamental issues of learners' needs, interest, and peculiarities, other physical and psychological characteristics and so forth (Yusuf, 2012).

Society; A society is usually perceived as a collection of individuals who have organized themselves into a distinctive group in relation to their natural and social environment. Such group is usually a distinct one with several things which are hold in common in order to make everyone belong. Those things which are held in common by the group and which also ensure togetherness of such a group. Culture, therefore becomes the total shared ways of life of a given people. These comprises the characteristics habit, ideals, modes of thinking, acting, feeling, child rearing practices, religion, law, language, art, customs as well as materials products, like type of house, cloth, tool and so forth (Yusuf, 2012).

Different societies have different cultures. It is important for educational programmed to be culturally biased. Since culture preserves a given society by educating the young on its norms and values, it is imperative that educational programmed or curriculum should be culture dependent. Therefore, agricultural science curriculum designed for any given society should essentially reflect societal needs, goals,

values/value systems, aspirations, expectations, and general pattern of life and culture of the people (Yusuf, 2012).

Classroom Organization; The organization of classes in schools has great effect on the implementation of agricultural sciences curriculum. The schools head should ensure that teachers attend their classes punctually. There should be effective monitoring of what goes on in the classroom for teaching and learning to be meaningful and rewarding (Yusuf, 2012).

Knowledge Discipline; The tremendous increase in existing knowledge has great influence on curriculum planning and development in agricultural science. Aspect of knowledge that are most worth, will have to be selected for learners in agricultural science in all the school system. For instance, it is an established fact that knowledge in the disciplines especially in agricultural science and other sciences has been expanding tremendously and has given rise to the problem of what to select from the various items of knowledge. At every point in time selection of the kind of learning that is of most worth should always be considered (Yusuf, 2012).

Availability of Resources; Availability of human and non-human resources is another major determiners of the agricultural science curriculum. Human resources include the teacher and any other person or group of persons that have some contribution to the successful implementation of a given agricultural science curriculum. Non-human resources include; facilities, equipment and materials used in teaching agricultural science in the school system. In schools today, there are inadequate resources. In situation where materials are not available in large quantities to meet the demand, implementation of an agricultural science curriculum that requires the use of the materials will be hampered.

Textbooks Authors and subjects' specialists; Textbooks authors usually determine the scope of content and the logic of subject matter in agricultural science. They in

addition determine the authenticity or truthfulness of the information the school system will be exposed to. If for instance, the information in a textbook is shallow, misleading and not authentic, learners will be exposed to wrong information. It is necessary that authors and subject specialist make effort to ensure that only the most relevant, the most purposeful, the most useful and the most functional information is included in the textbooks. Textbooks should also be reviewed from time to time to reflect any change in knowledge in agricultural science subject (Yusuf, 2012).

Economy or Finance; The economy or state of finance of any curriculum is one or the most significant influencing factors on the agricultural science curriculum. The economic situation or financial standing of any country determines to a very large extent the quality, content and even the method of education of the country.

The economic situation also determines the orientation of the educational philosophy, scope of the educational objectives, the range of school subjects and learning experiences, the mode of evaluation adopted, the quality of infrastructure for implementing the agricultural science curriculum and the quality of teachers.

The state of the economy during the era of oil boom in Nigeria greatly affected the educational system/ agricultural science curriculum in a positive direction. But presently, lack of funds as a result of the country's dwindling economy is one of the reasons why the federal government cannot expedite action on teacher's demand for salary increases and the reason for incessant strike actions (Yusuf, 2012).

Method of Teaching; There are so many methods used in transmitting and sharing knowledge with learners. The use of a variety of instructional methods is necessary for effective and efficient agricultural science curriculum implementation process. An efficient teacher should therefore always device different ways of facilitating the process of learning. The method of approach is very vital in any teaching – learning situation. The

way a teacher presents the subject matter in agricultural science class will make students like or dislike the subject. Appropriate methods of teaching are very vital for an agricultural science curriculum implementation to be productive. The method that a teacher uses has potentials for promoting or hindering learning, sharpening mental activity, encouraging initiative and curiosity.

Teachers of agricultural science should always make sure that the choice of teaching method(s) employed such the age, class or level, characteristics and number of learners, the nature of tasks, instructional objectives and available agricultural science curriculum materials.

Time allocation; Time available on the time table for teaching any particular subject especially agricultural science is a measure of attention that educational managers attach to that subject. The time allocated to agricultural science subject should be adequate for the teacher to carry the learners along. If the time is too short, the agricultural science teacher may tend to rush through the scheme of work not caring whether he is carrying the student along with him. ‘

Curriculum Materials; Agricultural science curriculum materials are those things that the teacher uses to help students in their learning. They are indispensable in teaching – learning process or agricultural science curriculum implementation. The Agricultural Science teacher is expected to have knowledge of a wide range of Agricultural Science curriculum materials. The Agricultural Science curriculum materials if creatively, efficiently and effectively used will enhance learning and improve teacher’s competence and also make learning more meaningful (Yusuf, 2012).

2.4 Effects of Charts, Diagrams, Maps and Specimens on Students' Performance

Effect of Charts on Students performance

Abdullahi (2013) defined charts as visual aids which depict pictorial and written key information in a systematic way to summarize or compare a process. He further said a flow or classification charts can be used in summarizing life cycles such as in insects or classification in animals. For example, charts can be used to explain the life cycle of grass hopper (Zonocerous variating). The female grasshopper laid eggs on the underside of leaves around April. These eggs hatch into nymph around October. During their instars stage migrate into the farm and continue to feed on cassava leaves up to the adult stage called imago. The life cycle of grasshopper is an incomplete metamorphosis that is, it has no pupa stage.

Classification charts is also used in teaching agricultural science concepts such as classification based on taxonomy. For example, taxonomy of plant and animal kingdom, classification based on life cycle of plants and animals or classification of crops based on their uses. Therefore, exposing students to various type of charts will stimulate their thinking and improve their performance which visualizing an items that it is otherwise difficult to explain only in word. Bassey (2008) further said, using charts in teaching agricultural science will provide an outline for materials covered in presentation.

Okechukwu, (2016) in his research studies showed that students of agricultural science taught with charts performed better than those students taught with only conventional chalk and talk method. He further said charts materials show continuity in process such as life cycle of insects, seed germination stages and to mentioned but a few. According to Akande and Azike (2008), said, bar-charts can be used to study the steps involve in understanding the diffusion /adoption process in farmer's acceptance of new innovation in agriculture. Agricultural science teachers can use bar-charts to illustrate the

percentage (%) of farmers adopting the new idea as adopted categories and their characteristics.

For examples; the chart helps to describe to the students, farmer into adopter categories based on their rate of adoption of new ideas as:

1) Innovator (2.5%)
2) Early adopter (13.5%)
3) Early majority (34%)
4) Late majority (34%)
5) Late adopter/Laggards) (13.5%)
6) Never adopter (2.5%)

(Source: STAN Senior Secondary School Agricultural Science, 2004)

Furthermore, Ajalla (2010) stressed that using charts in teaching Agricultural Science is very important because, it creates problems and stimulates thinking in students. Also, a research finding on the effect of charts on student performance in Agricultural Science revealed that those students that were exposed to charts do perform better than those students taught with only conventional chalk and talk method (Onyejegbu & Matthew (2013). Their finding was in line with the work of Olagunju (2009) who found that, there was a remarkable difference in the students' performance who were taught with charts and those students who were not exposed to charts material. Therefore, using charts in teaching Agricultural Science students will enhance learning and teaching as well as leading to a better students' performance.

Effects of Specimens on Students Performance

A specimen is a sample of the real objects or materials and it can be living or non-living (Abdullahi, 2013). A trained and experienced Agricultural Science teacher is always interesting in acquiring or improvising specimens as materials that will make

teaching and learning more efficient and effective. These can be achieved through presentation of different specimens during classroom activities and farm practical. Presenting specimens either as living or non-living will provide real life experience to students, thereby stimulate their interest and sustain their attention, which in turn improve students' performance (Akram, Sufiana and Malik, 2012)

The Agricultural Science teachers should take time in obtaining specimens before the commencement of the lesson. The teacher should also dedicate himself in improvising the specimens or purchasing from commercial stores if not available within the school environments. Also students of Agricultural Science should be motivated in collecting the specimens for class used and to make such specimens as a hobby, especially in Agricultural Science club, handcraft groups, basket making, local cage making for poultry to mentioned but a few. The rightly used specimens during teaching Agricultural Science will not only sustain student interest to the lesson but will also enhance student performance and to remember what he learned from the subject (Fakomogbo, 2012 & Imogie, 2009). Example, in studying farm implements such as hoe, cutlass, sickle, axe, and mattock, the teacher should emphasize more on the variation in the type, or shape of tools used on the farm in different communities. These variations are brought about by the rate of development of agriculture, the soil types, and the planting operation for which the tool is used. Encouraging students in the collection, displaying, observation and having a firsthand experience will make them to become interested in their educational pursuit as well as driving satisfaction (Prasad, 2009). Olawale, (2013) in his work on the effects of specimens on students' performance in Agricultural Science of JS3 students. Indisputably, the use of specimens has yielded better results in learning Agricultural Science, thus their widely proclaimed used. Comparing the mean scores of control group taught without specimens and experimental group taught with specimens has always

reported better performance from the later than the former. However, it has always been an inter comparison among the groups and usually no comment on the intra-performance. Thus, this study compares the level of disparity of the mean achievement scores of Agricultural science students taught with and without specimens.

Specimen for class use; A trained Agricultural Science teacher should see, handle and observed nearly all topics in agriculture that requires specimens for illustration of some kind. Brown, Lewis and Hardenad, (2008) states that, collection of specimens by students requires interaction with their fellow students, leading to development of special skills, values and enhances students power of observation as well as retaining first hand experiences. Furthermore, collection of specimens arouses some interest among students in learning which also become an interesting educational pursuit of the teacher and students alike, which in turn make teaching lively. Therefore, using specimens during farm and laboratory practical will not only improve students' performance but teachers' performance as well by saving his time and energy. For example, when studying root and shoot system of a monocotyledon plant (such as maize seedling). It is often possible to handle a specimen to each student. Quite often, if the teacher cannot supply a specimen to every student for observation, he or she should form small groups of 3-5 students per group, so as to handle round one specimen between each group of students (Umaru, 2011).

Furthermore, Akram et al., (2012) said in studying parts of sprayer (Knapsack), the teacher can bring the sample of Knapsack sprayer into the classroom. He or she should group students into his or her convenience so that they will see how the sprayer is being calibrated (dismantled or coupled). Also rabbits, chicken of both sexes in a cage, grasshoppers, tsetse fly, ticks, louse, feathers, termites, butterfly, bees in a jar, leguminous crop (groundnut, cowpea), spices (tomatoes, pepper) grasses, animal feeds and

concentrates, organic and inorganic manure. All of the above mentioned specimens can be displayed in the classroom for students to see, handle and to make observations. Exposing students to these specimens will increase their power of observations and first hand experiences is enhanced. This will maintain student attention and motivate them to think critically about what is being taught by their teacher (Mangal, 2011). Handling and manipulating of those specimens by the students will heighten the reality in the classroom, thereby improving students' performance in the subject.

Effects of Maps on Students' Performance

Maps and globes are important visual materials for the teaching and learning Agricultural Science at senior secondary school level. Using maps will help Agricultural Science students to develop better understanding about different crops and animals that are grown or kept in different continents and countries of the world (Ibrahim, 2011). Using maps and globe in teaching agriculture will enable students to understand the concept and ideas relating to different type of soil, dry and raining seasons. Maps and globe are good visual materials in presentation of topics such as, plant and animal products, forest resources and management, vegetation and mentioned but a few. As globe is a mini earth, which is round and rotating on its own axis around the sun, its knowledge will make students (dry and raining season), types of food eaten, and clothing worn by different people at different locations of the world (Akram et al., 2012). Therefore, exposing Agricultural Science students to maps and globe will lead them to critical thinking; good reasoning and development of inquisitive mind that will simply improve their educational performance in the subject (Mangal, 2011).

Since maps and globe are good companion in teaching Agricultural Science in senior secondary schools, the Agricultural Science teachers should use map and globe in teaching some concepts such the relative size of earth surface, surface features like river,

plains, mountains, water and land forms; scientific data like, ocean current, volcanic eruption, rock and soil formation; and economic data like, agro-allied production industries, agricultural products and to mentioned but a few. Alio and Ezemeanyi (2010), Igu, Ogba, and Igwe (2014) reported that there was a significant difference in the mean performance of students taught with maps and those students taught with conventional chalk and talk method. From the above assertion, it has deduced that maps and globes have a great effect on students' performance.

Effects of Diagrams on Students' Performance

Diagrams are one of the visual materials is use in teaching agricultural science, which help students to have better understanding and retention of information when ideas, word or concepts are associated with images (Scholastic 2013). He further said research shows us that the majority of students in a regular classroom read diagrams to see information in order to learn it as diagram is a common visual learning strategy. Therefore, teacher and students of Agricultural Science can use diagrams to display large amount of information in a way that are easy to understand and help reveal relationship and patterns. The teacher can provide or make clear and very bold diagrams on a chalkboard or cardboard papers to illustrate concepts such as, reproductive system or transport system in both plants and animals; digestive system in ruminant and monogastric animals, water, nitrogen and carbon cycles and so on.

Abbas, Binbo and Ojo, (2012) in their study to determine the effect of diagrams on the performance of students in senior secondary schools the discovered that the use of diagrams in agricultural science instructional processes has significantly influence students' performance. It is deduced that when students are exposed to diagrams, it encourages them participate and stimulate their interest for the lessons and help them in understanding the concepts in question, thereby improving their performance

(Talathi,Naik and Jalgaonkartoli, 2014). Mcnaught, (2007) observed that diagrams as a visual aid are useful in teaching and learning process as well as promotional aids in impacting agricultural knowledge. Gersten, Beckman, Clarke, Forgon and Witzel (2009) said, the use of a diagrams as a visual representation, can be a powerful strategy for helping students in agricultural science to understand or solve abstract word or concepts. Indeed, students that use diagrams can increase agricultural science understanding and performance. Furthermore, the advantage of a diagram is that it can serve as a "cognitive tool" to display information to a spatial manner, to allowing the students to better understand the problem, and subsequently, solve the problem (Diezmann & English, 2011, Adebule & Ayoola, 2016).

The use of a diagram in teaching students of Agricultural Science will provide exercises not easily secured in other ways of teaching the subject and it contribute to the depth and variety of learning that enhance students to perform better. Gopal (2010) stressed that diagrams in agricultural science is a self-explanatory drawing that can play a major role of making learning permanent as students are involved in making it in their notebooks or on the chalkboard. He further stressed that, diagram and other visual aids do facilitate learning, retention and recall of some different concepts of the lesson learned in agricultural science. Therefore, whenever an agricultural science teacher uses diagrams or visual aids either for introducing or supporting or evaluating the lesson, it will always evoke maximum response of students. These maximum responses from the students will improve their performance.

Effects of Chalk/blackboard and Textbook on Students' Performance

A chalkboard or blackboard is a reusable writing surface on which text or drawing are made with chalk or other erasable markers. Black board can simply be a piece of board painted with dark paint (usually black or dark green) (Yusuf, 2012). In view of the

above, the agricultural science teachers can use the boards for displaying vital information or summarizing some important points or making some illustration by drawing diagrams or charts to a large number of students. In utilizing the chalk/blackboard, the teacher should always be with a supply of colored chalks, as it aids parts of a diagrams reaching emphasis can be brought into prominence. According to Abdullahi. (2013), teachers of Agricultural Science in most cases should employ different colors that can be used to emphasize certain parts of a diagrams. For example, color chalks can make diagram of the parts of digestive system on blackboard of either chicken (fowl), livestock (goat) to mention but a few become clearer and more memorable if the esophagus, crop, gizzards, liver, gallbladder, preventriculus, intestine, pancreas and colon; or esophagus, rumen, rectum, omasum, obamasum gallbladder, liver, small intestine, large intestine and reticulum are indicated by different colors with corresponding color levels. Also teacher can make drawing of a root and shoot systems of a plant on a chalkboard using green for shoot and brown color for a root. Also, a diagram of a ranging pole as one of the common farm surveying tools is made much clearer and plain on the blackboard if it is painted with different colors of black, bright red and white.

Textbooks: The Agricultural Science textbooks are the most common printed visual aids that teachers used in disseminating agricultural knowledge and as reference materials to students and teachers (Hedjazi, Rezuee and Zamani 2009). The agricultural science textbooks add variety of values to the subject, but are not affordable by an average student because it is too costly. To overcome the problems of cost effective, government should have made adequate provision of those relevant textbooks to all our secondary school libraries to enable agricultural students to get access to read them.

Effects of Activity aids or Community Resources on Students' Performance

The activity aids or community resources are those learning situations in which student's participation through direct experiences can be easily incorporated. They are aids or resources that are really of great value as they put students in a role of active seekers of knowledge. (Fleming, Wiebel and Gegenfustner, 2013). They further stated five (5) important activity teaching aids as: field trip\study tour, demonstration, experiments and dramatization. However, the most common and effective activity/community resource aids used in teaching Agricultural Science students are educational field trips, demonstration and experimentation. Agricultural Science is a natural and practical subject that is taught both in the classroom and in the natural environment. The teacher of Agricultural Science can take out students on field trips or study tour or on practical either within the school environment as in demonstration farm/garden or outside the school environment for the purpose of teaching the students.

Ken (2012) defined field trip as "an educational procedure by which the student's studies first hand objects and materials in their natural environment". An educational trip can give Agricultural Science students an opportunity to meaningful construct knowledge and understand the material that will improve their performance in the subject. During educational fieldtrip, the students learning can be easily diverted toward effective learning that supplement the classroom learning through application of sense and reviewing the experiences of the students. Educational field trip provides an accurate information objects, process and system or their real life setting which are valuable aids to what students are curious about the natural and man-made process and object that add new knowledge to students in the field of agriculture.

In measurement of students' performance in Agricultural Science as a subject in senior secondary schools; various tasks are undertaken within and outside the schools.

Within the school, such exercise includes; assignment, farm/garden practicals and fieldwork supervised by the Agricultural Science teacher; continuous assessment and terminal examination. The results from the above exercises are reported by the subject teacher as part of the students' performance. Furthermore, outside the school, external and independent examination bodies have emerged over the years to validate the assessment of student's performance in agricultural science. These examination bodies include West African examination council (WASC) and National Examination Council (NECO) to mention but a few. These examination bodies used standardized test to measure senior secondary schools in Agricultural Science, (Ogbuluijah, 2014).

However, in pursuits of better and satisfactory students' performance in Agricultural Science in senior secondary schools, West African Examination Council (WAEC) 2006 recommended that the study of Agricultural Science should be supplemented by field trips (study tour) to well established public and private experimental and commercial farms, agricultural research institutions, zoos, game reserve, irrigation schemes, dams, agro-allied industries and other institutions related to agriculture (Ogbuluijah, 2014). This recommendation has become an acceptable practice as part of the curriculum and extracurricular activities in the senior secondary schools.

Onyeabor, Botril and Madi, (2012) stressed that an organized and guided agricultural science field trip is a visitation for an educational purpose. In fact, they admitted that taking students outside the comfort of the classroom can be an advancing step for improving some teacher and students' performance in Agricultural Science. He also added strongly that field trips provide unique opportunities to apply learning to the real world. To this end Ofsted, (2010) reported that when planned and implemented well, learning outside the classroom contributed significantly increasing standards and improving students' performance, social and emotional development of students. Field

trips are a journey into the land of knowledge for the purpose of acquiring practical knowledge and skills for a specified operation or occupation (Nwakor, Asumugha and Ezwe, 2010).

In view of the above, the benefits of field trips in an educational performance among students of agricultural science in senior secondary schools cannot be over emphasized as it has a motivation effects on student's performance towards accepting agriculture as a profession. It also has the potentials to expose and educate students in senior secondary schools in practical and real life knowledge of what agriculture is? If well designed, results in higher student's performance in all study areas in agriculture. Above all, the collaboration of the school community in providing meaningful direct learning experiences to students, hence result in enhancing learning and better performance of students in agriculture.

Practical farm and school garden; Agricultural science is a natural and practical subject which is taught both in the classroom and in the natural environment. It is expected that each an individual student, classes, and the entire school to have a small plots or farm for practical purposes, which will make them to learn about good method of gardening and practical farming (Talathi, Naik, & Jalgaonkar, 2014). Umaru (2011) said, agricultural education is the type of education that is employed in training students in the improved agricultural production processes and the techniques for the teaching Agricultural Science in secondary schools. Agricultural education in schools referred to the teaching of skills, values, attitude and related knowledge in production, processing and marketing of related agricultural products.

Therefore, in any senior secondary school, every Agricultural Science student is expected to carry on a short and long term practical activities such as; cultivation of crops, vegetables, fruits and raising of small livestock (goat or sheep) for the school

consumption and for local market. Exposing students into practical work will make them to have real life experiences that will motivate and sustain their interest in learning the agriculture as a subject. Hence involving students in the collection and handling of equipment, tools and specimens during practical work will make students to drive satisfaction of contributing to the school and arouse some interest among students in learning (Akram *et al.,* 2012).

Value of Practical Work in Agricultural Science

The Agricultural Science teacher can only teach effectively and efficiently if he/she is convinced that the subject has some importance for the student. Some Agricultural Science teachers look into the practical sides of Agricultural Science as an extra and rather a tiresome extra; because it usually requires more preparation than the purely oral lesson. The value of agricultural practical is obvious and is at once recognizable. In Agricultural Science, it is not necessary to spend so much proportion of time on practical work, but once the Agricultural Science teacher understands its value, he/she will not be tempted to omit it (Umaru, 2011).

Secondary School Agricultural Science Materials

The need for the tool; In practical Agricultural Science, the provision of visual instructional material for practical such as; tools, implements, equipment and laboratory is in most cases inadequate. In order to effectively promote teaching and learning in our secondary schools, the teacher and the school authorities need to purchase or improvise the materials for agricultural science use. The learners, apart from being exposed to the content of Agricultural Science to build his/her knowledge, must interact with Agricultural Science tools, equipment/implement and apparatus in order to develop, manipulate skills and be creative (Abdullahi, 2013). Also as Agricultural Science like any other practical subjects require tools, and laboratory materials, and recognizing this, the

school authorities are to make some provision for this necessities. In Agricultural Science, tools and practical materials are necessities. It is very common to find in most secondary schools like vocational and technical colleges well equipped workshop for teaching woodwork or electrical but without any tools or equipment or farm for practical Agricultural Science teaching. The tools and equipment needed for practical work suggested in this research study are very simple; much of it can either be collected at resources centers, home or improvise by Agricultural Science teachers and students as well. There are however, a few items which must be bought and there ought to be a small grand or allowance for this. (Umaru, 2011).

Improvising Equipment

Abdullahi (2013) said improvisation in instruction is the art of creating in modeling materials objects in place of the original, thus usually done where the 'proper' material is unviable or unaffordable at the time. Always the teacher should scout around the community, the immediate environment and the classrooms to look for suitable materials to be used instead. Umaru (2011) said, let no Agricultural Science teacher suppose that it is impossible to teach Agriculture Science without most of the apparatus and equipment (Visual instructional materials). Stringent economics may have to be made, the delivery of apparatus and chemicals may be long delayed or apparatus may be temporarily – unobtainable. The lazy or poor Agricultural Science teacher complains, blame lack of equipment for the dullness of his/her lessons, and allow his/her students to revert to the conventional class lecture and note taking as well as passive learning of the textbook.

The good Agricultural Science teacher, however, finds in some circumstances a challenge to his ingenuity. With an alert mind he or she adapts his or her lessons to the materials available. With patience, simplified version of more complicated apparatus can be made. In fact, the simpler the better is the students are able to appreciate the methods

used and the facts to be illustrated (Umaru, 2011). Some possible improvisations of material in Agricultural Science include; empty canned fruit tin, as beaker, botanical specimens of plants, bottles, flowers and plants, battery cage, cages of small domestic animals, feeding and drinking trough and to mentioned but a few.

Note on some possible improvisation

i. Beakers; canned fruit tins can be used for heating liquid contents

ii. Botanical specimens: these should be a collection of various plants specimens which can be pressed and dried between sheets of newspapers for preservation.

iii. Bottles; narrow neck, for liquid – various kinds and sizes which when ordinarily purchased from drugs store or disposed contained medicines and so forth, may be used. Those with plastic screw –tops are to be preferred.

iv. Flowers and plants; A collection of dried specimens is called herbarium. It main purpose is to provide a sample of identified plants for general reference and to facilitate the naming of freshly collected specimens.

v. Cages; the cages for small domestic animals like chickens, rabbit and so forth, can be made from wooden boxes and can be of various types and sizes of simple box type and improved box type. A cage which has no glass side is not much used for observation; every school ought to have one, so much better. An improved cage type is easy to clean; the shallow drawer at the bottom can be removed for cleaning without opening the cage. If possible line the drawer with metal.

vi. Feeding/drinking trough; A small tin can be used as a feeding/drinking trough, if the cut sides are rolled inwards to avoid sharp edges. If this is hangs by a wire hooks, it can be removed without reaching down into the cage. Some domestic animals like rabbit for example will drink water from a drinking tube (Umaru (2011).

2.5 Factors affecting students' performance in agricultural science

Many studies have been conducted on student's academic performance with different factors identified to influence academic performance in schools, yet controversy exist among schools as to what contributes simply or jointly to students' poor academic performance. The findings revealed that, student's motivation, parent educational background, age of students, family income, school location, distance from home to school, provision of basic school needs, condition of school environment, teacher qualification and teacher – student ratio are significant factors that influence students. However, Pedrosa (2012) reported that, those students who mostly come from deprived socio-economic and educational background performed relatively better than others coming from higher socio-economic and educational areas.

Kendy (2011) stated that decline sense of obligation to one's parents' correlates with a similar decline in academic performance. Aksoy and Link (2007) pointed out that an increase in time spent on home/work/test had a positive effect on students' performance. Ali, Zubair, Fahad, Hamid and Awais (2013) pointed out that students learning outcome and educational performance are influenced by the nature and standard of school attended by an individual. Further, Kwesiya (2012) affirmed that performance of students is also influenced by the school in which they studied. However, availability of facilities such as visual instructional materials in schools usually determine the quality of the school, which in turn affect the academic performance and accomplishment of its students.

Personal ambitions on the part of students motivate them to learn. It is intrinsic motivation towards learning and success. Malila (2009) observed that, children with intrinsic motivation in academic would have high self-perceptions of competence in academics and that students who are extrinsically motivated would have lower perception

academic competence. However, Osili (2008) is of the viewed that intelligence is not the only determinant of academic achievement. High motivation and engagement in learning have consistently been linked to reduced dropout rates and increased levels of students' success.

There are five (5) principal factors affecting students' performance in the study of agricultural science in senior secondary schools. They are; socio-cultural factors, individual factor, socio-economic factor, family, socio-economic status and structure, and situational factors (Kidane and Worth, 2012)

i. Socio-cultural factor: They have major implication in the school and student's performance. Socio-cultural factors that contribute to quality Agricultural Science curriculum implementation are student mobility and racial background (Cooper and Center, 2010) and social class discriminatory, language and ethnicity (Emmith, Pollock and Knomes, 2008). Furthermore, Otsuka (2009) confirmed that student's performance varies based on their different ethnic background. Jegede and Okebukola (2010) report that socio-cultural factors such as goal structure and American world view and societal expectation have significant effect on students' performance in Agricultural Science in particular and science as a whole.

ii. Individual factor: In the school environment, individual factors such as student's competence in the medium of instructional language, study effort, the number of period of lesson missed and age are the most determining factor in student's educational successes and performance and which it addressed the positive effect on students' performance (Herb and Ahmed 2008; Clabaugh and Razyeki, 2006). Similarly, Teddie and Reynold (2009) explained that student capacity and effort have a positive effect on student performance in the school. These confirmed that

individual factor have a positive intervention on student's performance, and identifying and controlling of these factor have a positive effect on student success in the school.

iii. Socio-economic factors relate indirectly to students' academic performance through parental belief, income and behavior (Davis, 2008). Socio economic status is estimated as an arrangement of factors including income, level of education and occupation (Boskey, 2009). Based on Davis (2008) findings, there were three (3) indicators that characterized family socio-economic status and structure. These indicators were parental education, parental income and family size.

Furthermore, much empirical evidence shows that parental education, children education and earning were strongly related to each other (Arias,Yamada and Tejevina, 2007). Vansteensel (2010) showed that students' family socio-economic status and home learning environment have noticeable effect on students' performance. Similarly, Davis (20085a) identifies that parental education and family income as factors that can explain differences in performance of the students in the schools. In addition, Herb and Ahmed (2008) stressed that parental education and family income determine the living condition of students and his performance.

iv. Family factor: Parents are the major role players in academic performance of their children (Alam, and Farid 2011). In the teaching and learning process, family factor influence student's success and his performance in the school – parental expectation and aspiration, home environment and parental involvement in their children education such as creating conducive home environment and the consistent provision of assistance in their studies are the main factors that could

affect the student's academic performance (Christenson, Rounde & Gorney, 2009). Kloosterman (2010) studied the effect of home environment on student socio-emotional and cognitive development. The researcher clearly showed that the family and school environment play important roles in students socio-emotional and cognitive development. Emotional support, family values such as respect, strong maternal role, legacy and maintenance of the home language were identified as the most essential family factors (Kloosterman, 2010).

Marks (2009) further reported that, both family size and family type have effect on student academic performance. Students from large, single parent and reconstructed families were found to be grouped in the academically weak categories in the school. The study also clearly showed that family types such as single parent and reconstructed family have negative effects on students' performance. These empirical studies show that factors can and do affect students' performance. Agricultural science as subject need to be conscious of this reality and the Agricultural Science curriculum should be designed in a way that can help students overcome any negatively influencing factors (Kidane and Worth, 2012).

v. Situational factors in teaching and learning process of Agricultural Science. The school environment such as safe school environment, flexible grouping and provision of language support for students was found to affect students' performance in the school. A positive school culture includes school vision, an orderly climate and positive reinforcement each play a crucial role in academic performance of students in the teaching and learning process (Teddie and Reynold, 2009). Also Killian and Baker (2008) suggested that an important situational condition in the school, namely, increased support school

administration, and the reinforcement would improve students' performance and achievement in learning.

Moreover, Kidane and Worth (2012) results show that lack of enforced policies and weak distraction are the main sources of student's stress in the school environment. Similarly, lack of connections between administration support and student discipline also create stress among students in the school. Higher stress leads to poor students' performance (Killian and Baker, 2008). Another factors that contribute to different in grades and student's performance is how crowded a classroom in our secondary schools is, the more frustrating the learning and the poorer the students will perform (Harb and Ahmed, 2008, Omarand, 2009, Rahman and Uddin 2011).

Also, in his research study, Egun (2007) identified the following factors affecting students' performance in agricultural science as thus: -

i. Staffing: most of our senior secondary schools are short staffed which sometimes necessitate a teacher having to teach more than twice the number of students required. In other situation unqualified teachers are assigned to teach Agricultural Science subject, they are not trained for. Which often result in disinterest, poor preparation and ineffective method of teaching and inability to use visual aids in teaching the subject being adopted by the teacher all these have seriously contributed to the increasing poor educational performance in practical oriented subject like Agricultural Science (Egun, 2007 and (Badmus, 2010).

ii. Funding: Poor funding of senior secondary schools is also responsible for the non-operation of the school farm, laboratory and the purchase of suitable visual instructional materials in the school. Agricultural Science teacher is not expected to use their income to fund them. The absence of appropriate and suitable visual instructional material for practical farm/garden in the schools will deprived

students of experiencing real life agriculture and not just verbal instruction or theory in isolation. Using visual aids and practical farm/garden in teaching Agricultural Science students will enable them to be actively involved and so acquire practical skills and real life knowledge participation and interaction through visual perception of agricultural activity (Apantaku, 2009).

iii. Negligence: The education sector is suffering a great negligence like the Agricultural Sector of the nation economy with less than thirteen percent (13%) of the 2009 budget allocated to education against the twenty –six (26%) percent recommended by United Nation education scientific and cultural organization (UNESCO) for developing Nation. URL: http://www.businessday_online.com/NG/index.php/publication/123-specialreport/2950-education-sector-still far from 7-point agenda). This is no doubt contributed to the fact of the recent discovery that about seventy (70%) percent of Nigerian graduates are unemployable due to inadequate education (Ikeokoh, Momoh, Bello, Obi, Anro and Okonedo, 2012). Further discovery revealed that the nation's literacy rate is less than twenty percent (20%) and still dropping due to lack of adequate and proper funding which has had negative impact on our secondary school's system today (Ike Okoh *et al.*, 2012).

iv. Parental influence: This has consistently affected students' performance by not allowing their participation and their active involvement in Agricultural Science activities. It is a well-known fact that most parents spear head the war against their children getting involved in manual work which is a common feature of Agricultural Science subject (Badmus, 2010). Some parents are of the opinion or afraid that their children might get wounded by either their colleague or working implements (farm tools), or get bitten by poisonous reptiles, insects and

mentioned but a few. They seem to forget that life itself must continue (Carson, 2010).

v. Infrastructure: many of our senior secondary schools lack the needed infrastructures such as adequate numbers of classrooms, Agricultural Science laboratory, practical farm and gardens, house, adequate visual materials as well as well-equipped libraries. The available classrooms are usually overcrowded failing far below the recommended standard of forty to forty-five (40-45) students per teacher (FRN, 2009). This encourages lack of seriousness on the part of the students and poor class control on the part of the teachers.

vi. Incompetence: sometimes diagram, charts, pictures, specimens, maps and globes to mention but a few, machines/tools (tractor and tractor coupled implements) plantation, livestock, insects, agricultural systems and methods which are not within reach or suitable for classroom presentation are needed to be brought to the classroom for easy identification. Most Agricultural Science teachers in the senior secondary schools find it difficult to produce these materials through improvisation. Because of incompetence, poor motivation, lack of incentive and lack or inadequate funding (Apantaku, 2009). An untrained agricultural science teacher will see no reason for preparing and utilizing the visual materials in the class based on the assumption that the students are familiar with them.

vii. Workload: insufficient agricultural science teachers in our secondary schools will generally result into much work for the available teachers on ground. The workload of most Agricultural Science teachers in our schools is always high since they are insufficiently unemployed. This has resulted in their non-utilization of visual instructional materials and poor timing of their lessons (Badmus 2010). In his view, Agricultural Science is a subject enjoying a great privilege of some

easily available (though sometimes costly or not transportable to the classroom/visual aids. The visual instructional materials such as, soil of different types, rocks, trees, plants, food crops (maize cobs, cassava, yam, tubers) cash crops (cocoa, palm kennel, groundnut, cotton) and farm animals. It is, however surprising to find these readily available visual instructional materials missing in the classrooms for learning purposes. The Agricultural Science teachers are either too busy to improvise or to get the already made visual aids for use or deem it unnecessary for the teaching – learning process, because of time factor. The visual instructional material available are thus, inadequately utilized to foster learning.

Ester and Bowen (2011) show that parents or guardians and friends are the primary individuals who influence students' choice of field of specialization in Agricultural Education, although mothers or female guardians are the most influential. From the finding of (Ester and Bowen, 2011), on students' academic performance, parents and friends can influence their choice in what decision to make regarding field of specialization options available either within or outside agricultural education. Therefore, low or high student academic performance can inform or influence the choice of students directly or even indirectly by second parties (parents, friends, sibling and so on). Low or high students' academic performance can be proven by the work of Adewumi (2011) who stated that "Reports of West African Examinations and National Examination Council in 2010 Examination. The percentage of candidates showed that, of the over two million, one thousands (2.1) candidates that sat for the senior school certificate examination (SSCE) and National Examination Council (NECO), the percentage (%) who obtained a minimum of credit pass (C6) in at least five (5) subjects including English language and Mathematics over the few years in senior school certificate examination had been below

thirty percentages (30%) average nationwide". As such choice of agricultural education as specialized field whose requirements include English and mathematics would be affected.

Therefore, a nation's strength largely depends on the quality and quantity of her human resources, and education is the pivot upon which development rotates (Eyo, 2012). Eyo's observation is true because, quality and quantity of human resources are possible through excellent students' academic performance. In realizing the Nigerian vision of becoming on the top twenty (20) economically developed countries of the world by 2020. Nigeria most produces world class educational institutions (Federal Ministry of Education Position Paper, 2008). This assertion is agreed by the researcher reviewing this work because input in education determines the obtainable output. As such quality of high students' academic performance is realizable through quality educational investment. This is in line with the view of Jega (2010) reports that "good funding is a very important requirement in human capital development.

Kolo (2012) further stated the following as academic challenges as factors resulting to poor students' performance:

i. Poor preparation of students from the lower to the higher level of educational system. Kolo opined that "both our private and public secondary schools these days are teaching and the students are learning only for examination purposes. Course content of subjects are no longer taught for the basic aim of wide knowledge and understanding.

ii. The current educational policy. Kolo (2012) explained "In our bid to develop rapidly, the nation decided to delete from the system the step gap of two years after secondary education to acquire A 'level paper to enter university. Now the qualification for university admission is just five (5) credits and a stipulated score from university matriculation examination (UME). For years, these two criteria

for admission have been abused and manipulated by parents, teachers, students and even examination bodies. The question then is, should we continue with a policy that is not working for our good as a nation?

iii. Fear of the future outside the institutional system. Kolo (2012) says "poor students performance is increasing because there is an increasing fear in the students that graduating and going out, exposes them, the more the dangers such as lack of employment that is taking over the life of the graduates. They feel the security against the unemployment syndrome is to remain with the academic system. This means the students are willing to graduate and keep incurring load of carry over.

iv. Lack of effective guidance services in our educational system: According to Kolo (2012), most academic institutions did not give adequate attention to the counseling needs of the students. Kolo (2012) identified these counseling needs of secondary school students to include: general problems, personal problems, finances, relating with peer groups, health and living conditions. If these needs are not met the students' performance becomes hampered.

Kolo (2012) point out other challenges that contribute to student's poor performance to include: parental neglect or over pampering of money to their children, wards in secondary schools, population explosion, inadequacy of teachers in terms of quality and quantity, outdated curricula content and programme.

Kolo (2012) provides the way forward to the identified challenges which include:

i. Returning to the previous structures of 6-5-2 to which was before 6-3-3-4 system

ii. Adequate investment in our educational system is the issue government needs to address seriously.

iii. Establishment of functional counseling services which must be intensified and effective in all senior secondary schools.

To crown it all, if proficient student academic performance must be realized we need an educational system that:

i. Provides access to quality education for all regardless of gender, ethnic, social background and geographical location.

ii. Develops the individual into a sound and effective citizen's. Identifies, develops and responds to individual needs, talent, and aspiration.

iii. Is our educational system relevant to the 21st century and the needs of the Nigerian economy?

v. Benefits from, and inculcates the values of technology while being efficient and effective in its delivery (Eyo, 2012). The researcher agreed with the fact that every nation depends on the quality of human resources than that of natural resources and that quality of human resources come through student performance in teaching and learning situation.

Concept of Students' Academic Performance Indicators

Students' academic performance indicators in agricultural science are measures of how well or how bad a student's work is being done (Akram, et al., 2012). In senior secondary schools, determining student's academic performance is not an easy task because students' performance depends on various goals, and criteria resulting from numerous subject areas and different teachers. Each of these subject teacher's impact their experiences which in one way or the other build up to influence the performance of the students. Ogbuluijah, (2014) noted that the performance of any level of educational system cannot be attributed to the efforts of a single teacher. Yet, this is not an excuse for not being expected to be called upon to account for the performance of the students. In view of the above, Kidane & Worth (2012) stated that in the past, parents have generally

viewed students' performance as a mark of a good school, but education performances and policy makers here reluctant to rely on the scores.

Ogbulujah (2014) in the same vein, associated increased students' performance with better grades which earn rewarding career. He stressed that qualitative measures of student's performance were from continuous assessment, tests and examination results and student's attendance levels. He also noted that almost all senior secondary schools evaluate students' performance on the mastery of the primary curricular in end of cycle examinations. However, they observed these cumulative assessments rarely provide information about students' performance and how well the educational systems impact learning skills. Furthermore, with the increase in technological changes, particular visual instructional materials, good cognitive and psychomotor skills will be a key element in the ability to adopt to changes taking place in the field of human endeavor. Especially in agriculture, the need for food security and competent workforce in agricultural sector is making much demand for improvement in performance knowledge, skills of the secondary school students.

2.6 Role of Agricultural Science Teacher

In defining the major roles of the teachers of agricultural science in secondary schools, Olaitan (2011) posited that a teacher of Agricultural Science is not only a "common teacher" but also a technician in agriculture. According to him, the role of a teacher in Agricultural Science differs to some extent from that of other teachers in the school system. This because they are expected to deal with cognitive, affective and psychomotor outcomes of teaching and learning processes. The teacher of agriculture is often looked upon as a master of definite skills in field of experimentation and laboratory activities. This mean, therefore, teacher of agriculture is supposed to give all round

education to their students and helping them to acquire definite skills that are necessary for efficient performance in all aspects of Agricultural Science.

The agricultural science teachers are expected to be knowledgeable in all aspects of agriculture such as crop and animal production, crop and animal protection, as well as agriculture extension and economic, engineering, soil science and mentioned but a few. The national curriculum council (NCC) specified that Agricultural Science should be taught in secondary schools in order to stimulate and sustain students' interest in agriculture, and to serve as a foundation for future advancement in the study of agriculture (NCC 2009). Teacher is also expected to link the theory in the classroom with field practical defined on the school farm/garden and laboratory in solving problems in content of the curriculum for a worthwhile learning outcome and effective transfer of learning experiences. It has been observed that professionally trained and experience agricultural teacher plays a vital role in effectiveness of teaching and learning process. Experienced teacher always teaches with various visual aids more effectively than the beginning teachers.

Whitelaw and David (2010) states that teachers sex is an important variable related to students' performance. A gender trait of boys and girls has shown in the attitude toward Agricultural Science. There is a bias that majority of females still choose not to opt for Agricultural Science. Also it has been observed towards the teaching of agricultural science, male teachers achieved better and have higher preferences for teaching Agricultural Science- including farm practical than female Agricultural Science teacher.

However, according to Popoola (2013) stressed that professional agricultural teachers always give adequate attention to poor knowledge of their students most especially in classroom activities. These will motivate his students to have a sense of

belonging and they will actively involve in teaching learning activity. By engaging the students in some activities in the school, will motivate, sustain their attention as well as enhancing their interest in the subjects. For successful students' performance in the subject an appropriate used of visual aids will facilitate the achievement of educational objectives, content or subject matter of the lessons. The Agricultural Science teachers should be knowledgeable and careful when selecting visual instructional materials in meeting student individual differences through learning by doing. This prior background knowledge of students will enhance teachers – student interaction and their environment. This interaction will motivate students to be more attentive and more interested in the subject, thereby improving their academic performance.

2.7 Importance of Visual Instructional Materials

Oyesola (2014) the essence of real life experience in Agricultural Science as attested to Agricultural Science teacher time and again, but more often than not, today the practicing Agricultural Science teachers only pay more lip service to this goal. Mere verbalization takes preponderance over visual illustrations. As a supplement to mere talk, the organization of learning and seeing is enhanced through the timely and appropriate utilization of visual instructional materials.

He further said that the fundamental importance of visual instructional materials and techniques in Agricultural Science are manifold. It enables the student to;

1) visualize the phenomena with which Agricultural Science deals;
2) learn the kind of facts about these phenomena that are of agricultural value;
3) analyze the facts from an Agricultural Science point of view;
4) develop Agricultural Science generalization and
5) apply generalization from the field of Agricultural Science to direct experiences and the interpretation of world agricultural events.

The mental stimulation and three dimensional images of the visual instructional aids is important for the generality of the class and the immense learning value of these visual aids for students with learning and practical problems cannot be overlooked.

However, Oyesola (2014) further stated that visual instructional materials are valuable instructional tools for Agricultural Science subjects that can help make learning more effective and interesting. The visual instructional materials facilitate learning through the stimulation of the senses. To be effective, visual instructional aids should be used to achieve a definite purpose and they should be well constructed to gain the students' attention and sustain interest. For effective use of visual instructional materials in teaching Agricultural Science students therefore, the following must be borne in mind:

1) Always the visual instructional materials must be placed or held where all students can see it clearly
2) The Agricultural Science teachers should identify point of difficulty and possible areas of misunderstanding before the visual instructional aides are introduced.
3) The teacher should give students a chance to study the visual instructional aids before discussing them.
4) He should direct the attention of his students to parts of the visual aids and so encourage them to real observation and discussion of the aids.
5) The agricultural science teacher should not display the visual aids at the beginning of lesson unless the visual aids is to be used immediately, that is, only induce the aids as and when are relevant to the part of the lesson.
6) The teacher should not keep the visual aids until the end of the lesson to be introduced as a reward for good behavior.
7) They frequently, it is undesirable to introduce a fully completed visual aids to the class. It is often better to introduce an outline on to which the Agricultural

Science teacher adds information (perhaps supplied by the class) during the lesson. The students understand diagrams of a digestive or reproductive system of plants and animals better as a result of observing the way it is built up.

Furthermore, according to Oladipo (2008) asserted that visual instructional materials are important tools for enriching, visualizing, simplify, transporting and accelerating the teaching and learning processes; thus enhance students' academic performance in Agricultural science. He further said, that, effective instructions with visual materials in the classroom require careful planning by the agricultural science teacher. This implies that agricultural Science teacher should take time to apply special knowledge and skill with respect to selecting, improvising and using different kinds of visual materials in teaching Agricultural Science students.

Bajah (2009) states some of the reasons for using visual instructional materials in teaching Agricultural Science as follows;

1) A good visual instructional material can supplement spoken or written words as stated by the Chinese proverb "what I heard I forget, what I see I remember, what I do I understand".
2) Visual instructional materials can bring teaching to a real life experience in a way which word cannot.
3) Using visual instructional materials such as picture, model and diagrams can immediately bring reality, whereby word can only describe objects and places.
4) Using visual instructional materials in teaching Agricultural Science can simplify and clarify what is complex and difficult to explain in words.
5) Visual instructional materials have a motivational value for them to develop the interest and sustain attention of the students.

6) Visual instructional materials can also promote retention in students as we stated by Chinese proverb that says “what I hear I forget what I see I remember, what I do understand.
7) Using visual instructional materials in teaching Agricultural Science save time and energy by the teacher, as what will be explained in some minutes (15 mins) will be possible in less time.

Therefore, visual aids are implied to help in teaching Agricultural Science in senior secondary schools, not to be substitutes for teaching the subject, nor for teachers, rather, it should be used to supplement oral explanation and description. Umaru (2011) stated that Agricultural Science involves a lot of simple test and practical activities which the students must involve in, at the senior secondary school level, to acquire necessary skills and exercises. This can only be achieved with the aids of visual instructional materials. He said “visual materials including self-supporting material like field trips, zoos which are used by the Agricultural Science teachers to present a complete body of instruction”. They make a lesson to become more explicit and interesting, as it is of prime importance to be the dull and bright students.

Ogundele (2010) considered visual instructional materials as one essentials part of teaching methods which help the Agricultural Science teachers to explain its subject matter or concept to the learners, thus promoting student’s academics performance. That such visual instructional materials are responsibility of the Agricultural Science teacher in improvising or producing them. He further stated that visual instructional materials are normally used during Agricultural Science instruction to enhance proper or effective learning and encourage retention. They reduced the work load of the Agricultural Science teacher in the classroom, reinforce and add clarity to learning.

Ozonehe (2008) said visual instructional material aid teacher's competence and effectiveness of instruction and classroom control. It makes the learning environment more attractive, appreciable, conducive, bearable and realistic. The learners' attention and interest are better controlled and sustained. Section ten (10) in the NFR (2009) stated the objectives of learning materials to:

i. Enhance teaching and improve the competence of teachers;
ii. Make learning more meaningful for students; and
iii. Develop and promote the effective use of innovative materials in schools.

In the same line Umaru (2011) outlined the reasons for the importance of using visual instructional materials in teaching and learning process in our educational system. They aid learning as the engage all the senses of seeing, hearing and touching. They direct teaching to its goals, make lesson become interestingly, arousing students' interest and motivate them to learn. Visual instructional materials are valuable in the following situation:

a) When the object of instruction is either too big or too small or to spread out to be seen effectively by the Agricultural Science students, examples, tractor, plough, ridges, harrower, bulldozers, elephant, hyena, insect's pests, sand dune and to mentioned but a few.
b) When an object is inaccessible to Agricultural Science student for example, fish pond, dams, irrigation scheme, wildlife game reserves, such should be displayed to the class with models
c) If an object is too expensive, dangerous or delicate for the students of Agricultural Science to use, for example a lesson on the treatment or prevention on a certain livestock diseases or handling of dangerous chemicals that may involve the use of syringe and needle or sprayers, both may be impractical to have in the classroom.

d) When a process being studied is very slow, the Agricultural Science teacher may use charts or diagrams to illustrate the various stages involved. Example plant growth, stages in insect life cycle – metamorphosis, transport system in plants and animals, rather than physical observation of plant growth, stages of an insects, transport system to mentioned few.

When using visual instructional materials during teaching and learning processes, it is important that Agricultural Science teachers consider the following suggestions:

i. Ensure that the visual instructional materials are accurate and acceptable to the Agricultural Science students.

ii. Arrange the visual instructional materials in such a way that the Agricultural Science students will see it from the place they are sitting.

iii. Use the visual instructional materials at the appropriate time in the lesson and after that remove them.

iv. Do not use only one type of visual materials to the exclusion of others, ensure there is change and variety of visual aids.

v. Always remember that Agricultural Science students are in age/maturity, interest and experience. It is always an advantage to combine the visual aids, to meet the need of students. The class needs to showed determination of the types of visual aids to be used and do not cause confusion by presenting too much information (Umaru, 2011).

Ibrahim (2009) stated that visual materials assist Agricultural Science teachers in the achievement of stated objectives and also help the teachers to make lesson explicit to the Agricultural Science students. Fakomogbon (2012), also reported that visual materials possess the quality of influencing the psychological, motivational and structural position of the learners in Agricultural Science. Attention and motivating orderliness in the

classroom; lesson presentation; recall and remembering; guidance active participation and response; feedback, assessment of performance and evaluation are influence by the use of visual instructional materials.

The visual instructional material is intended to help in teaching of Agricultural Science, not to be substitute for teaching the subject, nor for teacher, rather it should be used to supplement oral explanation and descriptions in a conventional class instruction, according to Abdullahi (2013) discusses general importance of visual instructional materials in classroom teaching as follows below;

1) Most of the students' learning takes place through listening and reading, but their comprehension of the subject matter is likely to be more meaningful and will permanently stay in their minds if it is accompanied with experiences. The belief is that students will learn best what they experience. These experiences could sometimes be direct, as in field trips, experiments (practical on farm), exhibitions and demonstrations, other times indirect as in photograph, pictures, globes and maps, charts or diagrams and to mentioned but a few.
2) Generally, it has been agreed by most educationists that students who are being taught with well selected and sensibly utilized instructional materials will be learning more effectively than those who are being taught verbally. The main reason for this is because materials that are sensibly selected will tend to present concepts in such a manner as to create interest and motivation in the minds of the students. Learners profit more from instruction when they become involved through their own interest and desire, and it is well known fact that motivation and desire for learning is an essential element in meaningful instruction.
3) Under normal circumstances, students are expected to physically see and hear if they cannot do either, then there is a barrier to physical perception. Abdullahi

(2013) said that; “the more a child has seen and heard, the more he wants to see and hear”. Visual instructional materials could provide a suitable environment from which the learners can do their own learning. Learning is generally affected by the environment in which it takes place, because the environment affects not only what the learners are able to see but also what they believe they see.

4) Varied visual instructional materials make subject matter clearer to students who come from different backgrounds with varying abilities. Thus, the materials promote effective learning not only the intelligent students, but also for the students who are not very intelligent. They allow slow and average students to absorb lessons through as many senses as possible, while freeing the rapid learner, the well-grounded students and the good readers to proceed as quickly and in as much depth as desired. Visual materials can provide an opportunity for the learners to do things they could not even attempt in real life, such as taking a visit to one of the irrigation scheme, dams, game reserves, agricultural production industries, traveling in the sahara desert, visiting extension service units, abattoirs and to mentioned but a few. This indicates that visual instructional material are particularly well suited to the transmission of sensory replications of objects, persons, events and scenes as they would appear in real life to an observer (Abdullahi, 2013).
5) Visual instructional material could make certain subjects like the sciences more colorful and highly motivating by allowing the students to see those things that are not possible to bring them into the classroom or see the invisible or allowing them to see things that could not normally be seen by the human eye, such as the processes of decay, growth and photosynthesis in plants, lion, hyena, elephant. They also allow students to see rapidly moving objects such as, movement of fast

running animals, which the students could view with greater clarity. The resources also allow students to see phenomenon that might be hazardous to view directly, such as the eruption of volcanoes or earthquake. These are all possible because of time lapse and high speed of photography which permit the telescoping contraction or expansion of a series of events (Abdullahi, 2013).

6) Visual instructional materials help provide meaningful sources of information. They allow students to collect data from a recorded experiment and new problem situations for analyses. This is not to say that textbooks are of less value, but the task confronting education is now growing at a very fast rates. Teachers not only have to teach more subject matter but they have also now broadened the scope of their goals (Abdullahi, 2013).
7) Students need to be prepared for experiences they need to be given directions, facts about situations and vivid descriptions of the application sources other than textbooks. The visual instructional materials help teachers in overcoming physical difficulties when presenting certain subject matters. For example, how does a teacher makes use of a single important map or charts or diagram containing vital information that needs to be communicated? How does he reveal the heart or digestive structure of a particular animal or how does a teacher give different kinds of information and direct different learning activities in different groups within a class at a time? All these could be done effectively by the use of visual instructional materials.

Abdullahi (2013) summarized the importance of visual instructional materials in classroom teaching as; supply a concrete basis of conceptual thinking and necessary basis for developmental learning, provide a high degree of interest for students' offer a reality of experience which stimulates self-activity on the part of the students, develop

continuity of thought, contribute to growth of meaning, provide experience not easily secured by other materials and contribute to the efficiency, depth and variety of learning.

2.8 Criteria for selecting visual Instructional materials

Adequate visual materials should be made available to accomplish effective learning in Agricultural Science. To be effective, visual aids (diagrams, picture, maps and globe, model, specimens) should be used to achieved definite objective and they should be well constructed to gain the learners/students' attention and sustain his interest. It follows therefore that, visual materials must be carefully selected and used. When selecting visual instructional materials for teaching Agricultural Science, teachers should apply the same guidelines used when choosing learning activities (content) in Agricultural Science (Oyesola, 2014) states the following criteria thus:

i. Visual instructional materials = selected in Agricultural Science study should consider the maturity (age) level of the students so as to achieved its main objectives.

ii. Visual instructional materials selected in agricultural science study should be selected to achieve specific objectives of the topic being taught at that particular time.

iii. Appropriateness of the visual instructional materials in Agricultural Science. That is, the visual instructional materials should be relevant to the topic being discussed so that, it will motivate the students' attention and sustain their interest. Once students' attention and interest is sustained, learning will be enhanced and the performance of the students will be better.

iv. Cost effective: This is very important, because most visual instructional materials used in teaching Agricultural Science are inexpensive in nature. Both teachers and students as well engage in improvisation or providing them from the local

material from around the school or within the local environment, rather than depending on the commercially produce materials (Yusuf, 2012).

v. Always the teacher should make the visual instructional materials available before embarking on teaching the topics. Where they visual instructional materials to be used in the classroom is not available in the school, the teacher should borrow either from the neighboring schools or any educational resources centers (Tukur, (2012).

vi. Any visual instructional materials to be used in teaching Agricultural Science should possess technical quality. That is, the visual materials to be used in teaching Agricultural Science students, should be clear so that those sitting at the back of the class can see and bold enough to avoid misconception of the appropriate conventional symbols.

For successful implementation of the agricultural science lesson after planning it, the teacher must also select appropriate and suitable visual instructional materials that will help him/her to strategically deliver the contents. Visual instructional materials where they are available in the school or in the educational resource Centre's, the teacher is advised to select from the array of them. Thus, the teacher of Agricultural Science is hereby guided on what consideration is required before he/she select the visual instructional material(s) that will help him/her in the delivery of his/her lesson. They criteria of selecting visual instructional materials are listed below by (Tukur, 2012) are:

1) Need of the learners, Abdullahi (2013) pupils/students are the focal point of the school system. Thus, the primary aim of the school is the learner, the basic needs of the child which range from mental to materials needs must be taking into cognizance in planning and running the affairs of the schools. This constructed by reference to the needs, wants and interests of the individual learners. A tools and

equipment's in Agricultural Science classroom can be accepted if the assumption is not to neglect the learner/students' needs interests and wants. As many Agricultural Sciences may not agree or were not considering that's, a resource material should always be selected simply because a student is interested in it. Example a student who wants to be a veterinary doctor has different learning needs from a student who wants to be an accountant.

2) Knowledge of the resource materials: An Agricultural Science teacher should have knowledge of a visual instructional material available both in school and/or resources centers should be made. From the list, the Agricultural Science teacher may get information on which resources are available and make a choice of the one to select. Thus also entails the knowledge of the tasks that can be performed using a particular material. Example in a case where a teacher know that a chart or globe cannot be used to teach a digestive or reproductive systems or vegetation of the world, will not select a chart or globe for teaching even when it is available (Tukur, 2012).
3) Authority of the visual instructional materials: Visual materials whether improvised or those produced by experts should be made to appear real to the learner. Authorities valid and current information or latest ideas must be presented. For instance, a map of Nigeria showing twenty-one (21) states would be inappropriate for teaching any about Nigeria today. The authenticity of the visual materials makes the lesson meaningful. Abstract concepts that may be difficult for the students/learners to understand or conceptualized can be made easy using visual instructional materials. Teaching abstract concepts with the use of visual materials bring authenticity into the classroom. Hence visual

instructional materials that bring reality into the learning environment should be selected.

4) Appropriateness of the materials: Visual instructional materials should be critically examined to see if it can be used to meet up the expected learning objectives. Example a globe used to teach the spherical nature of the earth and not a map. A map can be used appropriately to teach the location of countries.
5) Scope of the learners as well as the visual instructional materials: Learners in primary schools are not same with these in the secondary or tertiary institutions. So the visual instructional materials to be used in the senior secondary school level will be limited to the scope of learners at such level. For examples, in the senior secondary and tertiary levels the lesson could be taught with diagrams or pictures of animals or fruits. Therefore, there should be adequate coverage of the subject matter.
6) Physical characteristics of the visual instructional materials: Some materials are bulky, dangerous and heavy to be carried from place to place. Real objects, like lion, hyena, and snake to mentioned but few, are too dangerous to be brought into the classroom. So visual materials that are danger free, portable are to be chosen for teaching and learning. The durability, portability, size and attractiveness of the visual instructional materials are also to be considered in teaching Agricultural Science.
7) Organization of the visual instructional materials: There should be logical sequencing and presentation of subject matter content. So it is visual instructional materials that are organized logically and sequentially that meet the criteria for selection.

8) Availability of the visual instructional materials: Prior to the selection of a visual material for instruction in Agricultural Science, the teacher must make sure that such visual instructional materials or equipment is existing and easy to purchase or produce. It would be unreasonable to select visual instructional materials that are not available in the school or locality.
9) Accessibility of the visual instructional materials: It is one thing for a material to be available; and also to be accessible. A visual material that can only be found at the National Education Resources center and that cannot be released to a school in the village cannot be selected for instruction (Abdullahi, 2013).
10) Subject matter or course to be taught: Each subject matter has particular visual instructional materials that are likely to be adopted for use. For instance, in the digestive or reproductive system classes, visual instructional materials are most likely to be selected because of the learning of different parts and its functions. In the Agricultural Science class or practical specimens are prevalent. So the subject matter determines the nature of visual materials to be selected.
11) Size of the class: The number of learners in a class will determine to an extent the type of visual instructional materials to be utilized. If the learners are large in number, bold visual instructional materials should be selected (Abdullahi, 2013).
12) Cost of materials: The financial implication of the visual instructional materials that a teacher wants to select is of top most importance. The teacher should therefore consider his purse or that of a school. If the visual materials are expensive and there are cheaper once that can be used to achieve the same result, the cheaper one should be selected. This may also call for improvisation (Yusuf, 2012).

13) Operational facility: The facilities for operating equipment chosen should be functional and available. Also the agricultural science teacher should be able to manipulate effectively the visual material, tool or equipment for instruction (Abdullahi, 2013).

14) Teacher's capability: Abdullahi (2013), states that Agricultural Science, teacher should ensure that he is capable of manipulating effectively the visual instructional materials/tools selected for teaching. Abdullahi (2013) further states, that there is greater danger in a teacher who just decides to use tool or equipment because it is very attractive and have no guide and procedure to follow.

15) Objectives of the lesson: The objective comprising of the cognitive, psychomotor and affective domains are tailored towards attaining the desired needs of learners. Careful analysis of the objectives and how to achieve them determines the visual materials that can be used to achieve such objectives. When a teacher prepares his lesson, his objective leads him to selecting the materials that is appropriate for attaining such objectives. The visual materials must also contain the information and activities necessary for achieving the instructional objectives. The visual instructional material should also cater for the individual differences among learners.

Iwu, Rosemary, Ijioma, Blessing, Abel and Nzewuihe (2011) advocates that the use of following criteria to select a visual material will be beneficial.

i. Visual instructional material should be appropriate enough to meet the instructional objectives

ii. Used and selected visual instructional materials should be free from biasness and prejudices.

iii. Quality should be considered in selection of photography formats and prints.

iv. Variety must be presented in visual instructional material(s)

v. Good and sound knowledge of how to operate the visual instructional materials

vi. Ensuring the availability of visual instructional materials or device

vii. How reasonable the time and effort put by teacher are for both teacher and students.

2.9 Factors Affecting Visual Instructional Materials Selection and Usage

Abdullahi, (2013) stressed five important factors to be considered by an Agricultural Science teacher who is intending to select visual instructional materials. These are as follow:

i. Nature of objectives

ii. Characteristics of the learners (age of learner, ability of the learners, class size)

iii. Instructional methodology

iv. Constraints of the instructional situation

v. Evaluation of visual materials

Nature of objectives; the objective of an Agricultural Science lesson should be the reference point for any visual instructional material that is to be selected. That is, objective for a lesson should always be the reference point for any visual aids that is to be utilized by the teacher. The visual instructional material should be relevant for achieving the specific objectives designed by the teacher. The visual instructional material must also contain the information and activities necessary for achieving the instructional objectives. Teachers of agricultural science should therefore suspend the selection of visual instructional materials until a satisfactorily level or analysis has been performed, to supply all the data required for achieving the best match between the visual aids to be used and the objectives of the lesson. The results would also help in identifying visual aids that will cater for the individual differences among students.

Characteristics of learners; It is very important to have match between the visual instructional material to be selected and the learners. There are factors about learners that are critical for making excellent visual material selection. Taking good care of students' interest and needs is very important, particularly for making the use of the materials to be student centered. It is believed that visual instructional material may be differentially effective for different types of learners, and that visual instructional material should therefore, be designed which are best suited to various learner types. The characteristics to be considered include age, ability and class size.

Instruction methodology; The type of visual material a teacher will select for a particular learning may be influenced by the method he intends to use for his lesson presentations. For example, a colored drawing or diagram may be useful and ideal for increasing the motivation of students for an Agricultural Science topic, but due to the methodology to be used, a careful presentation with a model might be better for the same purpose.

Constraints of the instructional situation; the selections of visual instructional materials could be influenced by the constraints of the instructional situation. When selecting visual materials teachers should make sure that the environment in which they are to use the chosen material is suitable. For example, an Agricultural Science teacher will use world maps in teaching of senior secondary schools. Teachers should also make sure that the time scheduled for the lesson is adequate for proper use of the material. If the presentation of the material cannot finish within the given period of the lesson, it means all the objectives for the lesson may not be achieved.

Evaluation; Evaluation here is a means of obtaining information about the usefulness of the selected visual instructional; material in the process of achieving the desired objectives. The purpose of evaluation here is therefore to assess the effectiveness

or otherwise of the selected material. In evaluation, Abdullahi (2013) said the visual instructional material should have the following questionnaire to confirm whether the selected material has reached the standard proposed for it should be answered. In most cases this will help to determine its future use with or without modification.

a) Did the material cover the subject area?
b) Was the material suitable for the students' age and ability?
c) Did it explain its contents simply and accurately?
d) Was it interesting, absorbing or boring to the students?
e) Was the material cost effective in terms of the students' achievement?
f) Does it require modification for future use?

A teacher could use class discussions, individual interviews and observation of student behavior to evaluate the visual instructional material he selected (Abdullahi 2013). Fakomogbon (2012) observed that one of the cause of failure in Nigeria secondary schools is inadequate school materials. He further explained that it cannot be overemphasized that the provision of adequate visual instructional materials is a prerequisite for adequate performance in schools. Most of our schools lack necessary infrastructural facilities require for effective learning.

2.10 Problems Militating Against Effective use of Agricultural Visual Instructional Materials

Mangal (2011) described the selection of appropriate visual instructional materials in relation with the age group of students is very rare. Often, agricultural science teachers are not aware about particular visual aids that are most suitable for grown-up senior secondary school students. Suppose that charts and pictorials are good for junior senior secondary school but if a teacher selects them for senior secondary school students they may surely not be appropriate.

Teachers, when using visual aids, overlook the aspect of explanation rather consider visual aids as self-explanation. But explanation at every level of learning is a must. Suppose a diagram of heart or digestive system is shown to the students and it is wrongly labeled, instead of passing concrete concept it will lead to misinformation. Prasad, cited in Samreen, *et al.*, (2012). They stressed that, the human being is curious by nature so as students too, students are always enthusiastic and eager to see, touch and hear new things. When a teacher chooses to supplement the lecture with visual aids; managing the class happened to be a very difficult task. If a teacher is to show model of an inner ear, or kidney of an animal, then controlling the excitement of the students is a must, and if not the teachers' effort will be in vain.

Akram, *et al*. (2012) opine that using inappropriate visual instructional materials create aggression and develop destructive behaviors in students. Agricultural science teacher should avoid using visual instructional materials that are too complex which can confuse students and become frustrated. Therefore, the uses of such visual aids are strongly criticized by psychologists and educationists. He added that most of the schools suffer budget constraints and as the fact is clear, that is purchasing Agricultural Science visual aid are sometime expensive; it is impossible to make adequate availability of such aids require substantial amount of time. Making your own very good maps, charts, diagrams or any other visual aids is very time taking. While arranging them teacher totally overlooks the importance of developing clear and well-organized lesson plan.

Displaying too much of visual aids simultaneously in a single class can be very confusing for students and even for teachers as well. Concepts can overlap and can lead to misunderstanding and poor retention in students (Samreen, *et al.*, 2012). Samreen *et al.,* (2012) states that activity supplemented by visual instructional materials is completely more waste of time and resources if choice of desired visual aids is not plausible. Suppose

a teacher is to teach about specific skills in farm practical, using a map is wasteful activity; rather, specimen of farm implements and input can be beneficial.

Umaru (2011) stressed that motivation is often described as the derive to action, hence school psychologist, guidance and counseling specialist as well as educators are concerned with motivation factors in school learning. Whenever motivation is absent in the process of learning, effective learning will not take place. Most students studying Agricultural Science in secondary schools in our present day community have no interest in the subject they are studying. For instance, most Agricultural Science students have apathy for the subject because of its practical aspect.

Another major problem militating against effective use of Agricultural SAience visual instructional materials and acquiring them are problem of examination consciousness. Both agricultural Science teachers and students are always interested to finish the syllabus before the external examination such as senior school certificate examination (SCE) conducted by west African Examination Council (WAEC). The National Examination Council (NECO) and National Board for Technical Education (NABTE) to mentioned but few. Therefore, they lack time to acquire visual instructional materials for effective teaching and students memorize their work as they considered that by acquiring the materials is time waste (Umaru, 2011).

Umaru (2011) further stressed that, insufficient fund makes it difficult for Agricultural Science teachers to acquire learning materials. He further reported how lack of fund resulted to inability of agricultural science teachers to produce or improvise visual instructional materials and is amused in or her how a principal failed to make money available to purchase cardboard papers. This is how the ambition of many Agricultural Science teachers is being killed through lack of fund in many secondary schools.

2.11 Empirical Studies

The researcher reviewed past related researches conducted by experts in the field. They are given below;

Oyedun, (2009) carried out a research study titled "Effects of Instructional materials on students' performance in Agricultural science in selected secondary schools in Ilorin South Local Government Area, Kwara State". The past research focused his study on Effect of instructional materials in Agricultural Science in secondary schools. The researcher used quasi-experiment as research design. The target population was 1280 and the samples of 320 students in 4 selected secondary schools. Three (3) null hypotheses were tested using correlation coefficient test statistics at 0.8 significance levels, and all the three (3) null hypotheses were accepted. The result showed that eighty percent (80%) of the respondents did not make use of the instructional materials appropriately which had an effects on the performance of students in Agricultural Science in senior secondary schools in Ilorin, south local government area in Kwara State.

The present research study is related to it in its title; "Effects' of visual instructional materials on the performance of students in Agricultural Science of senior secondary schools in Taraba State, Nigeria". The present research focused on effects of diagrams, maps and specimens on students' performance in Agricultural Science. The researcher used quasi-experiment as the research design. The target population was 3105 Agricultural Science students in senior secondary schools compared with 1280 Agricultural Science students in secondary schools for the past research study. 342 Agricultural Science students were sampled size for the present research study compared with 320 students in secondary schools selected as the sampled for the past research study, using simple random sampling. Four (4) null hypotheses (Ho) were- tested using z-test and ANOVA statistics at 0.05 (5%) level of significance in the present research. The

past researcher focuses on the influence of instructional materials as a whole, while the present researcher focuses on the effects of visual instructional materials particularly on the effects of diagrams, maps and specimens on student's performance in Agricultural Science in Senior Secondary Schools.

Oshadumi, (2010) also carried out a research study titled; "Impact of instructional materials on student's academic achievement in Agricultural Science at secondary schools in Okene Local Government Area, Kogi State". The descriptive survey research design was used for the study. The researcher focused on the impact of instructional materials on students' academic achievement in agricultural science in secondary. The target population was 1352 secondary schools out of which 380 secondary school's students as the sampled. The researcher used questionnaires, four (4) null hypotheses were stated which were tested using correlation coefficient test statistics at 0.01 level of significance. All the four (4) null hypotheses were rejected.

The present research study shares some characteristics with it such as the title; "Effects of visual instructional materials on the performance of students in Agricultural Science in Senior Secondary Schools in Taraba State, Nigeria". The study focused on the effect of diagrams, maps and specimens on students' performance in Agricultural Science. The researcher used quasi-experimental design. The target population was 3105 Agricultural Science students compared with 1352 secondary school's students for the past research study. 342 Agricultural Science students were the sampled size for the present research study compared with 380 Agricultural Sciences Secondary School students selected as the sampled for the past research study. Four (4) null hypotheses were tested using z-test and ANOVA statistics at 0.05 (5%) significance level in the present research. The previous research study was on the use of instructional materials on student's performance in agricultural science in secondary schools. The present research

study was mainly on the effects of visual instructional materials on student's performance in Agricultural Science of Senior Secondary Schools in particular.

Oyagun, (2009) carried out a research study titled "Effects of Instructional materials usage and Teacher's quality on student's academic performance in science in senior secondary schools in Zaria Local Government Area, Kaduna State. The researcher used correlation case control study as research design. The target population was 15,430 senior secondary school students from 24 secondary schools in Zaria local government area and 1,033 teachers. Samples of 80 students with nine (9) teachers as sampled for the study. The researcher used questionnaire. Three (3) null hypotheses and three (3) research questions were formulated to guide the study, t-test statistics was used at 0.05 significant levels. All the null hypotheses were rejected.

The present research study shares some characteristics with it such as the title, "Effects of visual instructional materials on the performance of students in Agricultural Science in Senior Secondary Schools in Taraba State, Nigeria". The present study focused on the effects of diagrams, maps and specimens on students' performance in Agricultural Science in Senior Secondary School. The researcher used quasi-experiment design. The target population for the present research study was 3105 of Senior Secondary School students compared with 15,430 students in secondary schools and 1033 teachers. Four (4) null hypotheses (H_0) were stated using z-test and ANOVA statistics at 0.05 (5%) level of significance in the present research. The previous researcher concentrated on the effects of instructional materials and teacher's quality on students' performance in secondary schools, while the present research study was on the effects of visual instructional materials on students' performance [particularly on diagrams, maps and specimens] of Senior Secondary Schools.

Umaru (2011) carried out a research study titled; “Influence of instructional materials on the academic performance of students in agricultural science in secondary schools in Kwara State, Nigeria”. The researcher focused the research study on influence of instructional materials on academic performance of Agricultural Science in Secondary Schools. The researcher used descriptive survey research design. The target population was 8,142 students and 73 Agricultural Science teachers of the 235 government and private Secondary Schools of the three senatorial district of Kwara State. 30 government and private Secondary Schools with 206 students and 30 Agricultural Science teachers were sampled. The researcher used questionnaires and four (4) null hypotheses (H0) were state which were tested using (two tailed non-directional test), chi-square test (x^2cal) statistics at 0.05 (5%) significant level. All the four (4) null hypotheses were rejected.

The present study focused on effects of visual materials on students’ performance in agricultural science in senior secondary school. The researcher used quasi-experimental design. The target population was 3105 Agricultural Science students compared with 235 governments and private secondary schools with 8142 Agricultural Science students and 73 teachers. 342 Agricultural Science students as sampled for the study compared with 206 agricultural science students and 30 Agricultural Science teachers as the sampled for the past research study. Four (4) null hypotheses (H0) were stated using z-test and ANOVA statistics at 0.05(5%) significance level in the present research study.

The past research study treated instructional materials as a whole on student performance in Agricultural Science in both Junior and Senior Secondary Schools, while the present research study focused on the effects of visual materials particularly diagrams, maps and specimens on student’s performance in Agricultural Science, specifically in Senior Secondary Schools in Taraba State.

Tayo, Bimbo and Ojo (2012) carried out a research study titled; “Effects of Animated Agricultural Science Instructional package on attitude and performance in Junior Secondary School students in south-west local government area of Osun State, Nigeria”. The researcher used true experimental research design. The study focused on the effect of animated agricultural science instructional package on attitude and performance in junior secondary school students. The target population was 1092; the sampled size was 160 of junior secondary school students from two intact classes in the two schools. Two (2) null hypotheses were stated which were tested using t-test and analysis of variance (ANOVA) tests statistics at 0.05 significant levels and all the two (2) null hypotheses were rejected.

The present study focused on the effects of diagrams, maps and specimens on students’ performance in Agricultural Science in Senior Secondary Schools. The researcher used quasi-experimental design. The target population for the present research study was 3105 compared with 1092 junior secondary school students. 342 agricultural science students as the sample for the present research study compared with 160 junior secondary school Agricultural Science students as the sampled for the past research study. Four (4) null hypotheses (Ho) were stated using z-test and ANOVA statistics at 0.05 (5%) level of significance in the present research.

Matthew and Onyejegbu (2013) also carried out a research study titled; “Effects of use of instructional materials on student’s cognitive achievement in Agricultural Science in secondary schools in Orumba South, Anambra State, Nigeria”. The research used quasi-experimental design. The target population was 750 junior secondary school’s students out of which 258 junior secondary school’s students were selected as the sample. One null (1) hypothesis was stated which was tested using z-test statistics at 0.05 (5%) level of significance and the one null hypothesis was rejected.

The present research focused on the study effect of diagrams, maps and specimens on student's performance of Senior Secondary Schools. The researcher used quasi experimental design. The target population for the present research study was 3105 compared with 750 junior secondary school students for the past research study. 342 Agricultural Science students in senior secondary schools was selected as sample for the present research study. Four (4) null hypotheses were be stated using z-test and ANOVA statistics at 0.05 level of significance in the present research study. The present research study was mainly on the effects of visual materials on student's performance in Agricultural Science in Senior Secondary Schools. While past research study focused generally on the effects of instructional materials on student's cognitive achievement in Agricultural Science in Secondary Schools.

Nsa, Ikot and Udo (2013) also carried out a research study titled; "Instructional materials utilization and students' performance in practical agriculture in Ikot Abasi local government area in Akwa Ibom State". Research focused on instructional materials utilization and students' performance in practical agriculture. The researcher used quasi-experimental design for the study. The target population was 1,785 Junior Secondary School Agricultural Science students, from 12 schools in the Ikot-Abasi local government area. Sample of 200 Agricultural Science students was purposively selected using intact classes level in five (5) schools. Four (4) null hypotheses were stated which were tested using t-test and analysis of variance (ANOVA) at 0.05 level of significance. All the four (4) null hypotheses were rejected.

The present research study focused on the effect of diagrams, maps and specimens on students' performance in Agricultural Science in Senior Secondary Schools. The past research study was mainly on instructional utilization and student's performance in practical agricultural science in junior secondary schools, while the present research study

focused on the effects of visual instructional materials [particularly diagrams, maps & specimens] on student's performance in agricultural Science in Senior Secondary School.

Ogbuluijah (2014) carried out a research study titled "Impact of students' field trips on academic performances in Agricultural Science in selected secondary schools in River State, Nigeria". The researcher focused the study on an impact of field trips on students' academic performance in the secondary schools. The researcher used ex-post facto – design. The target population was 9600 Agricultural Science students of senior secondary schools in River State. The sample size was 384 Agricultural Science students. The researcher used questionnaires and 3 null hypotheses were postulated which were tested using descriptive statistics and chi-square at 0.05 level of significance. All the three hypotheses were retained.

The present research study focused on the effect of diagrams, maps and specimens on the students' performance in Agricultural Science in Senior Secondary Schools. The past research study was on the impacts of field trip on academic performance in Agricultural Science in Senior Secondary Schools, while present research study was on the effects of visual instructional materials on student's performance in senior secondary schools.

Okibayi, Usman and Olorukooba (2015) also carried out a research study titled; "Impact of Enriched-lecture method with multimedia - Board on Academic Achievement of secondary school' students in Evolution concepts of Biology-Niger State, Nigeria". The researcher focused on an impact of enriched lecture method with multi-media board on academic achievement of secondary school secondary students in evolution concept of Biology. The research used true experimental design. The target population was four hundred and ninety-eight (498) of the five public senior secondary schools in Rijau Educational Zone in Niger State. Sample of 2 schools from the educational zone consist

of 89 biology students for the study. The researcher used quasi experimental design. Two null (Ho) hypotheses were tested using t-test analysis at 0.05 level of significant. All the two (2) null hypotheses were retained.

The present research study was on the effects of visual instructional materials on student's performance in Agricultural Science in Senior Secondary Schools. While past research study was on the impact of enriched lecture method with multimedia board on academic achievement of secondary schools in evolution concept in Biology.

2.12 Summary

The chapter consists of the following; theoretical framework, conceptual framework such as; concept of instructional materials, categories of instructional materials, concept of visual instructional materials and types of visual instructional materials such as graphic aids, display boards, 3-aids, printing and reference aids as well as activity aids, concept of agricultural science, students' academic performance. Agricultural science curriculum objectives to be achieved by the secondary school students. In order to achieve those objectives, the agricultural science curriculum contents have been structured around three (3) major concepts of production, protection and economic. The agricultural science curriculum of senior secondary school recommended that; each students should be provided with adequate supply of fertilizers and animal feeds, each school should have kept at least two (2) farm animals and student achievement should be continuously assessed through various test and during field and laboratory practical.

The effects of visual instructional materials on student's performance and importance of visual instructional materials such as; it makes learning easier and understandable, it increases student's retention and comprehension to mentioned but few. The chapter also includes factors affecting student's performance in senior secondary

schools as well as factors to be considered for the selection of appropriate visual materials that enhance teaching Agricultural Science in Senior Secondary Schools. Others are resources for the implementation of Agricultural Science curriculum and problems affecting the use of visual instructional materials. Some case studies were also reviewed. In them the similarities and differences between them and the present study were brought out.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research design and methodology under the following subheadings: research design, population for the study, sample and sampling technique, instrumentation, validity of the instrument, pilot study and reliability of the instrument, procedure for data collection and procedure for data analysis.

3.2 Research Design

The research design for this study was quasi-experimental design. The choice of quasi-experimental design was to give a detailed result of the state of affairs at a given period using test items as an instrument for data collection. However, quasi-experimental research was most often performed in natural setting where the research questions are very important. Hence the research study was conducted on real students in the real schools without disrupting the educational process (Emmanuel 2013).

The quasi-experimental design was also chosen because it was useful in collecting the primary data on the variables (that is the respondents). This allowed establishing relationship between the variables that is used to generalize the research result on the target population of the senior secondary school students in Agricultural Science subject in Taraba State.

In this design, subjects were randomly assigned to experimental and control groups (R), subjected to an initial (Pre-test) measurement of the dependent variables of interest (O_1 and O3). The experimental group was administered with a treatment (X) (representing the independent variable of interest), and the dependent variables is measured again (Post-test, O_2 and O4). The experimental group was exposed to treatment

using visual instructional materials, while control group was exposed to conventional teaching method.

Below was the design illustration;

Experimental group	R1	→	O1	X	→	O4
Control group	R2	→	O3		→	O2

Where;

R1 = Experiment group

R2 = Control group

X = Treatment

O1 = (Pre-test for Experimental group)

O3 = (Pre-test for Control group)

O4= (Post-test for Experimental group)

O2 = (Post-test for Control group)

3.3 Population for the study

The target population for this study comprised of all Agricultural Science students of senior secondary school class two (SSS2) in the Northern Senatorial zone of Taraba State totaling three thousand one hundred and five (3105). This population are drawn from the eighty-three (83) senior secondary schools in the six local government areas of the northern senatorial zone of Taraba State. The six local government areas were; Karim Lamido, Lau, Zing, Yorro, Jalingo and Ardo-Kola respectively. Therefore. it became imperative to adopt an acceptable and standard sample size.

Table 1 represents the population distribution of Agricultural Science students in eighty-three senior secondary school II in the six local government areas of Taraba State.

Table 1: Population for the study

S/N	LGA	No. of Schools	Students population
1	Ardo Kola	9	459
2	Jalingo	20	719
3	Karim Lamido	20	642
4	Lau	11	332
5	Yorro	11	358
6	Zing	12	605
	Total	**83**	**3105**

Source: Taraba State Post-Primary Schools Management Board, Jalingo. February, 2016

3.4 Sample and Sampling Technique

The study had a sample size of three hundred and forty-two students in intact classes from the four senior secondary schools in Northern Senatorial District of Taraba State. The simple random sampling technique was used in selection of three hundred and forty-two students of intact classes in the four purposively selected senior secondary schools across the Northern Senatorial zone in Taraba State. The three hundred and forty-two student's samples are selected from the following schools as follows; GDSS Mutum-daya and GDSSS Jalingo which are treated as experimental groups; GDSS Sunkani and GDSS Karim-Lamido are treated as control groups as shown in Table 2.

Table 2: Sample Distribution

S/N	Name of schools	Number of sample students
1	GDSS Sunkani	83
2	GDSS Jalingo	95
3	GDSS Mutum-daya	86
4	GDSS Karim-Lamido	74
	Total	342.

Source; Taraba State Post Primary School Management Board, Jalingo.

3.4.1 Determination of Homogeneity of sample

The three hundred and forty-two students of intact classes of the four senior secondary schools in the Northern Senatorial district of Taraba State were randomly selected based on the homogeneity, meaning they had a unified Agricultural Science curriculum, same teachers' qualification, availability of school facilities and equipment as well as having the same average age of students, this would make the study fair and also to avoid any preferential treatment to any other school.

3.5 Instrumentation

The researcher used the pre-test and post-test as an instruments for collecting the primary data from the senior secondary school students of Agricultural Science. However, the pre-test was used to test the students' entry behavior in relation to certain Agricultural Science concepts to both control and experimental groups. The results of the pre-test of both groups was mark and scored (100%). The marking scheme for the pre-test and post-test of multiple choice test items was also designed for easy assessment of results.

The instrument; Agricultural Science Teacher Made Test (ASTMT) consisted of 50 items designed to measure the level of performance. The items were multiple choice question with four (4) option a, b, c and d.

Table 3: Table of specification for Agricultural Science

Units/Content	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Anatomy & Physiology of farm animal	5	2	3	1	2	2	15
Agricultural Ecology and System	5	3	3	2	2	1	16
Animal nutrition	5	3	4	3	2	2	19
Total							50

Source: Adopted from Obioma (2015)

Table 3 above showed the topics discussed, questions are written at the different stage under Benjamin Blooms (1956) Taxonomy of Educational Objectives. This was to identify the knowledge, comprehension, application, analysis, synthesis and evaluation for teaching and learning situation.

3.5.1 Validity of the instrument

The instrument used for this study was vetted by the researcher's supervisors in the Department of Educational Foundation and Curriculum and experts in the field of measurement and evaluation in the Faculty of education, Ahmadu Bello University, Zaria. This was to determine the face and content validity of the instrument (pre-test and post-test of multiple choice test items). All necessary corrections and modifications were made on the affected items and items were reconstructed based on the comments of the Supervisors.

3.5.2 Pilot Study

A pilot study was carried out in Government Day Secondary school Iware in Ardo-Kola local government area of Taraba State, which was not one of the four (4) senior secondary schools sampled. A total of seventy-two (72) agricultural science students and one Agricultural Science teacher was used for pilot study. The purpose of the pilot study was to determine the reliability of the instruments (pre-test and post- test items), its difficulty level as well as to determine whether the test items are free from ambiguity and also to know whether it has power to discriminate over results. The instruments were administered by the researcher and scored. This gave room for final correction of the pre-test and post-test items for possible commencement of field work.

3.5.3 Reliability of the instrument

The data collected from pilot study was statistically analyzed in order to determine its reliability coefficient, using Pearson product moment correlation coefficient [PPMCC] at

0.05 significance level and the result obtained is 0.87. The result indicated that the items were reliable within the acceptable limit and the reliability coefficients were considered adequate for internal consistencies of the instrument.

3.6. Procedure for Data Collection

Before the researcher moved to the four sampled Senior Secondary Schools, permission was obtained from the Taraba State Ministry of Education and Taraba State post-primary schools management boards, Jalingo through a letter of introduction from the Department of Educational Foundation and Curriculum, Faculty of Education, Ahmadu Bello University, Zaria. In the process of administering the instruments (pre-test and post-test items) to the students (respondents), four research assistants of Agricultural Science teachers were used. One week was used for the training of the research assistants on the modality and procedure of conducting pre-test and post-test items to both groups. A total of three hundred and forty-two (342) agricultural science students were randomly sampled from four (4) senior secondary schools of intact classes in the study areas. Two schools were used as the experimental groups and the other two groups as control. The exercise was carried out in eight [8] weeks. Both experimental and control groups were taught the following topics; Anatomy and physiology of farm animals, Agricultural Ecology and Systems as well as Animal Nutrition.

3.6.1 Treatment Procedure

This treatment lasted eight (8) weeks.

Week One: The researcher reported to the four sampled schools with introductory letter from the Department of Educational Foundation and Curriculum, Faculty of Education, Ahmadu Bello University, Zaria. Also the four research assistants were trained on how to carry out the procedures for pre-test and post-test on both experimental and

control. The pre-test was conducted to both experimental and control groups in the first week.

Week Two and three; both experimental and control groups were taught a topic Anatomy and physiology of farm animals concept using diagrams and conventional chalk and talk methods respectively. The groups would have three periods each of the four schools covering the duration of the two weeks with 40 minutes per period.

Week Four and Five: The experimental and control groups were taught a topic Agricultural Ecology and System concept using maps and conventional method. Both groups had three periods in each of the schools covering the duration of two weeks with 40 minutes per period.

Weeks Six and seven: The experimental group were also exposed to specimens on a concept animal nutrition The other control group were not exposed to any specimens but they were only taught using conventional chalk and talk method. The groups had three periods in each of the four schools covering the duration of two weeks with 40 minutes per period.

Week Eight: This was the last stage in which the revision exercise was given to the students (both experimental and control groups) and conduct of the post-test. After conducting the pre-test and post-test exercise, marks and scores were assigned for proper analysis. Below was the table of treatment processes;

Table 4: Treatment Procedure for Experimental and Control groups

Week	Topic	Method of Treatment		Period
		Experimental Group	Control Group	
1	Training of Research Assistants and pre-test			1
2-3	Anatomy and Physiology of farm animals	Diagram	Lecture Method	6
4-5	Agricultural Ecology and Systems	Map	Lecture Method	6
6-7	Animal Nutrition	Specimen	Lecture Method	6
8	Revision and Post-test			1

3.7 Procedure for Data Analysis

The data collected from the pre-test and post-test was statically analyzed using descriptive and inferential statistics as an appropriate tool in statistical package for social sciences (SPSS) version 21. Thus, mean and standard deviation were used to analyze responses for the research questions. Hypotheses 1-3 were analyzed using z-test and hypothesis 4 is analyzed using analysis of variance (ANOVA) at 0.05 level of significance. These statistical tools were appropriate to determine whether the means of the experimental and control groups are statistically different from each other. Analysis was on when the calculated value is greater than the critical value, the null hypothesis was rejected. But if the calculated value was less than the critical value, the null hypotheses was accepted.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

The data collected on experimental and control groups of Senior Secondary Schools Two Agricultural Science students were analyzed. The research questions were answered using mean and standard deviation and hypotheses 1-3 were analyzed by means of Z-test statistic for large independent variable samples, while hypothesis 4 was analyzed using Analysis of Variance [ANOVA] at alpha 0.05 level of significance.

4.2 Descriptive Data Analysis

The data obtained from the study was used to respond to and analyze research questions as follows;

Research question 1; what is the effect of diagrams on students' performance in Agricultural science of senior secondary schools in Taraba State?

To answer the above research question, items number 1 – 15 of the instruments were used. Mean and Standard deviation were computed from the students' responses as follows.

Table 5; Summary of mean score and standard deviation.

Variable	N	Mean	Standard Deviation	Mean Difference
Diagrams	185	22.856	4.751	
				6.535
Conventional Method	157	16.321	4.03	

Results in Table 5 indicate that the experimental group that were taught anatomy and physiology of farm animals' concepts in Agricultural Science using diagrams had mean score of [22.856] and standard deviation [4.751]. The control group that were taught anatomy and physiology of farm animals concept using conventional method had mean score of (16.321) and standard deviation (4.03). With mean difference of (6.535) in favor of the experimental group. This indicated that the experimental group had higher

mean score than the control group because of the effect of diagrams used in teaching Agricultural Science in Senior Secondary Schools.

Research question 2: What is the effects of maps on the students 'performance in Agricultural Science of Senior Secondary Schools in Taraba State?

To answer the above questions, items number 16 – 31 of the instruments were used. Mean and Standard deviation were computed from the student's responses as follows.

Table 6: Summary of Mean and Standard Deviation.

Variable	N	Mean	Standard Deviation	Mean Difference
Maps	184	19.443	4.38	
				5.329
Conventional Method	154	14.114	3.64	

Table 6 above show the performance mean score and standard deviation of each group. For the experimental group the mean score is (19.443) and standard deviation of (4.38), while the control group had the mean score of (14.114) and standard deviation (3.64). The experimental group had mean gain difference of (5.329) showing that the experimental group performed better than the control group as a result of the influence of maps during content delivery.

Research question 3; what is effect the of specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State?

To answer the above research question, items number 32 – 50 of the instrument were used. Mean and Standard deviation were computed from the students' responses and presented in Table 7.

Table 7: Summary of Mean Score and Standard Deviation.

Variable	N	Mean	Standard Deviation	Mean Difference
Specimens	185	30.05	5.840	
				11.42
Conventional Method	157	18.63	4.316	

Results in Table 7 revealed that the experimental group that were taught animal nutrition concept in Agricultural Science using specimens had mean score of (30.05) and standard deviation of (5.840). While the control group that were taught animal nutrition concept in Agricultural Science using conventional method had mean score of (18.63) and standard deviation of (4.316). This indicated that the experimental group had better performance in Agricultural Science than the control group. This was because of their interaction with the specimens during content delivery as compared to those students taught animal nutrition concept using conventional method alone.

Research question 4: What are the effect of diagrams, maps and specimens on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State?

To answer the above research question, items number 1 – 50 of the instrument were used. Mean and Standard deviation were computed from the students' responses as follows in Table 8.

Table 8: Summary of the mean scores, standard deviations, mean gains and mean difference.

Variables	Experimental Group	Control Group
No. of students	185	157
Pre-test mean	46.308	45.134
Pre-test SD	6.805	6.718
Post-test mean	71.351	49.065
Post-Test SD	11.480	6.933
Mean Gain	25.443	3.931
Mean Difference		21.112

SD – S = Standard, D = Deviation.

Results in Table 8 above show that the students' performance mean score and standard deviation of pre-test and post-test for both the experimental and control groups. The pre-test means score and standard deviation of experimental group is (46.308, 6.805) and the control group is (45.134, 6.718). While the post-test means score and standard deviation of the experimental group is (71.351, 11.450) and the control group is (49.065, 6.933). A mean difference of (21.112) in favor of the experimental group. This result shows that experimental group performed far better than the control group. This can be attributed to the use of diagrams, maps and specimens during content delivery in Agricultural Science lessons.

4.3 Hypotheses Testing

The hypotheses for this study were tested at 0.05 alpha level of significance as follows:

Hypothesis One; There is no significant effect of diagrams on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State.

Independent sample Z-test was employed in testing the hypothesis, Table 9 presents the summary of the following analysis.

Table 9: Summary of independent sample Z-test on the mean score of students.

Variable	N	Mean	SD	DF	Z.Cal	Z.Crit	Sig.	Decision
Diagrams	185	22.36	4.57	340	4.32	1.96	0.01	Rejected
Conventional Method	157	16.321	4.03					

P- Value 0.01< 0.05

Table 9 above indicate the mean performance of students taught anatomy and physiology of farm animals concept in Agricultural Science of Senior Secondary Schools in Taraba State. The results show that Z-calculated is greater than the Z-critical (4.32 > 1.96) with Probability-value less than the (p =0.01 < 0.05) alpha level of significance. This indicates that there was a significant difference in the mean performance of experimental and control groups. Thus, the null hypothesis which stated that diagrams has no significant effect on students' performance in Agricultural Science of Senior Secondary Schools was therefore, rejected.

Hypothesis Two: There is no significant effect of maps on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State.

Independent sample Z-test was employed in testing the hypothesis. Table 10 presents the summary of the following analysis.

Table 10: Summary of the independent sample Z-test on mean score of students.

Variable	N	Mean	SD	DF	Z.Cal	Z.Crit	Sig.	Decision
Maps	184	19.443	4.38	336	3.62	1.96	0.01	Rejected
Conventional method	154	14.114	3.64					

P – Value = 0.01

Table 10 above shows a significant effect of maps on the mean performance of students taught agricultural ecology and systems concept in agricultural science and those taught using conventional method as supported by Z-calculated is greater than Z-critical (3.62 > 1.96), at 336 degrees of freedom and P-value = 0.01. Since the probability value (0.01) is less than (0.05) alpha level of significance. Thus, the null hypothesis which states that there is no significant effect of maps on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State was therefore, rejected. The mean values indicate that students taught agricultural ecology and systems concept in agricultural science using maps had better performance (19.443) which is greater than those taught using conventional method (14.114).

Hypothesis Three: There is no significant effect of specimens on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State.

Independent sample Z-test was employed in testing the hypothesis. Table 11 presents the summary of the following analysis.

Table 11: Summary of independent sample Z-test on the mean of students.

Variable	N	Mean	SD	DF	Z.Cal	Z.Crit	Sig.	Decision
Specimens	185	30.05	5.840	340	14.28	1.96	0.03	Rejected
Conventional Method	157	18.63	4.316					

P – Value = 0.03

Result presented in Table 11 above showed that there was significant effect of specimens on students exposed to specimens during animal nutrition concept delivery in Agricultural Science and those not expose to specimens as supported by Z-calculated is greater than Z-critical (14.28 > 1.96) at 340 degree of freedom. The Probability value (0.03) is less than (0.05) alpha level of significance. Hence, the null hypothesis which states that there is no significant effect of specimens on students' performance in Agricultural Science of Senior Secondary Schools was therefore, rejected.

Hypothesis Four: There are no significant effects of diagrams, maps and specimens on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State.

Analysis of Variance (ANOVA) was employed in testing the hypothesis. Table 12 presents the summary of the following analysis.

Table 12: Summary of Analysis of Variance (ANOVA) on the joint effects between the mean scores of students.

Source of Variance	Sum of Square	Mean Square	DF	F-.Cal	F-.Crit	Sig.	Decision
Between Groups	71.351	23.784	3	8.60	2.84	0.03	Rejected
Within Groups	4876.568	14.385	339				
Total	4947.910		342				

P – Value = 0.03

The results in Table 12 above show that the calculated F-ratio value (8.60) at 3 and 339 degree of freedom at alpha level 0.05 is greater than the critical F-ratio value (2.84). The probability value P = (0.03) is less than 0.05, thus the null hypothesis which states that there are no significant joint effects of diagrams, maps and specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State was therefore, rejected.

4.4 Summary of findings

The summary of the major findings of this study is given below.

1. The performance of students taught anatomy, organs and systems of farm animal's concepts in agricultural science using diagrams was better than those taught without diagrams among Senior Secondary Schools' students at P – value 0.01
2. Students taught feed stuff, functions of food nutrients and balance ration concepts in agricultural science using specimens performed better than those taught without specimens among senior secondary schools' students at P – value 0.01
3. The performance of students taught the environmental factors affecting agricultural production, Plant nutrients and nutrients cycles concepts using maps was better than those taught without maps among senior secondary schools' students at P – value 0.03.

4.5 Discussion of Findings

The results of the study in Table 8 revealed that the students of both groups can be rated as similar on tested skills or knowledge level in the subject and topics they were taught as indicated by the pretest mean performance scores of 46.308 and 45.134 for experimental and control groups, respectively. The mean scores are close with the experimental group scores slightly above that of the control group. The standard deviations of 6.805 and 6.718 for the pretest further provided justification to assume that the students had equal or nearly equal level of tested skills and knowledge. The results of the posttest revealed positive improvement for both groups. However, the students taught with visual instructional materials performed better than those taught without visual instructional materials, as indicated by the mean gain of 21.517. For the experimental group, their mean performance score of 46.308 in the pretest rose to 71.351 with a performance enhancement of 24.864 which is greater than that of the gain in the control group. For the control group, their group performance mean rose from 45.718 in the pretest results to 49.065 with the gain 3.347. This performance mean is attributable to the knowledge acquired after content delivery and possibly to the re-interaction with the test items at the posttest. Like the control group, the acquisition of knowledge and re-interaction of the students with the test items explained their improvement. But the better improvement of the experimental group over control group can be attributed to the use of visual instructional materials during content delivery. The mean gain is likely a true knowledge or performance difference completely attributable to the use of visual instructional materials. The findings of this study reaffirm that of Oyedun (2009), Oyagun (2010), Umaru (2011) and Tayo, Bimbo and Ojo (2012) who reported that students taught with instructional materials performed better than those taught without instructional materials. However, some factors silent to the study might have favored the experimental

group or inhibited the control group, but the performance difference cannot be ascribed to mere chance.

While the use of visual instructional materials is worth encouraging owing to the better mean performance score of the experimental group as revealed in this study and other studies, a look at the level of disparity through the standard deviation is worthwhile. Standard deviation in studies like this help the researcher to explain how close to each other the scores were and / or how far apart the highest score (s) was (were) from the lowest (s). Usually, the lower the value the closer the scores, the smaller the gap between high scores and low scores and thus the more convergent the level of knowledge among the students. And the higher the value the farther the scores are from each other, the higher the gap between the higher and lower scores, thus the more dispersed and divergent the level of knowledge.

As presented in Table 8, the standard deviation of the experimental and control groups was 6.805 and 6.718 in pretest but were 11.480 and 6.933 in the posttest respectively. The mean scores of the posttest indicate that while the control group become closer in their knowledge level by reducing their disparity level by -0.215 in their posttest. Making them even closer than they were in the pretest, the level of disparity widened by 11.480 in the experimental group. On an average, the standard deviations of the pretest and posttest for both groups were 9.143 for the experimental group and 6.826 for the control group and an average difference of 2.317; meaning that the use of visual materials had made the experimental group more dispersed in knowledge level than the control group. The students in the experimental group likely reacted to the visual instructional materials differently unlike the control group, that no “foreign body” was introduced to them during the lessons. Conclusively, the experimental group taught Agricultural Science with visual instructional materials learnt better than those taught without visual

materials but were more dispersed in response and knowledge level with an average standard deviation of 9.143 against the control group with an average standard deviation of 6.826 indicating closer knowledge level among the students.

Similarly, the test of significance as indicated in Table 9 shows the probability value of 0.001 at alpha 0.05 level 0f significance. Since the calculated Z (4.34 > 1.96) value, is greater than the probability value at 0.05 alpha level of significance. The researcher, therefore, concluded that there was a significant effect of diagrams on students' performance that were taught anatomy and physiology of farm animals in Agricultural Science among senior secondary schools' students. Thus, the null hypothesis was, therefore rejected. This shows that the diagrams and conventional method had different effect on students' performance in Agricultural Science. The finding of this study agrees with the findings of Mathew and Onyejegbu (2013) and Scholastic (2013) who reported that the students that were taught Agricultural Science using instructional materials had better students' cognitive achievement than those taught without instructional materials. Also this study re-affirm the studies of Fakomogbon (2012) and Talathi, Naik and Jagaonkar (2014), in their studies to determine the effects of diagrams on students' performance in senior secondary schools, their studies shows that there was a significant difference on the performance of students taught Agricultural Science concepts using diagrams than those taught with conventional method.

In Table 10, the results show a significant effect of maps on the experimental group when compared with the control group. This implies that teaching agricultural science using maps improved students' performance significantly in agricultural ecology and systems concept than the conventional method. These findings confirm the studies of Tayo, Bimbo and Ojo (2012) and Umaru (2011) whose works support the view that visual materials improved students' performance and facilitates learning. The findings of this

study are in agreement with the findings of Mangal (2008), Akram, et.al (2012) and Igu, Ogba and Igwe (2014) who in their studies states that those students that are exposed to maps during Agricultural Science lesson performed better than those taught with conventional method.

The results in Table 11 reveal that students that were taught Agricultural Science using specimens had higher mean performance than those taught using conventional method. This result is in agreement with the studies of Oyagun (2010) and Nsa, Ikot and Udo (2013) who found that students that were taught Agricultural Science using instructional materials utilization in practical agriculture had better performance than those taught without instructional materials. On the contrary, the results of this study do not agree with some previous research such as Oshadumi (2003) and Ogbuluijah (2014). The outcome of their research held that there is no significant impact of students' field trips on academic performance of students in Agricultural Science. However, this finding is in line with the findings of Brown, Lewis and Hardenrd (2008) and Abdullahi (2013) they suggested that when students are exposed to specimens either in the class, farm or laboratory for practical, it enhances the development of special skills, encourages students' participation and enhances interaction among them, it also enhances power of observation as well as retention of first-hand experience.

Similarly, the test of significant as revealed in Table 12 which indicates the probability value P= (0.003 < 0.05) is less than alpha level of significance. Since calculated F- ratio value is greater than F-critical ratio value (8.60 > 2.84) at 0.05 level of significance. This indicates that there was a significant difference among the two groups. Thus, the null hypothesis which states that, there is no significant joint effects of diagrams, maps and specimens on students' performance that were taught Agricultural Science concepts of senior secondary schools was therefore, rejected. This shows that the

usage of diagrams, maps and specimens had a significant effect on students' performance than the conventional method alone.

CHAPTER FIVE
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

This research study was carried out to investigate the effects of visual instructional materials on students' performance in Agricultural Science of Senior Secondary Schools in Taraba State, Nigeria. This study was conducted with the objective to: -

Assess the performance of Agricultural Science students taught anatomy and physiology of farm animals using diagrams and those taught using the conventional method in senior secondary schools in Taraba State; ascertain the effects of maps on students' performance in Agricultural Science of senior secondary schools in Taraba State; identify the effects of specimens on students' performance in Agricultural Science of senior secondary schools in Taraba State and compare the effects of diagrams, maps and specimens on students' performance Agricultural Science of senior secondary schools in Taraba State.

The researcher used quasi – experimental research design and a total sample size of three hundred forty-two (342) students was used for the study. Analysis of the data collected was done using both descriptive and inferential statistics. Mean and standard deviations was used to analyze the research questions. Z- Test was used to analyze hypotheses one, two and three, while hypothesis four is analyzed using Analysis of Variance at 0.05 alpha levels of significance. The finding shows that there was a significant effect of diagrams on the performance of students taught anatomy and physiology of farm animal's concepts in Agricultural Science and those taught using conventional method in senior secondary schools in Taraba State. Results also show significant effects of maps on students' performance taught Agricultural ecology and systems concepts in agricultural science and those taught using conventional method in

senior secondary schools Taraba State. The study also reveals that there was a significant effects of specimens on students' performance taught animal nutrition concepts and those taught using conventional method in senior secondary schools in Taraba State. This study also shows that there was a significant difference on the mean performance of experimental and control groups. Finally, the result reveals that there was a significant difference between the pre – test and post – test performance of Agricultural Science students in senior secondary schools in Taraba State.

5.2 Conclusions

As a result of the findings from the study, the researcher concluded that the use of visual instructional materials in teaching and learning of Agricultural Science in senior secondary schools in Taraba State was effective as it enhanced students' performance on the instruments used on them. It was also concluded that significant difference exists between the pre–test and post-test performance of Agricultural Science students of senior secondary schools in Taraba State. Also, the results showed that the mean performance of students taught Agricultural Science concepts using diagrams, maps and specimens was higher compared to those students taught using conventional method in senior secondary schools in Taraba State.

5.3 Recommendations

Based on the findings emanating from this study, the following recommendations were made that:

1. The agricultural science teachers should ensure that, they always make use of diagrams in teaching anatomy and physiology of farm animals and other related concepts in Agricultural Science, as this can simplify and clarify what is complex and difficult to explain in word in senior secondary schools.

2. Despite the fact that, using maps in teaching Agricultural Science help to save time and energy of teachers. Therefore, the teacher should ensure that the use of maps in Agricultural Science lessons does not create diverse learning as some maps might create more confusion rather than clarification among the same students. This can be achieved by properly explaining every aspect of the maps before the subject matter delivery in the senior secondary levels.
3. As a skill based subject, the Agricultural Science teachers should always expose students to different types of specimens that will motivate them to think critically as well as to stimulate and sustain their interest throughout the period of lessons.
4. the teachers should be given an in-service training in form of seminars, workshops and conferences, so that they should learn more on how to use and improvise various visual instructional materials such as, diagrams, maps and specimens that used in teaching Agricultural Science subject in senior secondary schools.

5.4 Contribution to Knowledge

This empirical work has shown the effects of visual instructional materials on students' performance in agricultural science. The findings of this study have some implications for education in general and for effective teaching and learning of agricultural science in particular. These includes;

1. the use of diagrams highly improved students' performance in agricultural science, as it helps Agricultural science students to have an easy and clear understanding of agricultural science concepts.
2. use of maps in teaching Agricultural science would help the teacher to save time and energy when explaining abstract concepts in Agricultural Science subject.

3. Exposing Agricultural Science students to various type of specimens would help to stimulate and sustain their interest in Agricultural Science subject throughout the period of lessons.

5.5. Suggestions for Further Studies

During the course of the study, the researcher limited his study only to the theoretical aspect of agricultural science, however, the researcher recommends other researchers to carry out further studies on the practical aspects of agricultural science not only in Senior Secondary Schools but also in Junior as well in the following areas;

1. Effects of farm practical on students' performance in agricultural science of secondary schools.
2. Impacts of field trips on students' performance in agricultural science in senior secondary schools.

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APPENDIX A

Topic Profiles

Topic 1-Anatomy and Physiology of farm animals.

Sub-Topics;

a. Anatomy of farm animals.
b. Organs and Systems of farm animals.
c. Digestive Systems of farm animals.

Topic2 –Agricultural Ecology and Systems.

Sub-Topics;

a. Environmental factors affecting Agricultural Production.
b. Plant nutrients and nutrient cycles.

Topic 3.-Animal nutrition.

Sub-Topics;

a. Feed stuff
b. Functions of food nutrients.
c. Balance ration or diet.

APPENDIX B
LESSON PLAN ON EXPERIMENTAL GROUP

LESSON PLAN ONE

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of farm Animal
Subtopic:	Anatomy
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Diagram showing the shape and structure of the body goat, cock and tilapia Agricultural Science Textbook
Objectives:	By the end of the lesson, students should be able to: i. Defines anatomy of farm animals ii. identify anatomy (structure) of a goat.
Previous Knowledge:	Students were able to define their own body parts and compare it with the body of a goat
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. How many sense organs do goats have? ii. Of what importance does the sense of seeing and hearing is to a goat.
Presentation:	The lesson is presented through the following steps:
Step I:	The teacher explained the concept of anatomy using diagrams showing shapes, structure and external features of a goat and cock, i. e. anatomy is the study of the shape and structure of the body of a goat, cow, cock or fish
Step II:	The teacher described the shape and structure of the body of a goat and cock using diagram placed on the chalkboard.
Student Activity:	The students take turn to use diagram to identify and differentiate the shapes and external features of goat and compare it with that of cock
Evaluation:	The teacher evaluates the lesson by asking students to define anatomy and identify some structures of a goat and cock.
Summary and Conclusion:	The teacher summarize the lesson to the students for more understanding and finally ask the students to copy note on the chalkboard.

LESSON PLAN ON EXPERIMENTAL GROUP
LESSON PLAN TWO

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of Farm Animal
Subtopic:	Organs and Systems
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Diagram of organs and systems of goat and agricultural science textbooks
Objectives:	By the end of the lesson, students should be able to: i. list various organs and systems of a goat or cock. ii. state the functions of the organs and system listed above using agricultural science textbooks.
Previous Knowledge:	The students were asking to states the sense organs of a human being they have learned.
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. Of what importance was eyes and ear is to the sheep?
Presentation:	The lesson is presented through the following steps: Step I: The teacher explained the various organs and systems of a goat and hen using diagrams showing sense organs and systems. Step II: the teacher discussed the functions of the organs and systems with the students showing diagrams of organs and systems of a goat or hen.
Student Activity:	The students were groups. Each group discussed how each of the systems or organs performance their function (homework for continuous assessment)
Evaluation:	The teacher evaluates the lesson by asking the students to list the various systems and the areas where a particular operation take place in the body.
Summary and Conclusion:	The lesson is concluded by summarizing the main points on the chalkboard for the students to copy in their exercise books.

LESSON PLAN THREE

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of Farm Animal
Subtopic:	Digestive System
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Diagram showing digestive systems of ruminant and monogastric animals and Agricultural Science Textbook
Objectives:	By the end of the lesson, students should be able to use diagram to: i. Illustrate and label the organs and systems of a cow ii. describe the structure and function of the organs and system of the cock by the students.
Previous Knowledge:	The teacher asked the students to mention some systems and organs with a particular operation in the body of goat.
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. In which system does stomach and intestine of goat are found? ii. Testis and penis in the male, ovary and vagina in the female was found in which of the systems?
Presentation:	The lesson is presented through the following steps: Step I: The teacher used diagrams to show the digestive systems of a ruminant animal as goat, cattle, monogastric e.g. pig and chickens.. Step II: The teacher described the digestive systems of farm animals which are classified in three (3) groups: a). Digestive in ruminant animals e.g. goat, sheep or cattle etc. b). Digestion in non-ruminant animals such as rabbits, pigs and horses. c). Digestion in poultry such as domestic fowl, chick etc.
Student Activity:	The students used the diagrams of the digestive systems of goat, pig and cock and to differentiate between ruminant, monogastric and poultry.
Evaluation:	The teacher evaluates the lesson by asking the students the following questions: i). What is digestive system in farm animal ii). What differentiate ruminant from monogastric animals.
Summary/Conclusion:	The teacher concludes the lesson by summarizing the main point on the chalkboard for students to copy in their exercise.

LESSON PLAN FOUR

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Feed Stuff
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Method	Discussion method
Instructional Materials:	Feedstuff specimens and tables showing different feed stuffs as well as tables showing sources of plant animal protein, minerals and vitamins
Objectives:	By the end of the lesson, students should be able to use diagram to: i. Define what an animal nutrition is ii. List the common nutrients and their functions
Previous Knowledge:	The teacher asked the students to mention same kinds of feeds that a cow, goat, pig and fowl live on as their source of their food.
Introduction:	The teacher introduces the lesson by asking the students to list some domestic animals that are called ruminants and those that are called non-ruminants
Presentation:	The teacher presents the lesson through the following steps: Step I: The teacher explained what an animal nutrition is all about; meaning is science of feeding. Step II: The teacher asked the students to mention some feedstuffs that are used in feeding farm animals such as goat, sheep, cattle, pig, rabbit, chicken. Step III: The teacher describes feedstuffs as concentrates and roughages as the two main classes of feedstuff.
Student Activity:	The students were ask to distinguished or identify concentrates from the roughage feeds after they are exposed to various feed samples as a specimens in the class.
Evaluation:	The teacher evaluates the lesson by asking the students to distinguish between the concentrates and roughages, and state the difference between ruminant and non-ruminant animals.
Summary and Conclusion:	The lesson is concluded by summarizing the key points on the chalkboard for the students to copy in their exercise books.

LESSON PLAN FIVE

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Functions of the food nutrients
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural Science Textbooks, samples of plant and animal source of protein, macro-micro nutrients such as; soybeans' cake, blood meal, borne meal, g/nut cake etc.
Objectives:	By the end of the lesson, students should be able to use specimens to: I. State the functions of protein, minerals, carbohydrates, fat and oil as well as vitamins ii. State reasons for the preference of concentrates for non-ruminants
Previous Knowledge:	The students were able to mention some sources of plant and animal proteins.
Introduction:	The teacher introduces the lesson by displaying sample of fish meal, chick starter marsh, grower and layers mash, meat meal, groundnut cake, soya bean meal.
Presentation:	The teacher presents the lesson through the following steps: Step I: The teacher explained the function of the following as; protein help in enzymes composition, feed utilization, growth, repair of worn-out tissue etc.; minerals help in building of skeleton of the animal body, energy, form a bases for protein utilization, and fats and oil is used for the catabolism of feeds and for maintaining the body heat of the animal, while vitamins and water, as a constituent of various enzymes and aids metabolisms of feeds. While water as a solvent for mineral compound. Step II: The teacher asked students to mention some nutrients that are called macro or micro nutrients (elements) and state why it is called macro or micro nutrients? Step III: The teacher explained to the students why non-ruminant animals preferred concentrates than roughages feed as; a). Concentrates are feed containing high total digestible energy and protein, b). Simple stomach animals digest such feed better because of the nature of their digestive tract etc.
Student Activity:	The students were allowed to have thorough observation of different feeds for different animal species that are displayed before them as a specimen. For examples; wet and dry roughages, carbonaceous and nitrogenous concentrates.

Evaluation:	The teacher evaluates the lesson by asking the following questions; i). List at least three different feeds for farm animals ii). State two differences between concentrates and roughages iii). Mention three important reasons for feeding the non-ruminant livestock with concentrates primarily.
Summary and Conclusion:	The lesson is concluded by giving the summary of the key point for students to copy in their exercise books.

LESSON PLAN SIX

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Balance ration or diet
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science textbook, specimens of feed ingredients such as maize, palm kennel meal, groundnut cake, fish meal, bone meal, Soya bean meal etc.
Objectives:	By the end of the lesson, students should be able to use specimens to: i. Associate rations to different ages and products of animals ii. Explain balanced ration or diet iii. List causes and symptom of malnutrition
Previous Knowledge:	The students were ask to mentioned some ingredients used for different balanced rations for different purposes.
Introduction:	The teacher introduces the lesson by asking the students to mentioned some concentrated and roughages feedstuffs they have learned in the previous lesson.
Presentation:	the lesson is presented through the following steps; Step I: The teacher explained what a ration is, as the quantity of a feed required to keep an animal on a level of maintenance or production for a given period. They are of two types – maintenance and production. Step II: The students are asked to differentiate between maintenance and production rations. These ration types are reckoned on the bases of three factors (3) such as; age, type of animals and production. Step III: The teacher explained the term malnutrition; mean is a poor feeding of an animal as a result of small quantity of a balance ration such that the amount of nutrients available to animal is inadequate.
Student Activity:	The students were allowed to observed, sign of under nutrition or malnutrition on the chicken brought into the classroom as specimens. The students observed chicken with wrinkled on their body, emaciation, and dwarfism to mention but few.
Evaluation:	The teacher evaluates the lesson by asking the following questions; i). What is animal nutrition? ii). List four (4) important nutrients and their sources iii). What is ration? Give at least two (2) examples of rations.
Summary and Conclusion:	The lesson is concluded by given the students homework as: i). Mention two important minerals and discuss their importance in farm animal's nutrition and to discuss the following disease under the following heading – Diseases are; Acidosis, ketosis and enteroxaerence; causative agents, treatments, symptom, prevention.

LESSON PLAN SEVEN

School:	
Subject	Agricultural Science
Topic:	Agricultural Ecology & Systems
Subtopic:	Environmental Factors Affecting Agricultural Production
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Maps of Nigeria and west Africa showing dry and wet season of Nigeria and west Africa, as well as agricultural sciences textbook
Objectives:	By the end of the lesson, students should be able to use maps to: i. Mention some environmental factors affecting agricultural production ii. Understand farming systems as they affect agricultural production iii. Know the effect of farming practices on the soil.
Previous Knowledge:	The students are familiar with weather condition of an area
Introduction:	The teacher introduces the lesson by asking the students the following questions; i). What is a weather? ii). What are the weather condition?
Presentation:	The lesson is presented through the following steps; Step I: The teacher asked the students to define what a climate is? Step II: The teacher explained climate refers to the established condition of the weather of an area for considerable number of years. The climate of a defined area is split out by the rainfall, temperature, light and wind.
Student Activity:	The students had critical look or observation of maps of Nigeria and west African map, indicating the amount of rainfall and the influence of south-west monsoon as well as north – east trades wind on west Africa wet season and the type of crop grown in the savanna belt.
Evaluation:	The lesson is evaluated by asking the following questions; i). What environmental factors affecting agricultural production in the savanna region of Nigeria and west Africa as a whole. ii). List some biological factors that also affect the distribution of crops and animal in Nigeria
Summary/Conclusion:	The Lesson is concluded by given the students homework on the effect of farming practice on the soil.

LESSON PLAN EIGHT

School:	
Subject	Agricultural Science
Topic:	Agricultural Ecology and Systems
Subtopic:	Plant nutrients & Nutrients Cycles
Group	Experimental Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Map of Nigeria showing vegetation and agricultural science textbooks as well as diagram of nitrogen and carbon cycles.
Objectives:	By the end of the lesson, students should be able to use maps to: i. State plant nutrients and describe nutrient cycles ii. Identify the functions of plant nutrients and nutrient deficiency symptoms. iii. Explain factors influencing the availability of plants nutrients and methods of replenishing nutrients in the soil.
Previous Knowledge:	The students are asked to list some macro and micro nutrients learned during animal nutrition lesson
Introduction:	The teacher introduces the lesson by asking the following questions as; i). What is the difference between macro and micro elements? ii). Mention two examples each of the macro and micro nutrients.
Presentation:	The teacher presents the lesson through the following steps. Step I: The teacher explained the nutrient conditions showing the different vegetation zone on Nigeria map. Means; the nutrient condition of a good element or substance is that condition of which the element is soluble, absorbable and assailable by the organism concerned e.g. SPN, O, Ca or Cu, Zn Fe, Cl. Step II: The teacher explained to the students, how nitrogen cycles from the atmosphere to the soil and from the soil to the plant consume by an animal through the nitrogen cycle diagrams. Step III: The teacher explained some factors influencing the availability of plant nutrient in the soil; such as, excess nutrients, crop removal oxidation, burning effect and some methods of replenishing nutrients in the soil, like, crop rotation, organic manuring, inorganic fertilization, liming, etc.
Student Activity:	The students were ask to draw or illustrate how nitrogen circulate or lose from the gaseous lose down to the mineralization of nitrites.
Evaluation:	The teacher evaluates the lesson by asking the following questions; i). Distinguish between macro and micro nutrients. Give five examples of each; ii). Describe the nitrogen cycle and carbon cycle. Explain their important to plants and animals using a diagrams.
Summary and Conclusion:	The lesson is concluded by summarizing the key point for the students.

APPENDIX C
LESSON PLAN ON CONTROL GROUP

LESSON PLAN ONE

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of Farm Animal
Subtopic:	Anatomy
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard
Objectives:	By the end of the lesson, students should be able to use textbook to: i. defines anatomy of goat ii. Identify anatomy (structure) of organ of a goat and cock.
Previous Knowledge:	The students were ask to examine the body parts of a goat and compared it with the body of a cock.
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. Mention some parts of the body of a goat. ii. What is the importance of sense of seeing and hearing are to goat?
Presentation:	The lesson is presented through the following steps: Step I: The teacher explained the concept of anatomy as the study of the shape and structure of the body of goat, cock and tilapia fish Step II: The teacher asked the student to mention some sense organs they have known
Student Activity:	The students are grouped into six groups. Each group should described how each organs listed perform their function (homework)
Evaluation:	The teacher evaluates the lesson by asking the students to; i). Define anatomy of a goat and cock ii). State some functions of each organs of a goat.
Summary and Conclusion:	The teacher concludes and summarize the lesson by asking students to copy the definition of an anatomy and list of sense organs of a farm animals in their note books.

LESSON PLAN TWO

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of Farm Animal
Subtopic:	Organs and Systems of farm animal
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard
Objectives:	By the end of the lesson, students should be able to: i. list various organs and systems of a goat or cock. ii. state the functions of the organs and system of goat or cock.
Previous Knowledge:	The students were familiar with some of the sense organs of goat and cock.
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. Of what importance is an eyes and ear is to the life of a goat?
Presentation:	The lesson is presented through the following steps: Step I: The teacher listed and explained the various organs such as; eye, ear, nose, tongue, skin and systems such as; digestive system, respiratory system, circulatory system etc. Step II: The students state the functions of the organs such as; eye is a sense organ for seeing object, the ear for dictating vibration or hearing of sound, nose for respiration, tongue for tasting. While reproductive system for reproduction of young ones, digestive system for breaking and absorption of food in the intestine and stomach etc.
Student Activity:	The students are allowed to asked questions with regard to importance of organs and systems to goat and cock animals.
Evaluation:	The teacher evaluates the lesson by asking the students to list the various systems and central organs where a particular operation take place.
Summary and Conclusion:	The teacher concludes the lesson and summarize the main points on the chalkboard for the students to copy.

LESSON PLAN THREE

School:	
Subject	Agricultural Science
Topic:	Anatomy and Physiology of Farm Animal
Subtopic:	Digestive System
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard.
Objectives:	By the end of the lesson, students should be able to : i. Illustrate and label the organs and systems of a cow and cock. ii. List or mention the functions of the organs and systems of a cow and cock.
Previous Knowledge:	The teacher asked the students to mention at least two (2) systems with an area of a particular operation in the body of a farm animals.
Introduction:	The teacher introduces the lesson by asking the students the following questions: i. In which systems of the body of a cow does stomach and intestine is found? ii. Testis and penis in the male, ovary and vagina in the female are found in which of the system?
Presentation:	The lesson is presented through the following steps: Step I: The teacher explained to the students that farm animals are classified into two (2) on the bases of digestive systems. i). Those animals with rumen are called ruminants; they have a four (4) compartments stomach made up of rumen, reticulum, omasum and obamasum ii). Other animals are called nonruminants or simple gutted animals. iii). The teacher states some examples of animals that fall in each groups a). Ruminant animals e.g. goat, sheep or cattle b). Non-ruminant animals e.g. pigs, rabbits and horse. c). Digestive in poultry e.g. fowl, duck, turkey etc.
Student Activity:	The students are asked to mention some advantages and disadvantages of ruminants and non-ruminant animals.
Evaluation:	The teacher evaluates the lesson by asking the students the following question; i). How many stomach compartment does ruminant animals have, mention them? ii). What differentiate non-ruminant from the ruminant animals?
Summary and Conclusion:	The teacher concludes the lesson by summarizing the main points for the students to copy in their exercise books.

LESSON PLAN FOUR

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Feed Stuff
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard.
Objectives:	By the end of the lesson, students should be able to: i. Define animal nutrition ii. List the common nutrients and their functions iii. State the major differences between ruminant and non-ruminant animal.
Previous Knowledge:	The teacher asked the students to mentioned some kinds of feed that goat, cow, pig and fowl live on as a source of their food
Introduction:	The teacher introduces the lesson by asking the students to states some animals that are called ruminants and those that are called non-ruminants
Presentation:	The teacher presents the lesson through the following steps: Step I: The students were asked to define animal nutrition? Meaning, animal nutrition can be define as a science of feeding Step II: The teacher asked the students to mention some feedstuff that are used in feeding farm animals such as; goat, sheep, cattle, pig, rabbit, chicken Step III: The teacher describes to the students the feedstuff as concentrates and roughages as the two main classes of feedstuff.
Student Activity:	The students are asked to group those feedstuffs that are called concentrates and those that are called roughages.
Evaluation:	The lesson is evaluated by asking the following questions; i. What is animal nutrition? ii. What are the two classes of feedstuff that are used in feeding the farm animals? iii. What differentiate between the concentrates and roughages.
Summary and Conclusion:	The lesson is summarized on the chalkboard while the students copy the main point in their exercise books

LESSON PLAN FIVE

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Functions of the food nutrients
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard.
Objectives:	By the end of the lesson, students should be able to: i. States the functions of protein, carbohydrates, minerals, fats and oil, water and vitamins to the farm animal ii. State reasons for the preference of concentrates for non-ruminants
Previous Knowledge:	The students were ask to mention some sources of plant and animal proteins they have known.
Introduction:	The teacher introduces the lesson by asking the students the following questions; I. Mention three ingredients that are used in the formation of animal feeds ii. State the source of fat and oils
Presentation:	The teacher presents the lesson through the following steps: Step I: The teacher explained the functions of protein as it helps in enzyme composition, food utilization, growth, repair of worn out tissues; minerals help in building of skeleton of the animal body; carbohydrate form a bases for protein utilization, fats and oil is used for the catabolism of feeds and maintaining of body heat of animal while water and vitamins as a constituents of various enzymes, aids in feed metabolism and solvents for many compounds. Step II: The students were ask to mentioned those nutrients that are called macro or micro nutrients (elements), such as; Mg, S, N, K, P, Ca, Fe, Zn, Co, Md, etc. Step III: The teacher asked the students to states the reasons why they are called macro and micro nutrients?
Student Activity:	The students are divided into six groups, whereby each groups are assigned three macro or micro nutrients to write on, under the following heading; Name, functions, sources, deficiency, sources and how to correct it as a homework for continuous assessment.
Evaluation:	The lesson is evaluated through the following; i. State the functions of carbohydrate, water, proteins and vitamins to the body of the farm animals ii. What differentiate between macro and micro nutrients
Summary and Conclusion:	The lesson is concluded and summarizing of the main point was writing on the chalkboard for the students to copy in their exercise books.

LESSON PLAN SIX

School:	
Subject	Agricultural Science
Topic:	Animal Nutrition
Subtopic:	Balance ration or diet
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard.
Objectives:	By the end of the lesson, students should be able to: i. Define what a balance ration is? ii. Associate rations to different ages and products of domestic animals. iii. List causes and symptoms of malnutrition
Previous Knowledge:	The students were able to mentioned some ingredients used for different balanced rations for different purposes.
Introduction:	The lesson is introduced by asking the students to mentions some feeds that are called concentrate and those that are roughages.
Presentation:	the lesson is presented through the following steps; Step I: The teacher explained what a balance ration is to the students as quantity of feeds require to keep an animal on a level of maintenance and production for a given period. Balance ratio are of two types; maintenance and production. Step II: The teacher distinguished between maintenance and production as in the quantity of feeds rather than quality. Step III: The teacher explained malnutrition as a poor feeding of an animal as a result of small quantity of a balanced ration such that the amount of nutrients available to the animal is inadequate.
Student Activity:	The students are divided into four (4) groups, each group to present a nutrient and its importance or contribution to maintenance or production in different types of livestock; e.g. one group to defined crude protein for egg production, in poultry while another group defined crude fiber in swine breeders' diet etc.
Evaluation:	The lesson is evaluated through the following; i). What is animal nutrition? ii). List four (4) important nutrients and their sources iii). What is balanced ration? Give at least two (2) examples of rations.
Summary and Conclusion:	The teacher concludes the lesson by summarizing the main points on the chalkboard for the students to copy in their exercise books.

LESSON PLAN SEVEN

School:	
Subject	Agricultural Science
Topic:	Environmental Factors Affecting Agricultural Production
Subtopic:	Agricultural Ecology & Systems
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook and chalkboard.
Objectives:	By the end of the lesson, students should be able to: i. Mention some environmental factors affecting agricultural production ii. Understand farming systems as they affect agricultural production iii. Know the effect of farming practices on the soil.
Previous Knowledge:	The students are asked to states some weather condition of their school area.
Introduction:	The teacher introduces the lesson by asking the students the following questions; i). What is a weather? ii). How can we determine the weather of a day?
Presentation:	The lesson is presented through the following steps; Step I: The students are asked to define what a weather is all about? Step II: The teacher explained climate refers to the established condition of the weather of an area for a considerable number of years. The climate of an area is split out by the rainfall temperature, light and wind
Student Activity:	The students were ask to mentioned some domestic and cash crops in their locality, states and in different geo-political zones of Nigeria, as well as domestic animals rear in various states of the federation.
Evaluation:	The teacher evaluates the lesson by asking the students the following; i. List those environmental factors affecting agricultural production in the savanna region of Nigeria ii. List those biological factors that also affect the distribution of crops and animals in Nigeria
Summary and Conclusion:	The teacher summarize the main point on the chalkboard for students to copy in their note books and the lesson is concluded by given the students homework on the effect of farming practices on the soil.

LESSON PLAN EIGHT

School:	
Subject	Agricultural Science
Topic:	Agricultural Ecology and Systems
Subtopic:	Plant nutrients & Nutrients Cycles
Group	Control Group
Duration:	40 minutes
Period	
Class:	SS II
Sex:	Mixed (Boys & Girls)
Age:	16-17 years
Instructional Materials:	Agricultural science Textbook
Objectives:	By the end of the lesson, students should be able to: i. List plant nutrients and illustrate nutrient cycles ii. Identify the functions of plant nutrients and nutrient deficiency symptoms. iii. Explain factors influencing the availability of plants nutrients and methods of replenishing nutrients in the soil.
Previous Knowledge:	The teacher asked the students to list some macro and micro nutrients they have learned during animal nutrition lesson
Introduction:	The teacher introduces the lesson as follows; i). What is the difference between macro and micro nutrients? ii). Give two (2) examples each of the macro and micro nutrients.
Presentation:	The teacher presents the lesson through the following steps. Step I: The teacher explained nutrient condition as a condition of which the element is soluble, absorbable and assailable by the organism concerned. E.g. of nutrients are; N, S, P, K, Ca, O, Cu, Zn, Fe, Cl, Md,,etc. Step II: The teacher explained how nitrogen circulate from the atmosphere in form of gaseous and move down into the soil through some micro – organism and absorbed by plants while the plant is consumed by the animals. Step III: The teacher explained some factors influencing the availability of plant nutrient in the soil; such as, excess nutrients, crop removal, oxidation, burning effect and some methods of replenishing nutrients in the soil, like, crop rotation, organic manuring, liming, inorganic fertilization, etc.
Student Activity:	The students are asked to illustrates by drawing a well label diagrams of how nitrogen circulate from the atmosphere down into the soil and absorbed by plants and then consumed by animals.
Evaluation:	The lesson is evaluated through the following questions; i. Distinguished between macro and micro nutrients. Give three (3) examples of each nutrients. ii. Compare nitrogen cycle and carbon cycle.
Summary and Conclusion:	The lesson is concluded by summarizing the key point for the students to copy in their exercise books.

APPENDIX D

QUESTIONS FOR PRETEST AND POST

Instruction: Answer all questions; choose the correct answer and tick ( ) under letter A-D. All question carries equal marks

Time allow: 35 Minutes

1) The study of the shape and structure of the body of an animal is called _____
   a. nutrition
   b. Production
   c. Anatomy
   d. physiology
2) All farm animals use _____ to locate its feed and any source of danger, and _____ for their respiration
   a. the heart and the nose
   b. the eye and the nose
   c. the nose and the tongue
   d. the nose and ear
3) The reproductive system of male and female animals consist of _____
   a. testis/and penis, stomach and lung
   b. Testis/and penis, bones and vagina
   c. Testis/and penis, vagina and ovary
   d. Testis/and vagina, nose and ovary
4) The digestive system of farm animal is classified into _____ and _____
   a. Ruminant and non-ruminant
   b. Ruminant and rumen
   c. Rumen, ruminant and simple stomach
   d. Non-ruminant and simple gutted animals
5) The blood vessels and the heart have control organ called _____
   a. Respiratory system
   b. Circulatory system
   c. Skeletal system
   d.Nervous system
6) The organ that is responsible for detox cation and manufacturing of red blood corpuscles is known as _____
   a. Liver
   b. Heart
   c. Skin
   d. Ear
7) The male hormone produce by testes is called _____
   a. Progesterone
   b. Estrogen
   c. Testosterone
   d. Spermatozoa
8) The cells that fight against any disease organism that invades the animals' body is known as _____
   a. White blood cells
   b. Red blood cells
   c. White and red cells
   d. Leucocyte and red blood cells

9) _____ is a hormone responsible for preparing of the uterus bedding for a fertilized egg
   a. Estrogen
   b. Testosterone
   c. Estradiol
   d. Progesterone
10) The coordination of most activities from the brain to the other parts of the body is done through _____
   a. Excretory system
   b. Skeletal system
   c. Nervous system
   d. Digestive system
11) Skin, kidney and the lung are the central organs for _____
   a. Excretory system
   b. nervous system
   c. muscular system
   d. circulatory system
12) Examples of ruminant animals are:
   a. goat, sheep and cattle
   b. goat, chicken and sheep
   c. goat, chicken and donkey
   d. goat, sheep, and pig
13) The hormone that is released by the kidney into the blood to assist in digestion is known as _____
   a. Pogesterone
   b. adrenalin
   c. oestrogen
   d. physiology
14) The process of breaking down food into substances absorbable by cells into the blood of the animal's body is known as _____
   a. respiratory system
   b. physiology
   c. Reproductive system
   d. Digestive system
15) Parturition is _____
   a. The bring in forth of the young one of an animal by a dam
   b. the sexual contact between the male and female animal
   c. the releasing of milk by the female dam after given birth
   d. the breaking down food substance absorbable by cells
16) All of the following are environmental factors affecting agricultural production except _____
   a. Rainfall
   b. humidity
   c. range land
   d. light
17) Climate refer to as _____
   a. an average condition of an area for a short period of time
   b. an average weather conditions of an area for a long period time
   c. an average conditions of a room

d. an amount of rainfall recorded in a day

18) The two main environmental factors affecting agricultural production are ____ and _____
    a. soil and water factors
    b. crops and animal factors
    c. climatic and biotic factors
    d. climatic and weather factors

19) _____ is the amount of water vapor (moisture) in an area
    a. humidity
    b. temperature
    c. climate
    d. rainfall

20) The following are biological factors that affect the distribution of crops and animals except _____
    a. predators
    b. parasites
    c. rainfall
    d. pest and disease

21) The concentration of hydrogen ions (H^+) in the soil is refers to as _____
    a. soil texture
    b. soil pH
    c. soil profile
    d. soil water

22) The relative proportions of the different sizes of soil particle is called _____
    a. soil texture
    b. soil profile
    c. soil organism
    d. soil erosion

23) All of the following farming practices affect soil except _____
    a. bush burning
    b. overgrazing
    c. cover cropping
    d. clean clearing

24) Those nutrients that are needed and utilize by the plants in a relatively large quantities are called _____
    a. nitrogen cycle
    b. macro nutrients
    c. micro nutrients
    d. carbon cycle

25) All of the following are examples of nitrogen compound except _____
    a. protein
    b. common salt
    c. nitrate salt
    d. cobalt

26) Lack of nitrogen to plants will causes _____
    a. poor production and yield
    b. excess vegetation growth and lodging
    c. lack of cell division
    d. starch formation and sugar translocation

27) Phosphorus is important in _____ and _____
    a. timber formation and starch formation
    b. increase vegetation growth and yield
    c. it prevents lodging increased and sugar translocation
    d. growth of plants and cell divisions

28) The following factors influencing the availability of plant nutrients in the soil except _____
    a. soil pH
    b. leaching
    c. organic manuring
    d. crop removal

29) The breaking down of soil organic matter in the presence of oxygen is called ____
    a. bush burning
    b. oxidation
    c. liming
    d. mulching

30) All of the following are disadvantages of burning except _____
    a. loss of carbon
    b. destruction of soil organic matter
    c. reduction of labor
    d. destroys soil micro organisms

31) The following are methods of replenishing nutrients in the soil except ___ and __
    a. rotational cropping and liming
    b. bush burning and overgrazing
    c. organic manuring and mulching
    d. cover cropping and inorganic fertilization

32) Ruminant animals have four compartment stomach called ___, ____, ___ and __
    a. rumen, reticulum, crop and dictum
    b. rumen, reticulum, omasum and abomasums
    c. rumen, omasun, gizzard and colon
    d. rumen, omasum, small intestine

33) The science of feeding is called _____
    a. monogastric
    b. ruminant
    c. simple stomach
    d. animal nutrition

34) The two major classes of feedstuffs are _____ and _____
    a. concentration and roughages
    b. wet and carbonaceous
    c. dry and nitrogenous

d. concentrates and carbonaceous

35) The two major sources of proteins are _____ and _____
   a. plants and groundnut cake
   b. plants and fish meal
   c. plants and animal protein

36) An example of concentrates feeds is _____
   a. fresh fodder, pasture and hay
   b. pasture, different grazing and cereal
   c. cereals, roots and stem tubers
   d. silage, cereals and pastures

37) Aflatoxin is found on ____
   a. groundnut cake
   b. cotton seed cake
   c. soya bean cake
   d. palm kennel meal

38) All of the following are sources of plant protein except _____
   a. soya bean meal
   b. blood meal
   c. cotton seed cake
   d. groundnut cake

39) _____ animals preferred concentrated feeds
   a. ruminants
   b. non-ruminants
   c. rumen
   d. omasum

40) _____ is a quantity of a feed required to keep an animal on a level of maintenance or production for a given period
   a. balanced ration
   b. balanced concentrates
   c. balanced roughages
   d. balanced pasture

41) Gossypol poisoning is found on _____
   a. palm kennel meal
   b. groundnut cake
   c. cotton seed cake
   d. coconut meal

42) All of the following are energy sources of feeds except _____
   a. grains
   b. roots and tubers
   c. groundnut
   d. agro-industrial waste

43) The following are macro - nutrients in animal feeds except _____
   a. iron (Fe)
   b. phosphorus (P)
   c. calcium (Ca)

d. sodium (Na)

44) The following are fat – soluble vitamins except _____
   a. vitamin A
   b. vitamin D
   c. vitamin B
   d. vitamin E

45) The functions of vitamin A are _____ and _____
   a. maintains bone structure and vision
   b. sustains vision and skin career
   c. support reproduction and epithelial layers
   d. support blood clothing to prevent excessive blood lost

46) One of the following is a water soluble vitamins
   a. vitamin BC
   b. vitamin E
   c. vitamin D and A
   d. vitamin C

47) _____ mean supply of small quantity of nutrients per head of animal which is inadequate to maintain it.
   a. balanced ration
   b. fat – soluble vitamin
   c. malnutrition
   d. grinding

48) The accumulation of ketone in the body of an animal is known as _____
   a. acidosis
   b. malnutrition
   c. ketosis
   d. milk fever

49) The following animals are raised mostly on pastures or their food is cellulose or fiber except _____
   a. cattle
   b. goat
   c. poultry
   d. sheep

50) All of the following are different form of feeds for poultry except _____
   a. weaners mash
   b. growers mash
   c. chick's starters
   d. layer marsh

APPENDIX E

MARKING SCHEME

1) The study of the shape and structure of the body of an animal is called _____
   c. Anatomy
2) All farm animals use _____ to locate its feed and any source of danger, and _____ for their respiration
   b. the eye and the nose
3) The reproductive system of male and female animals consist of _____
   c. Testis/and penis, vagina and ovary
4) The digestive system of farm animal is classified into _____ and _____
   a. Ruminant and non-ruminant
5) The blood vessels and the heart have control organ called _____
   b. Circulatory system
6) The organ that is responsible for detox cation and manufacturing of red blood corpuscles is known as _____
   a. Liver
7) The male hormone produce by testes is called _____
   c. Testosterone
8) The cells that fight against any disease organism that invades the animals' body is known as _____
   a. White blood cells
9) Progesterone is a hormone responsible for preparing of the uterus bedding for a fertilized egg _____
   d. Progesterone
10) The coordination of most activities from the brain to the other parts of the body is done through _____
    c. Nervous system
11) Skin, kidney and the lung are the central organs for _____
    a. Excretory system
12) Examples of ruminant animals are:
    a. goat, sheep and cattle
13) The hormone that is released by the kidney into the blood to assist in digestion is known as _____
    b. adrenalin
14) The process of breaking down food into substances absorbable by cells into the blood of the animal's body is known as _____
    d. Digestive system
15) Parturition is _____
    a. The bring in forth of the young one of an animal by a dam
16) All of the following are environmental factors affecting agricultural production except _____
    c. range land

17) Climate refer to as _____
b. an average weather conditions of an area for a long period time

18) The two main environmental factors affecting agricultural production are ____ and _____
c. climatic and biotic factors

19) _____ is the amount of water vapor (moisture) in an area
a. humidity

20) The following are biological factors that affect the distribution of crops and animals except _____
c. rainfall

21) The concentration of hydrogen ions (H^+) in the soil is refers to as _____
b. soil pH

22) The relative proportions of the different sizes of soil particle is called _____
a. soil texture

23) All of the following farming practices affect soil except _____
c. cover cropping

24) Those nutrients that needed and utilize by the plants in a relatively large quantities are called _____
b. macro nutrients

25) All of the following are examples of nitrogen compound except _____
d. cobalt

26) Lack of nitrogen to plants will causes _____
a. poor production and yield

27) Phosphorus is important in _____ and _____
d. growth of plants and cell divisions

28) The following factors influencing the availability of plant nutrients in the soil except _____
c. organic manuring

29) The breaking down of soil organic matter in the presence of oxygen is called ____
b. oxidation

30) All of the following are disadvantages of burning except _____
c. reduction of labour

31) The following are methods of replenishing nutrients in the soil except ___ and __
b. bush burning and overgrazing

32) Ruminant animals have four compartment stomach called ___, ____, ___ and __
b. rumen, reticulum, omasum and abomasum

33) The science of feeding is called _____
d. animal nutrition

34) The two major classes of feedstuffs are _____ and _____
a. concentration and roughages

35) The two major sources of proteins are _____ and _____
c. plants and animal protein

36) An example of concentrates feeds is _____
c. cereals, roots and stem tubers

37) Aflatoxin is found on ____
a. groundnut cake

38) All of the following are sources of plant protein except _____
b. blood meal

39) _____ animals preferred concentrated feeds
b. non-ruminants

40) _____ is a quantity of a feed required to keep an animal on a level of maintenance or production for a given period
a. balanced ration

41) Gossypol poisoning is found on _____
c. cotton seed cake

42) All of the following are energy sources of feeds except _____
c. groundnut

43) The following are macro - nutrients in animal feeds except _____
d. sodium

44) The following are fat – soluble vitamins except _____
c. vitamin B

45) The functions of vitamin A are _____ and _____
b. sustains vision and skin career

46) One of the following is a water soluble vitamins
a. vitamin BC

47) _____ mean supply of small quantity of nutrients per head of head of animal which is inadequate to maintain it.
c. malnutrition

48) The accumulation of ketone bodies is known as _____
c. ketosis

49) The following animals are raised mostly on pastures or their food is cellulose or fiber except _____
c. poultry

50) All of the following are different form of feeds for poultry except _____
a. weaners

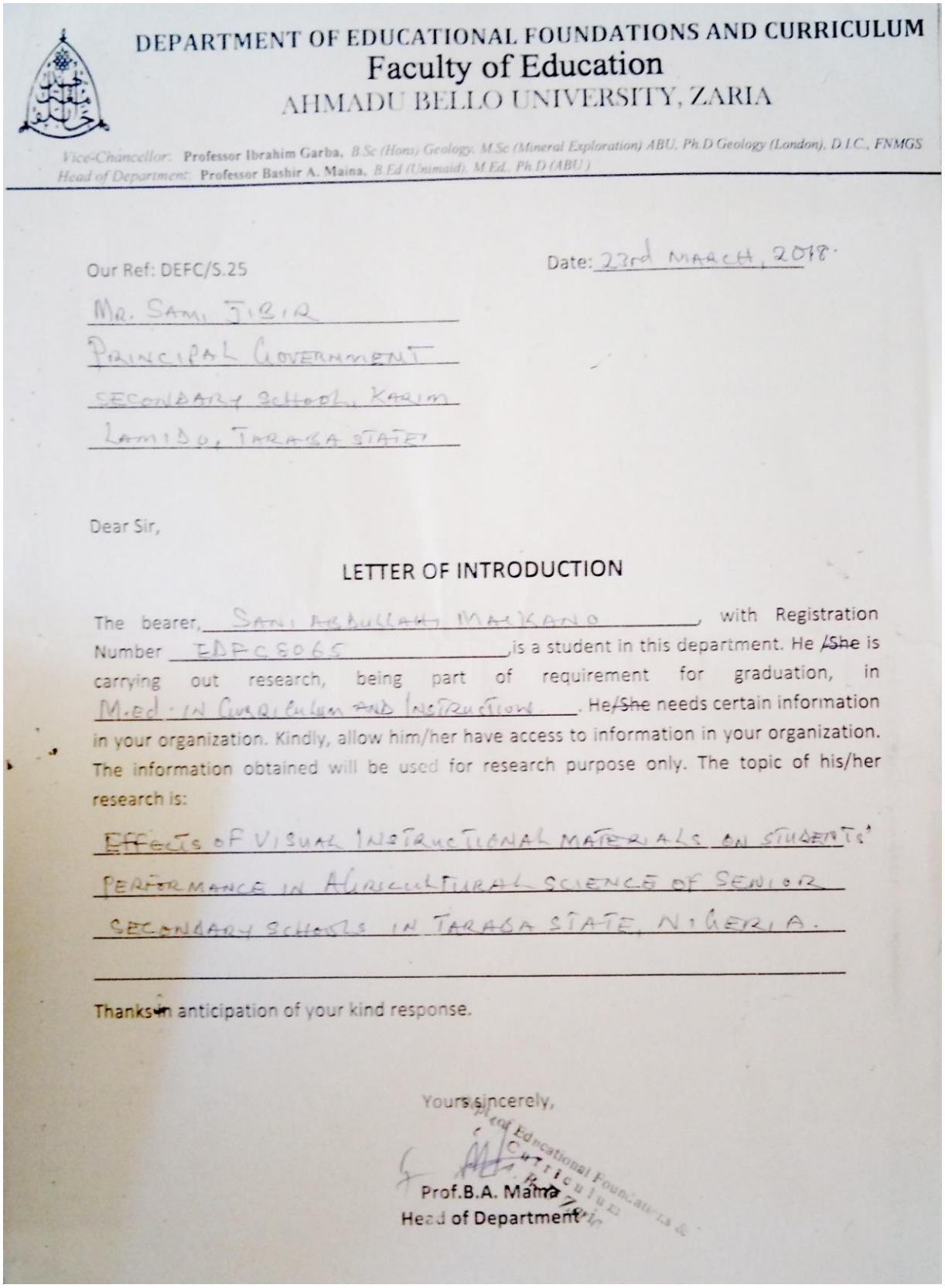
APPENDIX F

TRAINING MANUAL FORRESEARCH ASSISTANTS

The following instruction were given to the research assistants in the field of this research.

1. Self-introduction to the research assistants.
2. Be polite with the respondents, avoid being rude or hash to students.
3. No hate speech or violent words in the course of distribution and collection of test items.
4. Avoid misunderstanding issues.
5. Be attentive while collecting test items to avoid missing scripts.
6. Report or refer possible question ask from the respondents to the researcher
7. Speak good and simple English by considering their educational level of the students.
8. How to attend to questions that may arise from the respondents.

APPENDIX G
LETTER OF INTRODUCTION



DEPARTMENT OF EDUCATIONAL FOUNDATIONS AND CURRICULUM
Faculty of Education
AHMADU BELLO UNIVERSITY, ZARIA

Vice-Chancellor: **Professor Ibrahim Garba,** *B.Sc (Hons) Geology, M.Sc (Mineral Exploration) ABU, Ph.D Geology (London), D.I.C., FNMGS*
Head of Department: **Professor Bashir A. Maina,** *B.Ed (Unimaid), M.Ed., Ph.D (ABU)*

Our Ref: DEFC/S.25

Date: 23rd MARCH, 2018.

MR. SANI JIBIR
PRINCIPAL GOVERNMENT
SECONDARY SCHOOL, KARIM
LAMIDO, TARABA STATE.

Dear Sir,

LETTER OF INTRODUCTION

The bearer, SANI ABDULLAHI MAIKANO, with Registration Number EDFC/8065, is a student in this department. He ~~/She~~ is carrying out research, being part of requirement for graduation, in M.Ed. IN CURRICULUM AND INSTRUCTION. He~~/She~~ needs certain information in your organization. Kindly, allow him/her have access to information in your organization. The information obtained will be used for research purpose only. The topic of his/her research is:

EFFECTS OF VISUAL INSTRUCTIONAL MATERIALS ON STUDENTS' PERFORMANCE IN AGRICULTURAL SCIENCE OF SENIOR SECONDARY SCHOOLS IN TARABA STATE, NIGERIA.

Thanks in anticipation of your kind response.

Yours sincerely,

Prof.B.A. Maina
Head of Department